FINAL ENVIRONMENTAL IMPACT STATEMENT

Volume 3 – Appendices

Thirty Meter Telescope Project

Island of Hawai‘i

Proposing Agency:
University of Hawai‘i at Hilo

This Environmental Document was Prepared Pursuant to Hawai‘i Revised Statutes, Chapter 343, Environmental Impact Statement Law and Chapter 200 of Title 11, Hawai‘i Administrative Rules, Department of Health, Environmental Impact Statement Rules

May 8, 2010

Appendix A. Mailing List

Federal Agencies

U.S. Army Corps of Engineers
U.S. Department of Agriculture – National Resources Conservation Service
U.S. Department of Commerce – National Oceanic and Atmospheric Administration
U.S. Department of Energy
U.S. Department of Homeland Security
U.S. Department of Interior
- Fish and Wildlife Service
- National Parks Service
- U.S. Geological Survey

U.S. Department of Transportation
U.S. Environmental Protection Agency
National Aeronautics and Space Administration – Office of Space Science, Astronomy and Physics Division

State Agencies

Department of Accounting and General Services
Department of Agriculture
Department of Budget and Finance
Department of Business, Economic Development and Tourism (DBEDT); Energy and Planning Divisions
Department of Defense
Department of Education
Department of Hawaiian Home Lands
Department of Health
Department of Land and Natural Resources
Department of the Attorney General
Department of Transportation
Hawai‘i State Civil Defense
Office of Hawaiian Affairs

University of Hawai‘i

Center for Hawaiian Studies
College of Agriculture, Forestry, and Natural Resource Management (Hilo)
College of Hawaiian Language (Hilo)
College of Tropical Agriculture and Human Resources (Mānoa)
Environmental Center
‘Imiloa Astronomy Center of Hawai‘i
Institute for Astronomy
Mauna Kea Support Services
Office of Mauna Kea Management
Kahu Kū Mauna
Mauna Kea Management Board
Water Resources Research Center

County of Hawai‘i

Big Island Visitors Bureau
Civil Defense Agency
Department of Design and Construction
Department of Environmental Management
Department of Finance
Department of Parks and Recreation
Department of Planning
Department of Public Works
Department of Research and Development
Department of Transportation Services
Department of Water Supply
Fire Department
Mass Transit Agency
Office of Housing and Community Development
Office of the County Clerk
Office of the Prosecuting Attorney
Police Department

Elected Officials

U.S. Senator Daniel K. Inouye
U.S. Senator Daniel K. Akaka
U.S. Congressperson Neil Abercrombie (1)
U.S. Congressperson Mazie Hirono (2)
Governor, State of Hawai‘i, Linda Lingle
State Senator Dwight Takamine (1)
State Senator Russell S. Kokubum (2)
State Senator Josh Green (3)
State Representative Mark M. Nakashima (1)
State Representative Jerry L. Chang (2)
State Representative Clift Tsuji (3)
State Representative Faye P. Hanohano (4)
State Representative Robert N. Herkes (5)
State Representative Denny Coffman (6)
State Representative Cindy Evans (7)
Mayor, County of Hawai‘i, Billy Kanoi
Hawai‘i County Councilperson Dominic Yagong (1)
Hawai‘i County Councilperson Donald Ikeda (2)
Hawai‘i County Councilperson J Yoshimoto (3)
Hawai‘i County Councilperson Dennis Onishi (4)
Hawai‘i County Councilperson Emily I. Naeole (5)
Hawai‘i County Councilperson Guy Enriques (6)
Hawai‘i County Councilperson Brenda Ford (7)
Hawai‘i County Councilperson, Kelly Greenwell (8)
Hawai‘i County Councilperson, Pete Hoffmann (9)

Local Schools

Connections
DeSilva Elementary
Ha‘aheo Elementary
Hawai‘i Academy of Arts and Sciences
Hawai‘i Prepatory Academy
Hilo High
Hilo Intermediate
Hilo Union
Holualoa Elementary
Honaunau Elementary
Honoka‘a Elementary
Honoka‘a High and Intermediate
Ho‘okena Elementary
Innovations
Ka ‘Umeke Ka‘eo
Kahakai Elementary
Kalanianaole Elementary and Intermediate
Kanu o ka ‘Āina
Kapi‘olani Elementary
Ka‘ū High and Pāhala Elementary
Kaumana Elementary
Ke Ana La‘ahana
Ke Kula Nawahiokalaniopuu Iki Lab
Ke Kula ‘o ‘Ehunuikaimalino
Kea‘au Elementary
Kea‘au High
Kea‘au Intermediate
Kealakehe Elementary
Kealakehe High
Kealakehe Intermediate
Keaukaha Elementary
Keonepoko Elementary
Kohala Elementary
Kohala High
Kohala Intermediate
Konawaena Elementary
Konawaena High
Konawaena Intermediate
Kua o ka La
Laupāhoehoe High and Elementary
Mountain View Elementary

Na‘alehu Elementary and Intermediate
Pa‘auilo Elementary and Intermediate
Pāhoa Elementary
Pāhoa High and Intermediate
Volcano School of Arts and Sciences
Waiākea Elementary
Waiākea High
Waiākea Intermediate
Waiakeawaena Elementary
Waikoloa Elementary
Waimea Elementary
Waimea Middle
Waters of Life
West Hawai‘i Explorations Academy

Libraries

Hawai‘i State Library
DBEDT Library
Hawai‘i Island Libraries:
- Bond Memorial
- Hilo
- Hōlualoa
- Honoka‘a
- Kailua - Kona
- Kea‘au
- Kealakekua
- Laupāhoehoe
- Mt. View
- Nā‘ālehu
- Pāhala
- Pāhoa
- Thelma Parker

Kaua‘i Island Libraries:
- Hanapēpē
- Kapa‘a
- Kōloa
- Līhu‘e
- Princeville
- Waimea

Lāna‘i Island – Lāna‘i
Maui Island Libraries:
- Hāna
- Kahului
- Kīhei
- Lahaina
- Makawao
- Wailuku

Moloka‘i Island – Moloka‘i
O‘ahu Island Libraries:
- ‘Aiea
- ‘Āina Haina
- ‘Ewa Beach
- Hawai‘i Kai
- Kahuku
- Kailua
- Kaimukī
- Kalihi-Pālama
- Kāne‘ohe
- Kapolei
- LBPH
- Liliha
- Mānoa
- McCully-Mō ‘ili‘ili
- Mililani
- Pearl City
- Salt Lake
- Wahiawā
- Waialua
- Wai‘anae
- Waikīkī-Kapahulu
- Waimānalo
- Waipahu

University of Hawai‘i at Mānoa Hamilton Library
University of Hawai‘i Hilo Library
Hawai‘i Community College Library
Legislative Reference Bureau

News Media

Honolulu Advertiser
Honolulu Star Bulletin
Hawai‘i Tribune Herald
West Hawai‘i Today

Organizations

‘Ahahui Ku Mauna
‘Ahahui Mālama I Ka Lōkahi
American Friends Service Committee
Association of Hawaiian Civic Clubs
Bishop Museum

Center for Biological Diversity
Conservation Council for Hawai‘i
Earthjustice
Edith Kanaka‘ole Foundation
Enterprise Honolulu
Environment Hawai‘i
Environmental Defense
EnviroWatch
Friends of Haleakala National Park
Hawai‘i - La‘ieikawai Association
Hawai‘i Institute for Human Rights
Hawai‘i People's Fund
Hawai‘i Audubon Society
Hawai‘i Business Roundtable
Hawai‘i Conservation Alliance
Hawai‘i Ecotourism Association
Hawai‘i Island Chamber of Commerce
Hawai‘i Island Economic Development Board
Hawaiian Ecosystems at Risk
Hawaiian Historical Society
Hawai‘i’s Thousand Friends
Healthy Hawai‘i Coalition
Historic Hawai‘i Foundation
James Kent Associates
Ka‘ū Preservation
KAHEA
Kanaka Council Moku O Keawe
Kilakila o Haleakalā
Kohala Center
Kohanaiki ‘Ohana
Kona-Kohala Chamber of Commerce
Life of the Land
Malama O Puna
Maui Tomorrow Foundation, Inc.
Mauna Kea Anaina Hou
Na Maka o ka ‘Āina
Native Hawaiian Advisory Council
Native Hawaiian Chamber of Commerce
Nature Conservancy of Hawai‘i
Pacific Resource Partnership
Pele Defense Fund
Pulama Ia Kona Heritage Preservation Council
Royal Order of Kamehameha I
Sierra Club
Temple of Lono

Individuals

Mona Abadir
Alida Adamek
A. Adamson
Leslie Agorastos
Moaikeala Akaka
Moanikeala Akaka
Michael Akau
Scott Aken
Anthony Ching Ako
Jim Albertini
Catherine Allegretti
Imaikalani Anakaniami
Sarah Anderson
Satya Anubhuti
Taft Armandroff
R.M Arnett
Lisa Asato
Andea Aseff
Colin Aspin
Warlito Astrande
Mikel Athon
Meghan Au
Alan Axelrod
Bryan Azevedo
Keoki Baclayon
Lisa Bail
Paul Baillie
Carl Barash
L. Barbero
John & Chris Barnett
Bonnie Bator
Randy Bautista
Sabrina Baxter-Thrower
Lisa Bedinger
John Begg
Walter Bell
Susan Bender
Daniel Bent
Daryl Berg
Ed Bernal
Jason Bestamente

Christiane Betz
Matt Binder
Daniel Birchall
David Bishaw
Bernice Bishop-Kanoa
Larry Black
Patricia Blair
David Bohn
Kyle Boyd
Kat Brady
Fred Braun
Rosie Braun
Jill Breaux
Andrea Brower
Sheldon Brown
Wanda Brown
Alana Bryant
Leon Buchner
Glen Burris
Erica Burt
David A. Byrne
Heidi Byron
Loui Cabebe
Nancy Cabral
Fred Cachola
Anna Cariagu
Jerry Carr
Joe Carvauo
Keomailani Case
Lloyd Case
Kanoe Cazimero
Dawn Chang
Muncel Chang
Clarence Ching
Saw Ching
Donna Ching
Anthony Ching Ako
Newton J. Chiu
Terrilani Chong
Pradeepta Chowdhury
Pat Chu
Roberta Chu
Kathleen Chung
Duane L. & Gretchen W. Cobeen
Wheeler Cole
Paul Coleman
Kenneth Conklin
L. Brent Cook
Patti Cook
Booby Cooper
Robert E. Cooper
Andrew Cooper
Linda Copman
Nlohea Cordela
Tara Cornelisse
Dave Corrigan
Maggie Costigan
Gi Crabbe
Simon Craig
John Cross
Donna Cussac
Pam Daugherty
Keith Davenport
Carol Davies
David S. De Luz, Jr.
Gerald De mello
Laurel De Mello
Nick Deeley
Jessica DelaCruz
Gerald Demello
Gerald Demollo
Mary Detrick
Mary Dias
Dav Dinner
Ben Discoe
Hajime Dochin
Fred Dodge
Shannon Dodge
Vince Dodge
Richard Dods
Raquel Dow
Jaline Eason
Frederika Ebel
Britany Edwards
Jesse Eiben
Leningrad Elarionoff
Dennis & Marge Elwell
Ron Englund

Eloise Engman
Guy Enriques
Bob & Margot Enrst
Duane Erway
Marjorie Erway
Cindy Evans
Mei-Chiao Fang
Yen Wen Fang
Garid Faria
Erva Farnsworth
Hanalei Fergerstrom
Harry Fergerstrom
Kali Fermantez
June Fernandez
Jerry Ferro
Stephen Fischer
Matt Fisk
Mike Fitzgerald
Dennis Florer
Katy Fogg
Roger Fontes
Allie and Roy Forbes
Rick Frazier
Michael K. Fujimoto
Duane Fujiyama
Ronald Fujiyoshi
Fred Fukuchi
Keoki Fukumitsu
Wayne Fukunaga
Jody Fulford
Clayort Gamazut
Joshua Garfein
Suzanne Garrett
Joyce Gay
Tom Geballe
Maryjane Genco
Paul Gessert
Guido Giacometti
James Gilberston
Lawrence Goff
Dawn Gohara
Mark Goldman
William Golisch
David & Anne Gomes
Donald Goo
Debbie Goodwin
Mima Goto
Leah Gourker
Kuapapakai Graff
Daphne Gray
Joseph Green
Linda Gregoire
Charles Grogan
Kale Gumapae
Richard Ha
Bill Haig
John Hamilton
John & Ginger Hamilton
Val Hanohano
Cory Harden
Janice Harvey
Masa Hayasui
John Hayes
Toby Hazel
William Healy
Moses Heauu
Kevin Hedlund
Walter Heen
John Heide
Paula Helfrich
Sandy Hess
Inge Heyer
Thomas Higashida
Gwendolyn Hill
Candice Hilton
Steve Hirakami
Joe Hiscott
Nelson Ho
Mary Holley
William Hoohuli
Bruce Hopper
Matthew Hoshide-Andrade
Clyde Hugh
J. Kimo Hugho
L Humphrey's
Tiffany Edwards Hunt
Michealene Iaukea-Lum
Suzanne Iida

Vickie Innis
Jennifer Ire
Leslie Isemoto
Ricky Ishibashi
W. Iwasa
Kim Jackson
Jamila Jarman
Daniel Grant Johnson
Delton Johnson
Sherri Grant Johnson
Darryl Johnston
Rick Johnston
B Jones
Fithian Jones
Luana Jones
Richard Jones
Jim Juvik
Sonia Juvik
Russell Kackley
Keala Kahuanui
Ekela Kahwami
Lei Kalamau
Jo-Ann Kalamau
Alex Kalawe
Herriag Kalua
Ciro Kamai
Dwynn Kamai
Nahokualakaikawaikapuokalani Kamakawiwoole
Jeitn Kanu
Annette Kaohelaulii
Drew Kapp
Kanoe Kapu
Ana Kariaga
Christine Kauahikaua
Pualani Kauila
Harold Kaula
Kaiko Kaunale
Luana Kawelu
Kehaulani Kea
Pono Kealoha
Kapua Keliikoa-Kamai
Josephine Keliipio
L.V. Kelly
Reynold Kemalauiul
Denise Kenoi
W. D. Keomailani-Case
Mike Kido
Jo Kim
Lester Kimula
Ka'iu Kimuna
Art and Rene Kimura
Ka‘iu Kimura
Lei Kimura
Lester Kimura
paahana Kincaid
Malia Kipapa
Pohau & Larry Kirkland
Dave Kisor
Jim Klyman
Wiley Knight
Graham Paul Knopp
Paul Koehla
Jerry Konanni
Jerry Konanui
Klement Kondratovich
Rich Koval
Trina Kudlacek
Manuel Kuloloio
Brenda Kwon
Carmen L
Terry Ladwig
Tony Ladwig
David Lahuaa
Leslie Ann Laing
Kerstin Lampert
Joan Lander
Carlton Lane
Evelyn Lane
Lloyd Lane
Ann Lau
Betty Lau
Fred Lau
Vanda Lawson
Donna Lching
Kimo Lee
Laura Lee
Paul Leong

Mark Lessing
Corey Ann Lewin
Danny Li
Lila Liebmann
Noa Lincoln-Chong
Pete Lindsey
Denise Lindsey
Clifford Livermore
Skye Loe
Valerie Loh
Paul Lowe
Christy Luce
Kelden Lukzen
Jim LuPiba
Jim Lyke
Denise Lytle
Barney Magrath
Gail Makuakanelindi
Al Martinez
Anthony Marzi
Bob Masuda
Bryan Matsumoto
Theo & Mose Mauga
J. Mauhili
B.A McClintock
Ruby McDonald
Lindsay McDougall
Nancy McGilvray
Kawika McKegan
Pablo McLoud
Dan Taulapapa McMullin
Patrick McNeely
Terry McNeely
Darlene Meiden
Anakura Melemai
Jeff Melrose
Peter Michael
David Milotta
Myles Miyasato
James Monk
Jan Moon
Carolyn Moore
Darryl Moses
Paul Moss
Lee Motteler
Becky Moylan
Donn Mukensnable
Gloria Ann Muraki
Tom Murdic
Malie Myentier
LaVerne Nahinu
Elijah Navarro
Daniel Navratil
Ron Needham
John Nel
Geoff Nelson
Summer Nemeth
Christopher Neyman
Chieu Nguyen
Katherine Nguyen
Kathleen Nielsen
Kathleen Nielsen
Kihei Niheu
Kani K. Keana'aina Ohana
Suzanna Ohoiner
Katrin O'Leary
Jon Olsen
Thomas Orton
Johni Ota
Christian Pa
Sharlynn Paet
Enoch Page
Sandra Parker
Susan Parker
Mya Paw'u
Tom Peek
William and Maria Pendered
Cassandra Phillips
Doug Phillips
Brittany Pierce
Kimo Pihana
Frances Pitzer
Kealoha Pluiotte
Herbert Poepoe
Steve Pollard
Gerald Pozen
Jackie Prell
Charlene Prickett

Margaret Primacio
Greg Pronesti
Ed Pskowski
Noelah Pua
Nina Puhipau
Pauline Pule
Pauline Pule
Pamela Punihaole
Solvejg Raabe
Cornelia Radich
Diana Radich
Cornelia Radich
Paul Rambaut
Gaia Reblitz
Christine Reed
David Reed
Tyrone Reinhardt
Shel Remington
Marian Reyes
Odette Rickert
Herbert Ritke
Cstherine Robbins
Mary Robertson
Robert Rodman
Richard Rodrigues
John F. Roney
Michael Roposh
Karen Rosen
Don and Celeste Rudny
Alexa Russell
Jeff Sacher
George Salazar
Chaunnel Pake Salmon
J. William Sanborn
Daniel Sanchez
Peter Sanderson
Ian Sandison
Suzy Sanxter
Joan Schaal
Barbara Schaefer
Kia'gina Schubert
Stephen Scribner
Nathan Secrest
John Sevick
David Seyfarth
Daniel Sharpenberg
David Shaw
Amy Shiroma
Forest Shower
Damien Silva
Gail Silva
Damien Silva
Phoenix T.M. Simeona
Cynthia Simms
Bri Simonian
Philip Simonian
Lanny Sinkin
Yvonne Siu-Runyan
James Skibby
Edward Smart
Teena Smart
Cha Smith
A. Ku'ulei Snyder
Kent Sonoda
Carter Spencer
Amy Stahl
Daniel Stauffer
Krista Steinfeld
Aaron Stene
John Steuber
Megan Stevens
Justin Stevick
Siunny Stewart
Elizabeth Stone
Fred Stone
Bill Stormont
Kimo Stowell
Ann Strong
Yoshikazu Sueaobu
Kazu Suenobu
Curt Sumida
Barton Susan
Gyongyi Szirom
Gerald Taber
Milford Tabura
Paul Tallett
Evonne Tallett
Paul Nolan Tallett

Miwa Tamanaha
Nimr Tamimi
Wayne Taneh
Jack Telaneus
Mark Temkin
Chris Thomas
Thomas Tizard
Taro Togo
Leona Toler
Moana Towares
Marti Townsend
Kaliko Trapp
John Tremblay
Ash Tsuji
Damon Tucker
Carl Ullerich
Rowena Vaca
Rob Van Green
Leo VanGoyn
Christian Veillet
Glen Venezio
Dwight Vicente
Carla Von
Keomailani VonGogh
Leo VonGoyn
Virginia Walden
Thomas Walsh
Bill Walters
Christine Walters
Diane Wane
Guy Ward
Bob Ware
Miranda Watson
Dharma (Darlene) Wease
Leimomi Wheeler
John White
Marge White
Amy Wiecking
Bob Wilkins
James K. Willis
James 'Kimo' Wilson
Lisa Winborne
David Wissmar
Kanoa Withington
Jesse Wu
Antonie Wurster
Alison Yahna
Thomas Ah Yee
Aileen Yeh
Peter Young
Phyllis and Lanny Younger
Pablo Yurkievich
Douglas Zang

Appendix B. Summary of Scoping Comments

Responses to individual scoping comments were not prepared; responses are within the body of the Draft EIS document. Copies of all scoping comments submitted are available upon request to the Proposing Agency, UH Hilo, Office of the Chancellor (see contact information in Section 1.7). This section provides a summary of the substantive scoping comments received.

Cultural, Archaeological, and Historical Resources

Numerous comments were received regarding cultural resources, and while the comments expressed a wide range of sentiments, all made it clear that Maunakea is a sacred place revered by many. There were multiple statements condemning the past development of Maunakea as desecration and abuse. Some emphasized the need for cultural sensitivity and awareness training for anyone wishing to visit the summit, so as to fully understand and recognize the importance of the mountain and its features. Many comments underscored the need for the protection of cultural sites, resources, and practices, as well as the maintenance of access to the summit. Some comments expressed the sentiment that due to the lack of respect shown in the past and by other projects, many Native Hawaiians stand opposed to any further projects on the mountain, regardless of whether the project would or would not have impacts. Others stated that the development of a cultural affairs team or office, made up of Native Hawaiians with extensive knowledge of the mountain or lineal ties to it, within the TMT Observatory Corporation may help the Project connect with local and Native Hawaiian groups, and allow for continued cooperation and collaboration for the duration of the Project. Some comments likened the observatory and its research to the ancient Native Hawaiian practice of navigating by the stars. Numerous comments supported the TMT Observatory Corporation funding cultural programs already in place. Some commentors were appreciative of the efforts made by the TMT Observatory Corporation to meet with local and Native Hawaiian groups and maintain an open dialogue with them.

Biological Resources

Comments pertaining to the biological resources of Maunakea focused on the Wēkiu Bug, palila, māmane, and silversword, as well as their respective habitats. Many of the comments discussed the need for protecting these species and ensuring that their habitats remain healthy.

Visual and Aesthetic Resources

The comments regarding visual and aesthetic resources mainly focused on requests to see simulations of what the Project would look like on the mountain, including a preliminary design of the structure, with approximate dimensions. Other comments discussed the adverse impact of the existing observatories on the summit on cultural practitioners and residents. Some commentors wondered if TMT could perhaps be painted or coated with something other than

white or reflective coating, in an effort to minimize the visual impact. Another suggestion was to bury the observatory, at least partially, to lessen the amount that is visible.

Water Resources and Wastewater

The most frequent comment about water resources and wastewater was that there should be no discharge of wastewater to the mountain; instead, all of it should be collected and trucked down off the mountain.

Solid Waste and Hazardous Waste Management

The comments received discussing solid and hazardous waste were almost entirely focused on the hazardous wastes that could be produced by the Project, including all chemicals and products that could be potentially harmful. The mirror-coating process to be used by the TMT was another large focus that was brought up. Some comments suggested the creation of a hazardous material and waste officer whose duty would be to oversee all such activities.

Socioeconomic Conditions

A number of comments were received regarding the social and economic conditions, and possibilities due to the Project. One of the most frequent statements expressed the need for the consideration of future generations of Hawai‘i, and how the Project could benefit the existing and coming generations. Multiple suggestions were given, including establishing, or supporting existing, scholarship and/or internship programs; providing on-the-job training or vocational training programs at the local college to encourage the involvement of local residents with the Project; and performing outreach efforts to local schools and community groups to raise interest in astronomy and the research performed in the observatories. Other ideas to benefit the community included funding of community centers, health clinics, or research efforts not necessarily associated with the Project. There were also concerns raised, in particular about the low level of local hiring and that most of the high-paying jobs at the observatories are held by people not originally from Hawai‘i. Multiple comments asked for detailed and precise information about the positions to be created by the Project with their associated salaries, and how these positions are anticipated to be distributed between Native Hawaiians, long-term residents of Hawai‘i, and people brought into the state; another suggestion was to break the employment information down by educational or vocational requirement. Some expressed concerns about the implications of creating a number of new, high-paying jobs on the island’s communities, in that those jobs would then lead to possible rises in property values and taxes, prices of goods, and other increases.

Land Use Plans, Policies, and Controls

Many of the comments pertaining to land use focused on the siting of the Project. Some comments suggested the dismantling of an older observatory and using that site for the TMT. Other comments focused on placing the TMT as close to existing facilities and infrastructure as possible, in order to minimize the amount of new disturbance to the mountain. Some questioned whether the Project would qualify for a Conservation District Use Permit (CDUP).

Roadways and Traffic

The main concern about traffic was that the Project could lead to more traffic on the mountain, which already experiences periods of congestion, particularly during times of snow. One suggestion that was provided was to pave the unpaved section of Mauna Kea Access Road as a means of mitigation for the Project.

Power and Communications

The sole comment received regarding power and communications sought information about how much electrical power the Project would use.

Climate, Meteorology, Air Quality, and Lighting

The possible effects of climate change, and impacts of such changes on the Project, were brought up a few times in the comments. The other focus was on the vog currently being experienced by the island, and whether it would have any impact on the Project.

TMT Project

Comments were largely related to what the TMT would be able to accomplish, and what made it so different from existing telescopes. Related to this, some comments also wanted to see objectives, missions, and priorities for the TMT, including what types of research would be performed. A comment that was received multiple times involved whether or not the military would have access to or interest in the TMT. The location of the Headquarters was asked by a few commentors. Other frequent comments focused on the request for a complete life-cycle analysis of the Project, from construction through operation to dismantling. Another comment was about the restoration plan for the site; that it needs to be prepared and include evidence that funding for the restoration work would be there when needed. A complete comparison between siting TMT on Maunakea and in Chile was asked for a few times, including all associated costs, impacts, and the analysis used to arrive at the conclusion of which site would be best to make the investment in. The past analysis from the sites surveyed that narrowed it down to the final two choices was of interest to some commentors. Some comments indicated that the same information from the Outrigger EIS should be used for the cumulative impacts analysis for the TMT project.

Other Comments

Numerous comments were received that, while valid and important, are not within the scope of environmental analysis of this Draft EIS. Many of these comments expressed concern and disappointment with the amount of rent paid by the existing observatories for the use of the mountain. Another comment's concern was the expiration date of the lease that allows the lands to be used and subleased by the University of Hawai‘i (UH). Some comments stated that UH has proven to be a poor steward of the mountain by past actions and occurrences, and that the trust of many on the island has been broken. The last-approved management plan limited the number of telescopes to 13, which has been reached, and the point was brought up that any new development would exceed that maximum. The decommissioning of older, less advanced telescopes was a comment that was made numerous times, as well. Comments focused on the

Comprehensive Management Plan (CMP) were also numerous and wide-ranging. The most frequent one was that the CMP being done by UH would not meet the legal requirements pertaining to the document, and that without a proper CMP an EIS would not be able to be completed. Another comment made was about the ownership of ceded lands, which include the Project site; that the ownership is still unclear and therefore, the lands should not be used in this manner.

Appendix C. Draft EIS Comment Form

COMMENT FORM

Thirty Meter Telescope Project

The University of Hawai‘i encourages comments on the Thirty Meter Telescope (TMT) project. The 45-day Draft EIS comment period opened with the notice of availability published in the OEQC Environmental Notice on May 23, 2009. Comments are required to be submitted or postmarked by July 7, 2009. Comments can be submitted via the website (www.TMT-HawaiiEIS.org), the toll-free hotline (1-866-284-1716), at public meetings, or by mailing written comments to the address on this form. This form is provided for convenience only; to submit this form by mail, please fold and staple, and affix proper postage (see reverse side for guide). Any letter or other printed comments not using this form are also welcome.

All comments received will be responded to individually with both the comment and responses included in the Final EIS.

Name: _____ **Address:** _____

Phone: _____ _____

E-mail: _____ _____

Comments: _____

(use additional sheets if appropriate)

Fold Here

Return Address:

_____

_____

_____

Place
Postage
Here

University of Hawai‘i at Hilo
Office of the Chancellor
200 W. Kāwili Street
Hilo, Hawai‘i 96720-4091

STAPLE HERE

Appendix D. Cultural Impact Assessment Report

Preface

The Cultural Impact Assessment for the Thirty Meter Telescope (TMT) Observatory Project and TMT Mid-Level Facility Project, Maunakea, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island (the "TMT CIA") provides a summary of traditional and historic background, from the perspective of the Native Hawaiian traditions, and summary of archaeological research for the Project area. Traditional and historic backgrounds and summaries of archaeological research are also available in the Archaeological Inventory Survey for the Thirty-Meter-Telescope (TMT) Observatory Project, Maunakea, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island (Appendix G of this Final EIS) and the Archaeological Study and Assessment for the Thirty-Meter-Telescope (TMT) Observatory Project Ancillary Facilities, Hale Pōhaku Area, Maunakea, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island (Appendix H of this Final EIS). Within the body of this Final EIS, historic and archaeological resources are discussed in Section 3.3, Archaeologic/Historic Resources.

The TMT CIA also provides summaries of community consultations with 29 persons (including interviews with 16 persons, four of them since the Draft EIS was completed) performed exclusively for the TMT CIA and describes potential mitigation measures reflecting those consultations. Cultural resources and the Project's potential impact on cultural resources are discussed in Section 3.2, Cultural Resources, of this Final EIS. The discussion presented in Section 3.2 of this Final EIS includes information from the TMT CIA and from other sources. The TMT CIA includes only information collected during the development of the TMT CIA. For example, the TMT CIA does not include the following information, which is considered in Section 3.2 of the Final EIS:

- Comments received from individuals and organizations during the 45-day Draft EIS public review and comment period. Comments were received from Hawaiian Civic Clubs and Hawaiian and kamaʻāina individuals, among others, and are presented in Chapter 8, Volume 2, Responses to Comments, of this Final EIS.
- The Office of Hawaiian Affairs (OHA) adoption of a motion on July 2, 2009, that "In consideration of various cultural and economic factors, the OHA Board of Trustees resolves to support the selection of Maunakea, Hawaiʻi as the site for the proposed Thirty Meter Telescope Project."

As illustrated in the TMT CIA consultations and discussed in Section 3.2 of the Final EIS, there exists a wide range of opinions concerning the Project's potential impacts on cultural resources and practices. Opinions range from recommendation for no further development of any kind on Maunakea, to support for astronomy on Maunakea, in coexistence with cultural practices, including construction of the TMT Observatory and support facilities.

As detailed in Section 3.2.4, Mitigation Measures, of this Final EIS, TMT has committed to a number of mitigation measures to address the Project's potential impact to cultural resources. These include measures similar to the mitigation measures recommended in the TMT CIA, with the exception of locating the observatory on a recycled site (because of greater environmental effects associated with that location) and nominating the summit region as a Traditional Cultural Property (because only the land owner can make such a nomination). Beyond the measures identified in the TMT CIA, TMT has committed to a number of additional mitigation measures, including reduced observatory operations on identified days of cultural observance, collaboration with ʻImiloa on a number of issues including exhibits regarding cultural resources that can be used at the Visitor Information Station (VIS) and other locations, and a Community Benefit Package (CBP).

Cultural Impact Assessment for the Thirty Meter Telescope (TMT) Observatory Project and TMT Mid-Level Facility Project, Maunakea, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island TMK: [3] 4-4-015:001 por., 009 por., 012 por.

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(Job Code: MAUNA KEA 2)

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Management Summary

Reference	Cultural Impact Assessment for the Thirty Meter Telescope (TMT) Observatory Project and TMT Mid-Level Project, Maunakea, Ka‘ohe Ahupua‘a, Hāmākua District, Hawai‘i Island, TMK: [3] 4-4-015:001 por., 009 por., 012 por.
Date	February 2010
Project Number	Cultural Surveys Hawai‘i (CSH) Job Code: MAUNA KEA 2
Project Location	The proposed TMT Observatory Project area is located on the northern plateau of the Maunakea summit area, within Area E of the Astronomy Precinct of the Mauna Kea Science Reserve. Approximately 3.5 miles south of the proposed TMT Observatory Project site, are the TMT Mid-Level Facility, two discreet parcels located in the Hale Pōhaku area, at approximately 2,800 m (9,200 ft.) elevation on the southern slope of Maunakea. The Project areas are depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993) (Figure 1).
Land Jurisdiction	State of Hawai‘i
Agencies	State of Hawai‘i Department of Health, Office of Environmental Quality Control (DOH/OEQC), and State Historic Preservation Division (SHPD), Department of Land and Natural Resources (DLNR)
Project Description	The proposed Thirty Meter Telescope (TMT) Observatory Project involves the construction of the TMT Observatory and associated infrastructure on an approximately 5-acre site within Area E of the Astronomy Precinct. Minimally, land disturbing activities would include grading of the TMT Observatory Project site and Access Way and excavations associated with building construction and installation of subsurface utilities. The proposed TMT Mid-Level Facility includes construction staging areas and development of dormitories and offices for TMT Observatory Project construction personnel. The proposed Project also involves upgrades to the existing Hawai‘i Electric Light Company (HELCO) power substation near Hale Pōhaku. Minimally, land disturbing activities would include grading of the construction staging areas, and excavations associated with construction of dormitory/office building, installation of subsurface utilities, and substation upgrades. In January 2010, Project proponent PB changed the acreage of the proposed TMT Mid-Level Facility near Hale Pōhaku from approximately six acres to 3.2 acres after the community consultation was conducted. The downsized acreage has been noted in this report along with figures that have been revised to depict the reduced acreage. In addition, the above paragraph contains language that has been changed at the request of PB after community consultation was

	completed.
Project Acreage	The footprint of the proposed TMT Observatory Project ground disturbance measures approximately 5 acres. The footprint of the proposed TMT Mid-Level Facility measures approximately 3.2 acres (see Figures 1-3).
Area of Potential Effect (APE)	The APE for the TMT Observatory Project includes the entire approximately 36-acre Area E of the Astronomy Precinct, as the precise location of the 5-acre Project area has yet to be determined. The APE for the TMT Mid-Level Facility includes an approximately 6-acre area which includes the 3.2 acres now planned for use. The APE also includes the rest of the island of Hawai‘i and other Hawaiian Islands.
Document Purpose	The Project requires compliance with the State of Hawai‘i environmental review process (Hawai‘i Revised Statutes [HRS] Chapter 343), which requires consideration of a proposed project’s effect on cultural practices and resources. At the request of Parsons Brinckerhoff (PB**)**, CSH conducted this Cultural Impact Assessment (CIA). Through document research and cultural consultation efforts, this report provides information pertinent to the assessment of the proposed Projects’ impacts to cultural practices and resources (per the *Office of Environmental Quality Control’s Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCPs) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai‘i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria (HAR §13-275-6) under Criterion E. The document is intended to support the Project’s environmental review and may also serve to support the Project’s historic preservation review under HRS Chapter 6E-8 and Hawai‘i Administrative Rules (HAR) Chapter 13-275.
Consultation Effort	Twenty-eight Hawaiian organizations, agencies and 38 community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and the vicinity. The agencies consulted include the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), and the Hawai‘i Island Burial Council (HIBC) in addition to community groups such as Mauna Kea Anaina Hou, Royal Order of Kamehameha ‘E kahi, Mamalahoa, Hilo Chapter and Hale o Lono. This effort was made by letter, e-mail, telephone, and in person contact. In the majority of cases, letters were mailed along with a map and an aerial photograph of the Project area.
Note on Spelling of Maunakea	For this CIA, both spelling variations of the name Maunakea are used. The two word format—Mauna Kea—is used to address official entities such as the “Mauna Kea Science Reserve” and when quoting content

	from other sources such as books or past published interviews that include the name of the mountain as two words. All other uses of the mountain will be written as one word, Maunakea. See Section 3.2 on Place Names for further details on the spelling of Maunakea.
Results of Background Research	Background research conducted for this Project yields the following results: 1. Maunakea is a sacred cultural landscape; symbolic of Wākea (the ‘Sky Father’ to all Hawaiians), home of Poli‘ahu, the goddess of snow and foe of Pele (the fire goddess), and of many other resident deities and supernatural entities (e.g., Līlīnoe, Kūkahau‘ula and Mo‘oinanea) and the *piko* (umbilical cord) of the island-child, Hawai‘i which connects the land to the heavens (Maly and Maly 2005:v); home of Waiau, the highest permanent lake in the Hawaiian Islands; location of the highest and most extensive basalt quarry in all of Polynesia and perhaps the entire world; and numerous trails, *ahu* (stone markers), *heiau* (temple, place of worship) and cinder cone *pu‘u* (hills). 2. Maunakea is rich in *mo‘olelo* (legends), *mele* (songs), *oli* (chants), and *‘ōlelo no‘eau* (proverbs, poetical sayings) associated with *akua* (God, male and female deities, spirits) and storied places (*wahi pana*). Poli‘ahu, the snow goddess, and Pele, the volcano goddess, engaged in legendary battles to control Maunakea. Pele also had legendary battles with the pig demi-god Kamapua‘a on the summit of Maunakea. Numerous stories of Wākea and Papa, Poli‘ahu, Līlīnoe, Kūkahau‘ula and Mo‘oinanea, to name a few, are written into the landscape. 3. The TMT Observatory Project area is located on a plateau at 13,150 feet elevation north of the summit cone, Pu‘u Kūkahau‘ula. The Hale Pōhaku Project area is located at approximately 9,200 feet in elevation. Maunakea, the tallest mountain in the Hawaiian Islands at 13,796 feet elevation, is also the tallest mountain on earth as measured from the ocean floor to the summit, a distance of some 29,500 feet (thus, exceeding by approximately 1,000 feet the non-volcanic Mount Everest). 4. Vegetation is almost non-existent in the summit region of Maunakea; the tree-line is located nearly a mile in elevation below the summit (at approximately 9,000 feet elevation); the highest major vegetation zone, known as the Alpine Scrub Zone, generally ends at approximately 11,300 feet elevation. Plants in the so-called Alpine Stone Desert Zone

	of the summit region are mostly limited to small lichens and mosses. More plant life is present in the Hale Pōhaku Project area characterized by scrub vegetation including a number of natives such as *māmane* (*Sophora chrysophylla*), *pūkiawe* (*Styphelia tameiameiae*) and the endangered endemic, *‘āhinahina*, also known as Maunakea silversword (*Argyroxiphium sandwicense*) as well as introduced exotics such as mullein (*Verbascum thapsus*) and various grasses. 5. Maunakea translates literally as white (*kea*) mountain (*mauna*), so named for its breathtaking snow-capped summit. However, according to Nā Maka o ka ‘Āina (2008) and according to other authorities on Hawaiian culture (e.g., Kepā Maly, Pualani Kanahele), Maunakea has numerous other meanings and translations. It is a short version of Mauna a Wākea, a name that connects it to the sky father, Wākea; this would be one of its *kaona* (hidden or more subtle meanings). 6. Hale Pōhaku, literally “stone house,” refers to the two stone cabins constructed by the Civilian Conservation Corps in 1936 and 1939 at an elevation of 9,220 feet on the southern slope of Maunakea. L.W. Bryan, who served as the Territorial Forestry Office and oversaw the construction of the “stone houses,” also named them Hale Pōhaku. 7. Pu‘u Poli‘ahu is named for Poli‘ahu, “the woman who wears the snow mantle of Mauna Kea;” Poli‘ahu, which is also the name of a land division on Maunakea, is translated as “garment [for the] bosom (referring to the snow)” by Pukui et al. (1974) and as “Snow goddess of Mauna Kea. Lit. Bosom goddess” by Pukui and Elbert (1986). Maly and Maly include a citation by W.D. Alexander regarding the naming of Pu‘u Poli‘ahu. As the peak was nameless, Alexander called it “Poliahu” since it had “a poetical name, being that of the demigoddess with snow mantle who haunts Mauna Kea” (Maly and Maly 2005:200). 8. Waiau, the permanent lake located within Pu‘u Waiau near the summit of Maunakea at approximately 13,020 feet elevation, translates as “swirling water,” and is associated with the snow goddess Poli‘ahu and is guarded by the supernatural water spirit (*mo‘o*) known as Mo‘oinanea. Queen Emma went to the top of Maunakea to bathe in the waters of Waiau. The ceremony was to cleanse in Lake Waiau at the *piko* of the island. The water caught at Lake Waiau is considered pure water of the gods much like the

	water caught in the *piko* of the *kalo* (taro) leaf and is thought of as being pure, therefore it is used medicinally (Nā Maka o ka ‘Āina 2008). 9. The Mauna Kea Adze Quarry, also known as Ke-ana-kāko‘i, “the adze-making cave” (Pukui et al. 1974:103), is located on the southern slopes of the mountain, at elevations up to 12,400 feet. The site was listed on the National Register of Historic Places in 1969, and the Hawai‘i State Register of Historic Places in 1981. 10. The *ahupua‘a* of Ka‘ohe was government land on which four native claims were made following the Māhele in 1848. Only one *kuleana* claim was awarded in the entire *ahupua‘a*. The single awarded claim indicates coffee, arrowroot, banana, and taro were all cultivated in the lands of Ka‘ohe. Ka‘ohe was also known as a habitat for *uwa‘u*, or *‘ua‘u* (dark-rumped petrel) seabirds that reside in rocky, dry, elevated areas (Foster 1893). 11. While historic accounts and *mo‘olelo* tell of the presence burials on Maunakea (Maly and Maly 2005), archaeological evidence until recently, was relatively limited concerning confirmed human burials in the summit region. Prior to 2005, archaeological authorities on Maunakea, including Pat McCoy, had documented only one confirmed burial site (with multiple burials) and four possible burial sites in the summit region (McCoy 1991). All of these sites are located on Pu‘u Mākanaka to the northeast of the subject Project area. In progress work by McCoy and Nees however, has documented 28 sites designated as burials and possible burials (McCoy et al. 2008). 12. Several extensive cultural studies have been previously carried out for Maunakea (McEldowney 1982; Kanahele and Kanahele 1997; Maly 1998; Langlas et al. 1999; Maly 1999; PHRI 1999; Maly and Maly 2005). The most comprehensive study by Maly and Maly (2005) builds on archival and oral historical research conducted by the authors beginning in 1996 (to 2005) and presents a wide range of information on natural and cultural beliefs, resources and practices associated with Maunakea. Among the many critical findings of Maly and Maly’s (2005) cumulative research is the emphasis on Maunakea as a sacred landscape and native lore associated with traditional knowledge of the heavens—documenting 270 Hawaiian names for stars. 13. Past studies identify Traditional Cultural Properties (TCP)

	on Maunakea. Three places that have been identified by the SHPD as TCPs and documented in a study done by PHRI (1999) are: (1) Kūkahau‘ula, the summit (Site 21438), (2) Līlīnoe (Site 21439) and (3) Lake Waiau (Site 21440). Other traditional places may also qualify (see Figure 6). Maly (1998:29) has suggested the entire Maunakea summit region down to the 6,000 foot elevation contour be designated a Traditional Cultural Property see (Figure 16). 14. Archival and oral-historical evidence confirms that Maunakea has long been, and continues to be, a place where significant cultural practices are carried out: where, the *piko* of newborn children are taken to Pu‘u Kūkahau‘ula and Lake Waiau to ensure long life and safety; the remains of individuals with generational ties to Maunakea are taken to *pu‘u* and the summit plateau for interment (Maly and Maly 2005:vi); shrines and stone markers are erected and; ceremonial and other activities occur related to birth, death, healing, navigation and more.
Summary of Community Consultation (Individuals)	CSH attempted to contact 60 community members (government agency or community organization representatives, or individuals such as cultural and lineal descendants, and cultural practitioners) for the purposes of this CIA. Twenty-five people responded and 14 *kūpuna* (elders) and/or *kama‘āina* (native born) were interviewed for more in-depth contributions. The results of cultural consultations indicate that there are major concerns (and several ancillary ones) regarding potential adverse impacts on cultural and natural resources and associated beliefs and practices as result of the proposed development of the Thirty Meter Telescope, construction of the staging area for the TMT Observatory Project and the HELCO electrical transformer needed to supply electrical power to the TMT Observatory Project: 1. All of the community members interviewed for this study stress that Maunakea is a sacred landscape and that any future development activities on the mountain proceed with greater awareness of, and the utmost respect for Hawaiian culture, Hawaiians’ spiritual connection to the mountain, and the sanctity of Maunakea. 2. Several participants discussed the association of Maunakea with other places in Polynesia, from its shared tradition of Polynesian celestial observation and navigation to its cultural and spiritual links in *mo‘olelo* (myths, legends, oral histories), *wahi pana* (legendary or storied places), *mele* (chants and songs) and poetical sayings as well as proverbs (*ōlelo no‘eau*).

	3. Ten of the community members interviewed, and three of the respondents who provided brief commentary, explicitly stated their opposition to the proposed actions on Maunakea which is traditionally, and continues to be, one of the most sacred locations in all of Polynesia, not to mention Hawai‘i. These participants voiced sadness, frustration or negative feelings about the cumulative impacts of past and present developments on Maunakea. In the words of one participant, referring to the telescopes on the summit of Maunakea, “When is enough, enough?” Specific *mana‘o* (concerns) and recommendations from those that oppose the proposed TMT Observatory Project and TMT Mid-Level Facility Project are: a. Three participants called for astronomy facilities to be removed and for Maunakea to be repaired to its original condition. Two of these participants recommended that the proponents of the TMT Observatory Project make an effort to better reach out to the community about the findings of the Mauna Kea Science Reserve and scientific intent of the proposed TMT Observatory Project through public education events. b. One respondent stated that there should be no further development until issues are rectified with the Hawaiian people. c. One participant called for the proposed TMT Observatory Project to be installed in Chile rather than in Hawai‘i. Two participants called for the TMT to be installed on the mainland or other countries. d. Three of these participants stressed the importance of astronomy to Hawaiians, especially to their voyaging traditions. e. Five interview participants and respondents expressed concern about the disturbance of burials and associated cultural artifacts, markers and shrines (*ahu*) and *pu‘u* as result of construction of the proposed TMT Observatory Project and support facilities. f. Five participants discussed environmental concerns, particularly about Lake Waiau and the mountain aquifer, as well as other impacts to environmental services. These participants assert that Maunakea—

	the principle aquifier and watershed for Hawai‘i Island—is being contaminated by human use (i.e., sewage and toxic chemicals leaching from astronomy facilities). Participants also mention the threatened endemic Maunakea Wēkiu Bug (*Nysius wekiuicola*) and cleaning up trash left by visitors to Maunakea. g. One participant notes that the entire Mauna Kea Science Reserve has been identified by SHPD as an historic district; suggesting that a Cultural Reserve be created and that the following landscape features qualify as TCPs: the Mauna Kea Adze Quarry Complex; the cluster of three *pu‘u* of Kūkahau‘ula that make up the summit region of Maunakea; Lake Waiau; and Līlīnoe, referring to the *pu‘u* southeast of the summit and within the Science Reserve (Section 7.7, Appendix D). h. Five participants question legal aspects of the lease agreement between the University of Hawai‘i and the State and legitimacy of the Mauna Kea Science Reserve to operate on ceded and/or occupied lands. i. Three participants question the benefits to the local economy and education promised by past and proposed telescope projects on Maunakea. j. One participant commented on the view plane and noted that if the TMT project did proceed with development on Maunakea, it should be built away from sacred sites on the summit. S/he added that it should be built off the summit at the 13,000 ft. level near the VLBA (Very Long Base Array) Telescope Facility to avoid interfering with the major view planes of the summit area and to avoid being visibly intrusive from lower levels on the island (e.g., Waimea). 4. Three participants interviewed for this CIA, and one respondent who provided brief commentary, are in favor of the development of the TMT Observatory Project and its associated facilities on Maunakea. These participants recommend Project proponents proceed with care and respect to the sacredness of Maunakea and advised mitigation measures and/or alternatives to the current proposed design and location of the TMT Observatory Project and support facilities. In the words of one participant, “The future of Maunakea…can serve as an

	educational center and a place for man to view the stars and the universe but it has to remain a sacred and holy place. It's like stepping into a sanctuary, a very sacred place of peace, a place that one can learn the things beyond what man knows now." Concerns and recommendations from these participants are: a. One participant believes the TMT Observatory Project should be built on a recycled site. He states that if an outdated telescope site on Maunakea is identified, the site should be recycled for TMT Observatory Project usage to avoid unnecessary intrusions that detracts from the beauty and majesty of Maunakea. b. Oneparticipant calls for a process to be put in place that respects community and allows projects such as TMT Observatory Project telescope to continue. c. One participant recommends the removal of all other telescopes and that only one telescope be utilized and shared by interested parties. d. All three of these participants state that if the TMT Observatory Project proceeds, it should be developed to blend in with the natural setting and not detract from the natural beauty and sacredness of Maunakea. 5. Interviewees discussed salient features of the cultural landscape, resources and associated uses of Maunakea including, *mo‘olelo* about Wākea and Papa, Poli‘ahu, Līlīnoe, Kūkahau‘ula and Mo‘oinanea; the summit as an area where families take the *piko* of their babies to bury, and where the bones or ashes of deceased family members are placed; burials and burial complexes; shrines and stone markers; navigation traditions and astronomy; the adze quarry; ancient and historic trails; the healing and purifying waters of Lake Waiau and snow and ice collected for medicinal and ceremonial purposes; bird hunting; and other past and present cultural practices (see Sections 7 and 8).
Agency Responses	CSH received comment in writing from the SHPD and OHA: 1. SHPD, responding in a memo sent on May 4, 2009 states, "As you may have discerned from the most recent Mauna Kea Comprehensive Management Plan (MCMP) for the UH Management Area (January 2009) and the public hearings for that plan that Maunakea is a very sensitive subject that truly needs and deserves more time to consider

	all the cultural impacts to this iconic symbol of all cultural connections including but not limited to the genealogical connections, and the spiritual connections to all of the deities in the Hawaiian cosmos and to the kanaka maoli world view." Additionally, SHPD recognizes Maunakea's place in Hawaiian navigation as "the first sighting for voyaging canoes to arrive safely to our islands in the middle of the Pacific [and] a significant part of the Pacific Rim mythological connections to all the Pacific Rim." SHPD recommends: a. An assessment of buildings no longer functional be done before building new structures or "perhaps no more development on this sacred mountain;" b. access for cultural practitioners be clearly addressed and defined; c. the entire summit of Maunakea be treated as one traditional cultural landscape and not as a piecemeal analysis of just the Science Reserve and that; d. more community outreach occur for all cultural impacts on the summit and the proposed area to properly assessed—see list of contacts in the MCMP. 2. OHA, responding in a letter dated January 9, 2009 (Appendix C), acknowledges the different perspectives on Maunakea as a spiritual, sacred place, home to "wao akua" (dwelling, place of the gods) and the place where the presence of numerous *ahu* and *iwi kūpuna* provide silent testimony that generations of Hawaiians have worshipped and buried loved ones at "the highest point possible to rest in peace." The "life sustaining waters known as Kanekawaiola…contribute to a healthy natural environment, which in turn allows man to thrive." The letter describes the 40-year debate surrounding the development of Maunakea and recommends that the current proposed TMT Observatory Project study be viewed in context of this long history to "consider the overall impacts of development on Mauna Kea." OHA suggests several parties for consultation. In a letter dated May 27, 2009, OHA wrote that the comments provided in their initial letter of January 9, 2009 remain the same (Appendix C), despite the addition of the TMT Mid-Level Facility Project area information to the CIA. 3. Both the SHPD and OHA asked that the current proposed

	TMT Observatory Project and TMT Mid-Level Facility Project be viewed in light of the long history of development on Maunakea and cumulative impacts to cultural resources and practices and not on an isolated basis.
Summary of Additional Community Consultation	After the DEIS, Project proponent PB requested CSH contact additional community members (government agency or community organization representatives, or individuals such as cultural and lineal descendants, and cultural practitioners) for the purposes of this CIA. Four individuals (Mr. Ed Stevens, Mr. Gene Leslie, Mr. Patrick Kahawaiola‘a, and Mrs. Ululani Sherlock) were referred by PB to CSH. The remaining four individuals (Mr. Paul Chung-Hoon of the Royal Order of Kamehameha, Superintendent Geraldine Bell, Dr. Pualani Kanahele, and Mrs. Cynthia Nazara) were contacted at the recommendation of Mrs. Sherlock. Of these eight, four people responded and two *kūpuna* (elders) and/or *kama‘āina* (native born) were interviewed for more in-depth contributions. The results of the additional community consultations indicate that there are major concerns (and several ancillary ones) regarding potential adverse impacts on cultural and natural resources and associated beliefs and practices as result of the proposed development of the Thirty Meter Telescope, construction of the staging area for the TMT Observatory Project and the HELCO electrical transformer needed to supply electrical power to the TMT Observatory Project: 1. All four of the additional community members contacted emphasize the historic and sacred place Maunakea occupies in Hawaiian beliefs and practices: a. Two participants note that Maunakea should not be crowded with more telescopes, with one of the participants stating “culturally, there’s no more room for new telescopes on Mauna Kea…the most sacred part of Mauna Kea, the summit, is already overbuilt, overcrowded with telescopes.” b. One respondent states “the entire Pu‘u is considered sacred from the ocean to the very top of Mauna Kea” and that “mere digging…is considered by most a desecration of Mauna Kea in itself.” Another participant calls for the observation of the sacredness of the mountain by not leaving anything manmade on the summit as to do so “diminishes the mana [power] that adds to the sacredness of Mauna Kea.” This same participant discusses “the three levels of transition” that an individual passes on the way to the summit, which lies at the 13,000 ft level and above,

	where only *ali‘i* (chiefs, royalty) and the priesthood could go. c. One participant discusses the belief that Maunakea belongs to Hawaiians, stating that “the mountain, the highest part of the land, comes to us with an alloidal title.” d. One participant described how traditional practitioners such as members of *hālau* (meeting house for either canoe or hula instruction) or those from Royal Orders and Ali‘i Societies “often go to the Summit to perform their rituals, respects and present Ho‘okupu.” Another participant notes the ongoing practice of people bringing the “piko [umbilical cord] of their young ones [to the summit].” 2. Two participants express their preference for the de-commissioning of telescopes from the summit. a. One participant states that telescopes should be taken out as they get older and near “obsolescence,” so that “the summit would be cleared whether it be 20 years or 50 years…there would be no remaining telescope facilities on the summit.” b. One participant notes that if a replacement telescope is needed, then the lower northern plateau, the proposed location for the TMT, would be his area of preference for the replacement telescope, as that location is “more benign and [it] has less cultural artifacts that can be disturbed.” 3. Of the four who responded or were interviewed, three community members state their support for the development of the TMT Observatory Project and its associated facilities on Maunakea. However, they stress that any development of the TMT and its supporting facilities should be kept far away from any historic or cultural features and sites such as *ahu* and *iwi kūpuna*. They also call for Project proponents to proceed with extreme care and respect for the sacredness of Maunakea in addition to addressing several critical issues: a. One of these participants, the president of the Keaukaha Community Association, states that “the association is opposed to any new development, without some of it [telescopes] being taken down.” Another participant states that he does not see a

	cultural impact, but if anything temporary will be put up, it should be taken down. b. Another participant calls the TMT telescope “an outstanding piece of equipment” that has “amazing potential.” However, he stresses that before the TMT can go ahead, the master lease has to be revised and modified so that “it would be fair and equitable to all” with “appropriate compensation” to help educate students. c. One participant notes that the proposed location for the TMT, the northern plateau, is an area that does not have *iwi* or *heiau*. However, he sees a problem regarding “the proximity to several *pu‘u*.” He adds that in the event that *iwi* are found, “they would have to stop.” d. One participant points to the lack of “any cultural historic objects within a 200 ft. radius of the site” while another participant notes that the proposed supporting facilities such as dormitories and a cafeteria are necessary, and will have little or no impact at Hale Pōhaku. 4. All four community members stress their concern for cultural features and historic sites to remain undisturbed. a. Two of these members discuss the importance of treating *iwi kūpuna* with respect and extreme care if any additional burials are found. b. One respondent recommends that *kūpuna* from the *ahupua‘a* as well as the HIBC be consulted in the event that any inadvertent burial sites are uncovered during ground disturbances. c. One participant notes that the location of burial caves on Maunakea are known only to the *‘ohana* (family) caring for the *iwi kūpuna*. 5. One respondent raises the issue of pollution. She asks who will be responsible for transporting waste and/or water run-off away from Maunakea. She voices concern about the light pollution that may be generated by the temporary dormitory at night. She also voices concerns about waste generated by hunters and tourists visiting Maunakea. 6. One participant provides the background, history and purpose of Kahu Ku Mauna (“Guardians of the Mountain”),

	while another participant describes the group's deep understanding of the cultural protocol for the mountain.
Summary of Community Consultation	For 15 participants in this cultural impact study, as well as a few invited participants who opted not to participate in the CIA study (see Section 6.1.1), there are *no* mitigation measures that could begin to address the variety of cultural concerns and concomitant issues (legal, economic and environmental) raised by the proposed actions; future developments are viewed as further desecration of a sacred mountain (a realm of the gods) and do not honor Maunakea's place in Native Hawaiian contributions to navigation and astronomy. For seven participants in this assessment, careful planning, better attention to community desires and cultural concerns regarding protection of Maunakea, access to cultural and natural resources and other considerations suggest a way forward; the proposed actions are viewed as an extension of Native Hawaiian knowledge of the stars and voyaging traditions.
Recommendations	Recommendations are based on a synthesis of all available findings to date, including background research and community consultation, gathered during preparation of this CIA. Some of the themes expressed in past CIAs and cultural studies completed for Maunakea (Sections 4.7 and 4.8) were echoed in this current assessment: 1. Based on the majority view of participants in this current study who have voiced their concerns against proposed actions on Maunakea, it was recommended that Project proponents strongly consider no further development, including the TMT Observatory Project and the TMT Mid-Level Facility at Hale Pōhaku, take place on Maunakea. Consequent to their determination of no action, it is further suggested that Project proponents consider alternative proposals and remediation measures suggested by CIA study participants (see Community Consultation Results above and Mitigation Measures below).
Mitigation Measures	The following mitigation measures are offered as a way to remediate and address present and future adverse impacts to Hawaiian cultural beliefs, practices and resources as result of developments on Maunakea generally, and specifically for the proposed TMT Observatory Project and TMT Mid-Level Facility Project: 1. Should the Project move forward in Hawai‘i, faithful attention to the following measures may help minimize adverse impacts: a. As expressed by one participant in this current study and several participants in past cultural studies (see

	Maly 1998, 1999; Maly and Maly 2005), it is recommended that the TMT Observatory Project be built on a recycled site of an outdated telescope on the summit instead of Area E of the Northern Plateau. b. An *exit plan* should be created, including an estimated life span for the TMT Observatory Project and a detailed strategy for the removal of the TMT Observatory Project from the summit of Maunakea, before development begins. c. Cultural monitors should be present during ground disturbance and construction phases of the TMT Observatory Project and its TMT Mid-Level Facility Project. In addition, personnel involved in development activities in the Project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law. d. Access for all cultural practitioners to culturally significant sites on Maunakea should be clearly addressed, defined and allowed before, during and after construction of the TMT Observatory Project and its TMT Mid-Level Facility. e. Project proponents should consider expansion and further development of education programs, such as the star gazing program at the annual Makahiki festival, that share the findings of the TMT Observatory and astronomy research with schools and the general public. At the same time, Project proponents should consider training programs for TMT Observatory staff that incorporate Polynesian perspectives in the study of astronomy. f. Based on prior cultural studies (e.g., Maly 1998, PHRI 1999) and the statements of respondents in this CIA—including the SHPD—it is recommended that the landowners (State of Hawai‘i) explore the possibility of nominating the entire summit region of Maunakea, from the 6,000 foot level to the summit at Pu‘u Kūkahau‘ula as Traditional Cultural Property for the State Register of Historic Places. The SHPD

	maintains the Hawai‘i and National Register of Historic Places and processes all nominations to either register (see http://www.state.hi.us/dlnr/hpd/hpinvntory.htm). g. Generally, it is recommended that Project proponents—to employ a phrase used by OHA in their response letter for this CIA—develop a paradigmatic shift in how they engage with the community in a way that truly recognizes cumulative impacts and addresses interrelated concerns (cultural, legal, environmental and socio-economic) enumerated in this CIA report.

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Section 1 Introduction

1.1 Project Background

Cultural Survey Hawai‘i, Inc. (CSH) conducted this Cultural Impact Assessment (CIA) for the proposed construction and operation of the Thirty Meter Telescope Observatory Project (TMT), an optical-infrared telescope on an estimated 5 acres of presently undeveloped land of the 525-acre Astronomy Precinct of the Science Reserve near the top of Maunakea. Approximately 3.5 miles south of the proposed TMT Observatory Project site, is the TMT Mid-Level Facility, two discreet parcels located in the Hale Pōhaku area, at approximately 2,800 m (9,200 ft.) elevation on the southern slope of Maunakea. The Project would be located in Ka‘ohe Ahupua‘a, Hāmākua District, on the island of Hawai‘i, on a portion of TMK: (3) 4-4-015: 009 and 012 (Figures 1 through 3).

The proposed TMT Observatory Project would be located within the western portion of the area known as the northern plateau within the Astronomy Precinct. More specifically, the area being considered is the general vicinity of the 36-acre area designed Area E in the Mauna Kea Science Reserve Master Plan (UH 2000). Area E ranges in elevation from 13,100 to 13,300 feet and is located approximately half a mile northwest of the nine existing optical-infrared telescopes located near the summit at elevations of 13,600 to 13,775 feet. The entire Mauna Kea Science Reserve is designated part of the State of Hawai‘i Conservation District, resource subzone. Ancillary facilities include an access road from the end of the current Access Way near the summit to the new telescope site would need to be developed.

When the TMT Observatory Project’s CIA consultation was initiated on November 24, 2008, communication with Project proponents indicated that the proposed Thirty Meter Telescope CIA consisted mainly of the actual construction of the TMT Observatory Project within the 36-acre area known as Area E in the Mauna Kea Science Reserve Master Plan. In February 2009, CSH was informed that the TMT Observatory Project will also include a construction staging area located at the 9,200 foot level Hale Pōhaku site, approximately 3.5 miles south of the proposed TMT Observatory Project site. Additionally, included in the proposed TMT Observatory Project description is a new electrical transformer to be installed at the Hawaiian Electric Light Company (HELCO) site located at the Hale Pōhaku site. For this reason, CSH sent out a second round of community consultation letters in February 2009 to include the additional information regarding the construction staging area and the electrical transformer in order to provide community participants the opportunity to provide further comments and concerns.

The footprint of the proposed ground disturbance for the TMT Observatory Project measures approximately 5 acres. However, the precise 5-acre Project area is not yet determined, so the entire approximately 36-acre Area E of the Astronomy Precinct is included in the Project area. The Area of Potential Effect (APE) for this TMT Observatory includes the 36-acre area of the possible construction footprint as well as the approximately 6-acre which includes the 3.2 acres now planned for the proposed TMT Mid-Level Facility. For the purposes of this CIA, the APE considers the Project area/s within the larger cultural context of the *ahupua‘a* of Ka‘ohe; Hawai‘i Island and other islands of Hawai‘i. This assessment further includes consideration of the *cumulative* effects of the proposed Project on traditional Hawaiian practices and resources in and around the Project area.

On May 11, 2009, an updated map of the TMT Mid-Level Facility was provided by project proponents for this assessment and has been inserted in Appendix F. It is important to note that this updated map of the TMT Mid-Level Facility was not used in the community consultation efforts for this assessment. Additionally, on January 2010, the acreage of the proposed TMT Mid-Level Facility near Hale Pōhaku was changed by PB from approximately six acres to 3.2 acres after the community consultation was conducted. The downsized acreage has been noted in this report along with figures that have been revised to depict the reduced acreage.

1.2 Document Purpose

The Project requires compliance with the State of Hawai‘i environmental review process [Hawai‘i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed Project’s effect on cultural practices. CSH conducted this CIA at the request of Parsons Brinckerhoff (PB). Through document research and cultural consultation efforts this report provides information pertinent to the assessment of the proposed Project’s impacts to cultural practices and resources (per the *Office of Environmental Quality Control’s Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCPs) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai‘i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria (HAR §13-275-6) under Criterion E which states to be significant an historic property shall:

> Have an important value to the Native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

The document is intended to support the Project’s environmental review and may also serve to support the Project’s historic preservation review under HRS Chapter 6E-8 and Hawai‘i Administrative Rules Chapter 13-275.

1.3 Scope of Work

The scope of work for this CIA includes:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources as may be indicated in the historic record.
2. A review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.

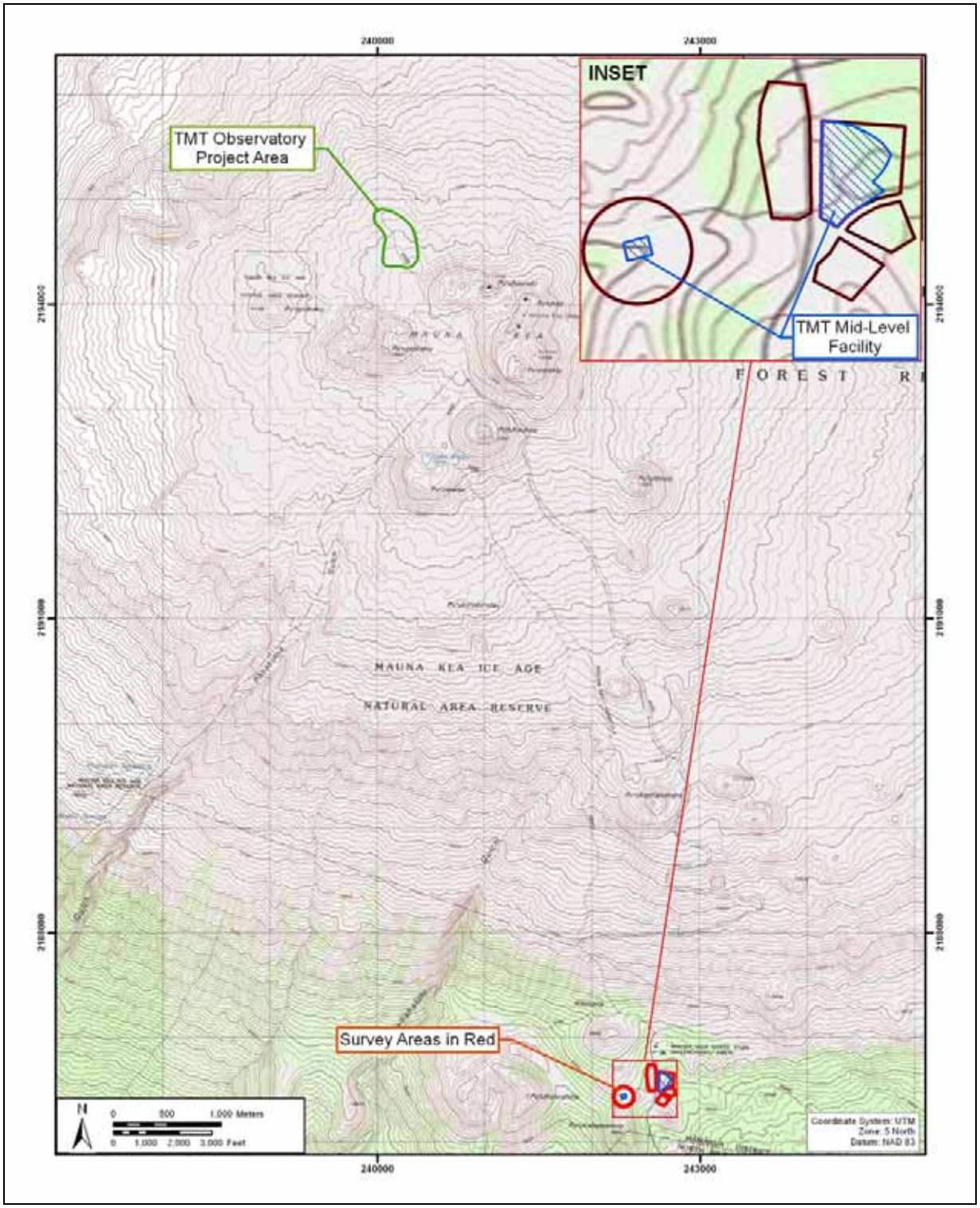

Figure 1. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing the location of the Project areas

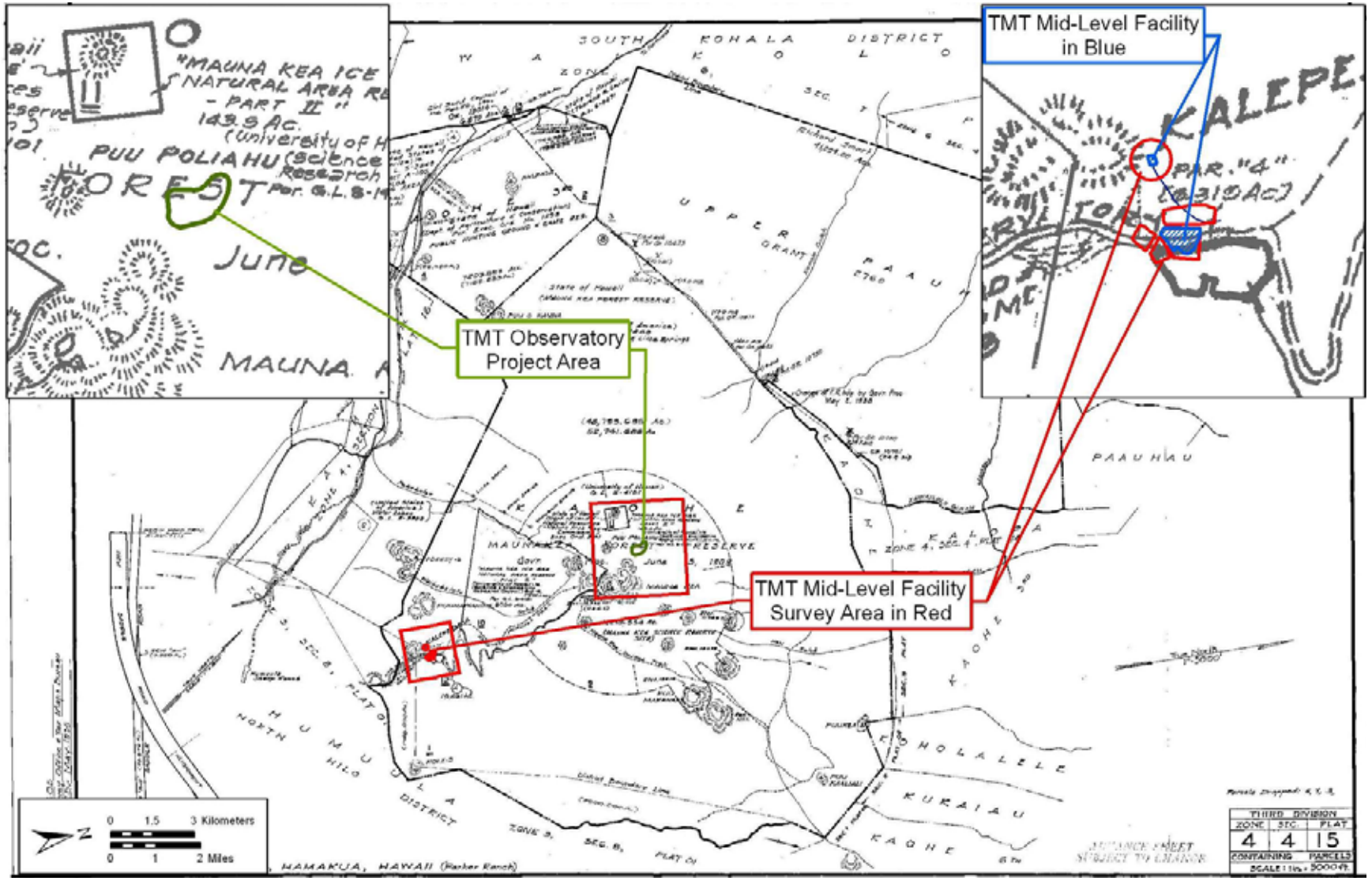

Figure 2. Portion of Tax Map Key (TMK) 4-4-015, showing the location of the Project areas

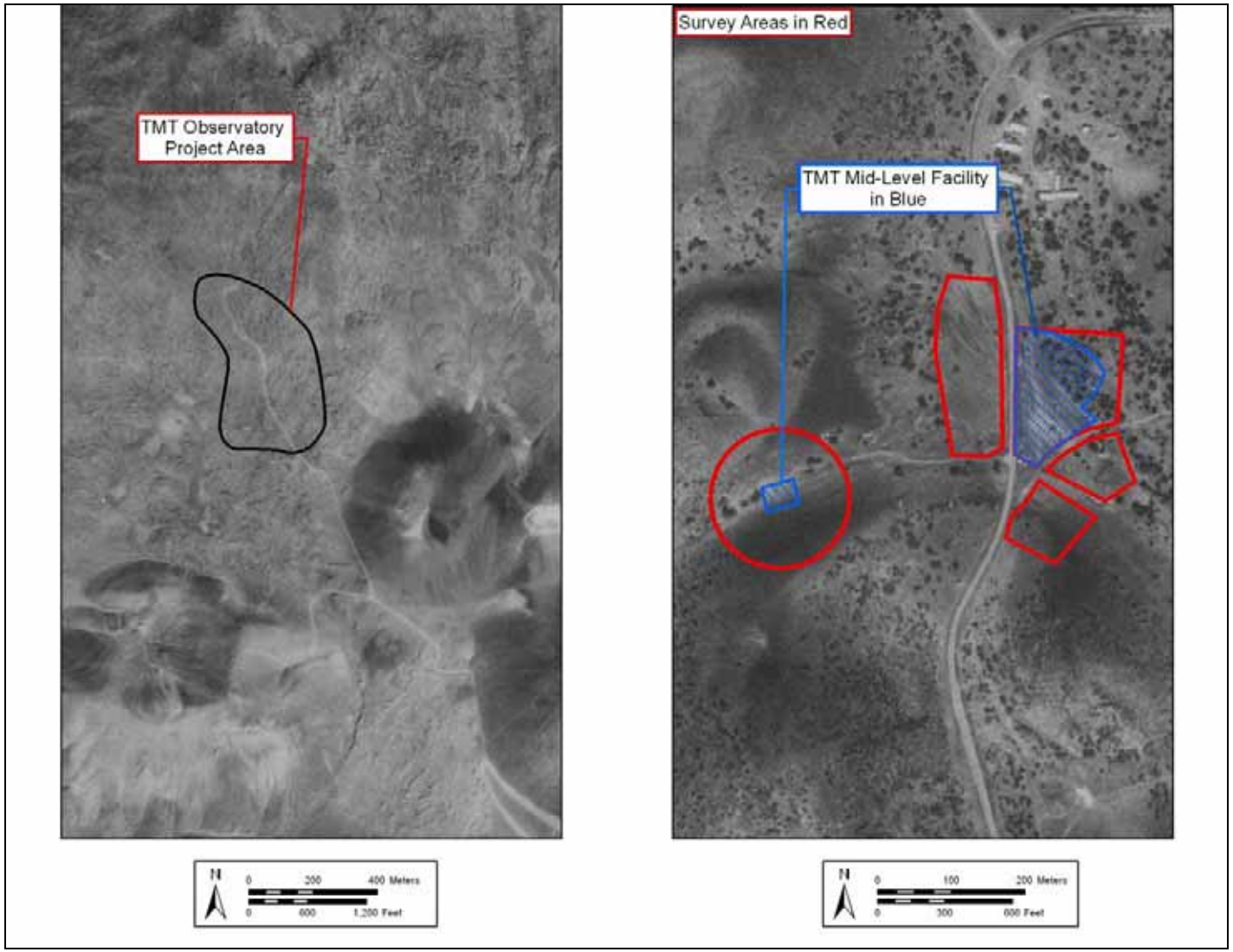

Figure 3. Aerial photograph (source: U.S.D.A. 2000), showing the location of the Project areas

3. Consultation and interviews with knowledgeable parties regarding traditional cultural practices at or near the parcel; present uses of the parcel; and/or other (non-Hawaiian) practices, uses, or traditions associated with the parcel.
4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting for the TMT Observatory Project Area

1.4.1 Natural Environment

The information in this subsection is based on the following primary sources: Macdonald et al. (1983), Juvik and Juvik (1998) and Ziegler (2002).

The TMT Observatory Project area is located on a plateau at 13,150 feet elevation north of the summit cone, Pu‘u Kūkahau‘ula. Maunakea, the tallest mountain in the Hawaiian Islands at 13,796 feet elevation, is also the tallest mountain on earth as measured from the ocean floor to the summit, a distance of some 29,500 feet (thus, exceeding by approximately 1,000 feet the non-volcanic Mount Everest). This massive “shield volcano,” one of five making up the island of Hawai‘i (the others are Maunaloa, Kīlauea, Kohala and Hualālai), has formed through the action of the Pacific Plate moving over a more or less stable “hot spot” located deep within the earth that generates magma (molten rock). The oldest exposed basalts (cooled magma) from Maunakea have been dated to approximately 250,000 years ago, and the mountain is in its dormant Postshield Stage (highly unlikely to erupt but possible). No historic (i.e., prior to the late 1700s) eruptions have been reported for Maunakea, which last erupted approximately 4,500 years ago.

Unlike mountain-top regions in other parts of Hawai‘i Island and the rest of the Hawaiian Islands, the summit of Maunakea is actually very arid, receiving less than 15 inches of rainfall, and appropriately classified as an “alpine desert.” Most of precipitation is in the form of freezing fog and snow. This aridity is due to a meteorological phenomenon known as the “inversion layer,” in which a layer of relatively warm air between approximately 5,000 and 7,000 feet elevation impedes the upward rising of relatively cooler, moisten-laden air.

Light snows are common in the “winter months” at the summit, and frost is a nightly occurrence year-round. The monthly average temperature ranges from 25 to 60 degrees Fahrenheit with winter storms often depositing up to several feet of snow in the higher elevations. Maunakea was glaciated (i.e., covered with snow and ice-pack that did not melt during the summer) in the Late Pleistocene, and the primary geological activity shaping the summit terrain is glaciation. Several main glacial features present on the summit region include glacial striations on bedrock outcrop, the sculpted configuration of cinder cones, and the formation of Lake Waiau and Pōhakuloa Gulch as a result of glacial melt-water. The summit region’s ground surface is generally characterized by rubbly ground moraine deposits and Hawaiite ‘a‘ā flows of Late Pleistocene origin (Figure 4), partially mantled by cinder, coarse ash, and spindle bombs (McCoy 1982:A-29). The lowest temperature ever recorded in historic times in the Hawaiian Islands (9°F) was atop Maunakea. Permafrost is still present a few meters below the present ground surface in the summit region.

Vegetation is almost non-existent in the summit region of Maunakea; the tree-line is located nearly a mile in elevation below the summit (at approximately 9,000 feet elevation); the highest major vegetation zone, known as the Alpine Scrub Zone, generally ends at approximately 11,300 feet elevation. Plants in the so-called Alpine Stone Desert Zone of the summit region are mostly limited to small lichens and mosses. However, due to daily convection currents (warm winds moving upslope), the summit experiences a special type of local ecosystem known as the High-Altitude Aeolian Ecosystem in which insects and other small arthropods (and sometimes small birds) are driven up to the summit, whose low temperatures immediately kill or immobilize them. The endemic Maunakea Wēkiu Bug (*Nysius wekiuicola*), which has lost the ability to fly, has developed a remarkable specialization (extremely low body temperature that withstands below-freezing conditions) that allows it to feed on immobilized or dead insects and arthropods driven up by the wind. According to Ziegler (2002:209), there are other similar creatures in this most forbidding environment, including a non-described species of black rock centipede only 1 cm long.

As discussed in more detail below, it is important to understand that Native Hawaiians were utilizing this Alpine Stone Desert Zone in pre-Contact times, as evidenced by the extraordinary (State and National Register of Historic Places site) Mauna Kea Adze Quarry, one of the largest traditional adze quarries in the world, located up to 12,400 feet elevation, a little over two miles south of the TMT Observatory Project area; and as indicated by many dozens of shrines at or above 13,000 feet elevation. The basalt available between approximately 11,000 and 12,400 feet elevation on Maunakea is generally perceived by expert stone workers to be the highest quality material available in the Hawaiian Islands. Several old trails exist in and around the TMT Observatory Project area that testify to the long-term utilization of the Alpine Stone Desert by the Native Hawaiians.

1.4.2 Built Environment

The TMT Observatory Project area is located at the end of an existing 4-wheel-drive road that was originally built in the 1960s to develop the general summit area for a number of astronomical observatories. Today, there are 13 main observatories and associated facilities located in the general vicinity of the TMT Observatory Project area.

1.5 Environmental Setting for TMT Mid-Level Facility

1.5.1 Natural Environment

The environmental setting of the Hale Pōhaku area has been well described by McCoy (1990:237-92; 1991:4-9) and the reader is referred to his work for a thorough study and references. A brief overview is presented in this study, based on Dr. McCoy’s work. The current TMT Mid-Level Facility Project area is located on a gently sloping saddle area surrounded by prominent cinder cones, including Pu‘u Kalepeamoa, Pu‘u Ha‘iwahine, and Kilohana. Pu‘u Kalepeamoa is understood as an older hawaii-ite cone which contains a large number of cored bombs many of which are formed of angular mafic blocks with dunnite and gabbro inclusions (McCoy 1991:6). Pu‘u Kalepeamoa is understood as the likely source for much of the raw material worked at the Pu‘u Kalepeamoa site complex (see Section 5.3 and Table 4). The

surrounding geology includes cinder cones, lava flows and air fall deposits termed Laupahoehoe Volcanics understood as probably less than 40,000 years old.

Elevations within the TMT Mid-Level Facility Project area range from approximately 2,780-2,805 m (9,120-9,200 ft.) above mean sea level. The TMT Mid-Level Facility Project area receives an average of approximately 650 mm (26 in.) of annual rainfall (Giambelluca et al. 1986). Sediments within the TMT Mid-Level Facility Project area are listed as Huikau Extremely Stony Loamy Sand (rHLD) and Cinder Land (rCL) (see Figure 4). Soils of the Huikau Series are described as "somewhat excessively drained loamy sands that formed in volcanic ash, pumice, and cinders" (Sato et al. 1973). Cinder Land is described as "bedded cinders, pumice, and ash…The particles have jagged edges and a glassy appearance and show little or no evidence of soil development" (Sato et al. 1973).

The TMT Mid-Level Facility Project area lies close to the timberline and the vegetation is generally a subalpine xerophytic scrub of both native and non-native, introduced plants such as *pūkiawe* (*Styphelia tameiameiae*), *noho-anu* (*Geranium cuneatum*), *ʻōhelo* (*Vaccinium reticulatum*), *naʻenaʻe* (*Raillardia ciliolata*), *kalamoho* fern (*Pellaea ternifolia*), *ʻāheahea* (*Chenopodium oahuensis*), *pilo* (*Coprosma montana*), *māmane* (*Sophora chrysophylla*) and the endangered endemic, *ʻāhinahina*, also known as Maunakea silversword (*Argyroxiphium sandwicense*), as well as introduced exotics such as mullein (*Verbascum thapsus*) and a variety of native and exotic grasses. It seems probable that prior to human utilization of this area, and the presence of feral goats and sheep, that the *māmane* vegetation was more extensive and diverse (McCoy 1990:91). The work of McCoy (1990) has also emphasized the "non-subsistence" nature of this alpine environment, and it is understood that virtually all food to support temporary habitation in the area would have been imported from lower elevations.

1.5.2 Built Environment

The eastern portion of the TMT Mid-Level Facility Project area is adjacent to the Mauna Kea Access Way and includes components of the Hale Pōhaku Mid-Level Astronomy Facilities. Development in the Hale Pōhaku area includes the Onizuka Center for International Astronomy, the Visitor Information Station (a.k.a. Ranger Station), and construction laborer residences. The construction laborer residences are located within the current TMT Mid-Level Facility Project area and include two dormitory structures and four cabins. The western portion of the TMT Mid-Level Facility Project area consists of the existing HELCO power substation within a fenced enclosure. The vicinity of the TMT Mid-Level Facility Project area is generally undeveloped, with the exception of jeep roads.

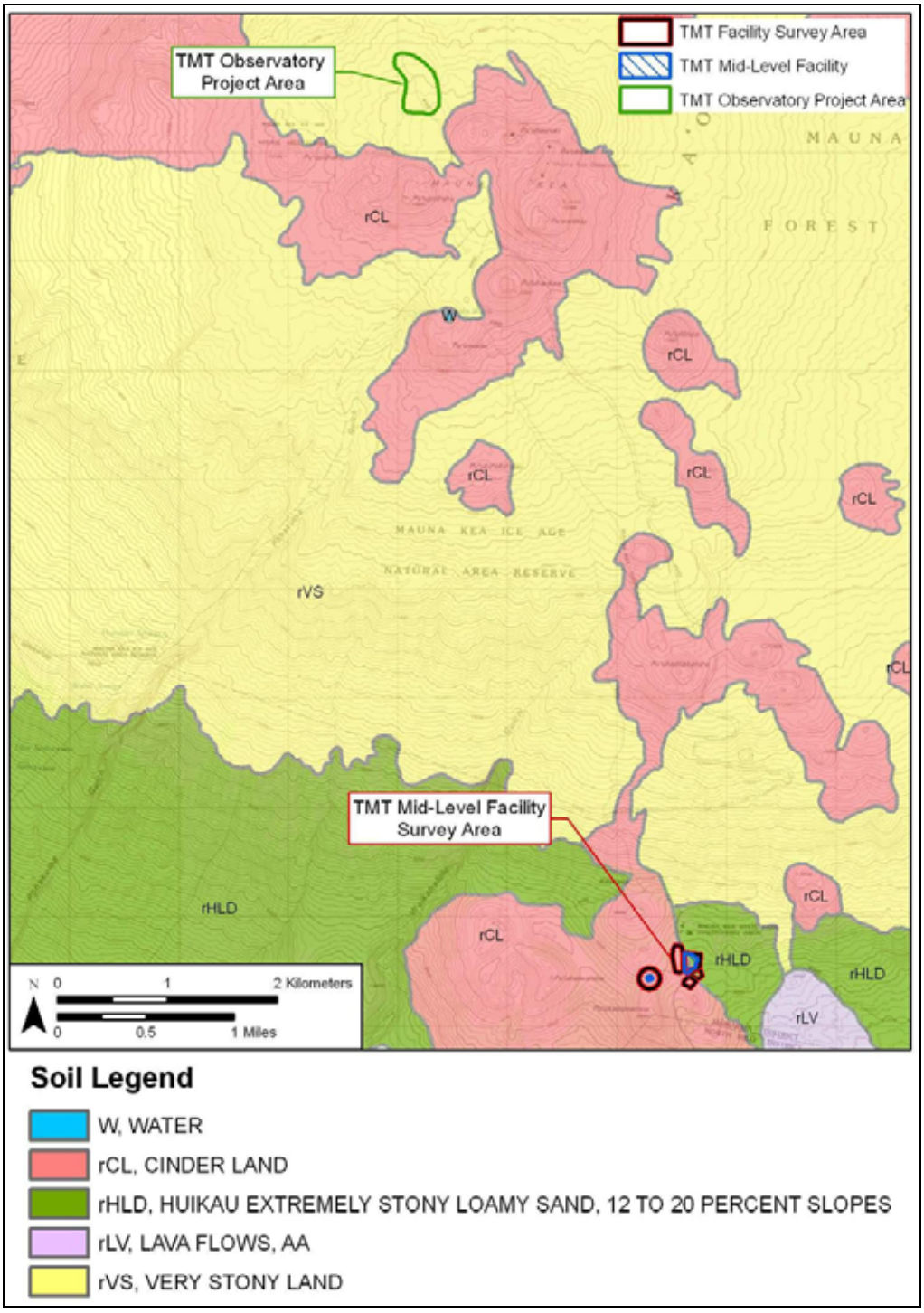

Figure 4. U.S. Geological Survey Topographic Map, Mauna Kea Quadrangle (1993) with overlay of the Soil Survey of the Island of Hawai‘i (Sato et al. 1973), showing sediment types within the Project areas

Section 2 Methods

2.1 Archival Research

Historical documents, maps and existing archaeological information pertaining to Maunakea were researched at the CSH library. In addition, historic and archival research included the University of Hawai‘i at Mānoa’s Hamilton Library, the State Historic Preservation Division (SHPD) library, the Hawai‘i State Archives, the State Land Survey Division, and the archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and photographs and primary and secondary historical sources. Information on Land Commission Awards was accessed through Waihona ‘Aina Corporation’s Māhele Data Base (www.waihona.com) as well as a selection of CSH library resources.

For cultural studies, research for the Traditional Background section centers on Hawaiian activities including: religious and ceremonial knowledge and practices; traditional subsistence land use and settlement patterns; gathering practices and agricultural pursuits; as well as Hawaiian place names and *mo‘olelo*, *mele*, *‘ōlelo no‘eau* and more. The Historical Background section focuses on land transformation, development and population changes beginning in the early post-European Contact era to the present day (see Scope of Work above).

2.2 Community Consultation

2.2.1 Sampling and Recruitment

A combination of qualitative methods, including purposive, snowball, and expert (or judgment) sampling, are used to identify and invite potential participants to the study. These methods are used for intensive case studies, such as CIAs, and they are use used to recruit people that are hard to identify, or are members of elite groups (Bernard 2006:190). Our purpose is not to establish a representative or random sample. It is to “identify specific groups of people who either possess characteristics or live in circumstances relevant to the social phenomenon being studied….This approach to sampling allows the researcher deliberately to include a wide range of types of informants and also to select key informants with access to important sources of knowledge” (Mays and Pope 1995:110).

We begin with purposive sampling informed by referrals from known specialists and relevant agencies. For example, we contact the SHPD, Office of Hawaiian Affairs (OHA), Hawai‘i Island Burial Council (HIBC), and community and cultural organizations for their brief response/review of the project and to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area and vicinity; and to identify cultural and lineal descendants and other appropriate community representatives and members. Based on their in-depth knowledge and experiences, these key respondents then refer CSH to additional potential participants who are added to the pool of invited participants. This is snowball sampling, which entails asking a few key individuals (including agency and organization representatives) to provide their comments and referrals to other locally recognized experts or stakeholders who would be likely candidates for the study (Bernard 2006). CSH also employs expert or judgment sampling which involves assembling a group of people with recognized experience and expertise in a specific

area (http://www.socialresearchmethods.net/kb/sampnon.php; Bernard 2006). CSH maintains a database that draws on over two decades of established relationships with community contacts: cultural practitioners and specialists, community representatives and cultural and lineal descendants. The names of new potential contacts are also provided by colleagues at CSH and from the researchers' familiarity with people who live in or around the study area. Researchers often attend public forums (e.g., Neighborhood Board, Burial Council and Civic Club meetings) in (or near) the study area to scope for participants. A discussion of the consultation process can be found in Section 6 on Community Consultations. Please refer to Table 6, Section 6 for a complete list of individuals and organizations contacted.

CSH focuses on obtaining in-depth information with a high level of validity from a focused group of relevant stakeholders and local experts. Our qualitative methods do not aim to survey an entire population or subgroup. A depth of understanding about complex issues cannot be gained through comprehensive surveying. Our qualitative methodologies do not include quantitative (statistical) analyses, yet they are recognized as rigorous and thorough. Bernard (2006:25) describes the qualitative methods as "a kind of measurement, an integral part of the complex whole that comprises scientific research." Depending on the size and complexity of the project, CSH reports include in-depth contributions from about one-third of all participating respondents. Typically this means three to twelve interviews.

2.2.2 Informed Consent Protocol

An informed consent process is conducted as follows: (1) before beginning the interview the CSH researcher explains to the participant how the consent process works, the project purpose, the intent of the study and how his/her information will be used; (2) the researcher gives him/her a copy of the Authorization and Release Form to read and sign (Appendix A); (3) if the person chooses to participate by way of signing the consent form *or* providing oral consent, the researcher begins the interview; (4) the interviewee receives a copy of the Authorization and Release Form for his/her records, while the original is stored at CSH; (5) after the interview is summarized at CSH (and possibly transcribed in full), the study participant is afforded an opportunity to review the interview notes (or transcription) and summary and to make any corrections, deletions or additions to the substance of his/her testimony/oral history interview; this is accomplished primarily via phone, post or email follow up and secondarily by in-person visits; (6) participants receive the final approved interview, photographs and the audio-recording and/or transcripts of their interview if it was recorded. They are also given information on how to view the draft report on the OEQC website and offered a hardcopy of the report once the report is a public document.

Should an interviewee agree to participate on the condition that his/her name is withheld, procedures are followed to protect his/her confidentiality (see Protection of Sensitive Information below).

2.2.3 Interview Techniques

To assist in discussion of natural and cultural resources and cultural practices specific to the study area, CSH initiates "talk story" sessions (i.e., unstructured and semi-structured interviews as described by Bernard 2006) by asking questions from the following broad categories: gathering practices and *mauka* (upland, mountain) and *makai* (lowland, ocean) resources, burials,

trails, historic properties and *wahi pana* (storied or legendary places). The interview protocol is tailored to the specific natural and cultural features of the landscape in the study area identified through archival research and community consultation. For example, Hawaiian voyaging, navigation and astronomy were emphasized for this CIA. These interviews and oral histories supplement and provide depth to consultations from government agencies and community organizations that may provide brief responses, reviews and/or referrals gathered via phone, email and occasionally face-to-face commentary.

2.2.3.1 Field Visit

Initially, CSH researchers visit the project area to become familiar with the land and recognized (or potential) cultural places and historic properties in preparation for interviews. All field activities are performed in a manner so as to minimize impact to the natural and cultural environment in the project area. Where appropriate, Hawaiian protocol is used before going on to the study area and may include the offering of *ho‘okupu* (offering, gift), *pule* (prayer) and *oli* (chant).

2.2.3.2 In-depth Interviews and Oral Histories

Interviews are conducted at a place of the study participant's choosing (usually at the participant's home or at a public meeting place). Following the consent protocol outlined above, interviews may be recorded on tape and in handwritten notes, and the participant photographed. The interview typically lasts one to four hours, and records the who, what, when and where of the interview. In addition to questions outlined above, the interviewee is asked to provided biographical information (e.g., connection to the study area, genealogy, professional and volunteer affiliations, etc.).

2.2.4 Protection of Sensitive Information

It is sometimes the case that participants in cultural studies agree to contribute their comments or be interviewed for a study on the condition that their names are withheld from the report. Their reasons for doing so vary from concern about protecting the identity of resource collectors and/or revealing the precise location of certain natural and cultural resources to opposition to the proposed project. For the interviewee who agrees to participate on the condition that his/her name is withheld from public disclosure, CSH takes all precautions to make sure his/her contribution remains confidential. The confidentiality of subjects is maintained via protected files. For this reason, CIA reports sometimes include a subsection of Summaries of Kama‘āina "Talk Story" Interviews entitled, Additional Statements.

2.3 Compensation and Contributions to Community

Many individuals and communities have generously worked with CSH over the years to identify and document the rich natural and cultural resources of these islands for cultural impact, ethno-historical and, more recently, traditional cultural places (TCP) studies. CSH makes every effort to provide some form of compensation to individuals and communities who contribute to cultural studies. This is done in a variety of ways: individual interview participants are compensated for their time in the form of a small honorarium and/or other *makana* (gift);

community organization representatives (who may not be allowed to receive a gift) are asked if they would like a donation to a Hawaiian charter school or nonprofit of their choice to be made anonymously or in the name of the individual or organization participating in the study; contributors are provided their transcripts, interview summaries, photographs and—when possible—a copy of the CIA report; CSH is working to identify a public repository for all cultural studies that will allow easy access to current and past reports; CSH staff do volunteer work for community initiatives that serve to preserve and protect historic and cultural resources (for example, in Lāna‘i and Kaho‘olawe). Generally our goals are to provide educational opportunities to students through internships, to share our knowledge of historic preservation and cultural resources and the State and Federal laws that guide the historic preservation process, and, through involvement in an ongoing working group of public and private stakeholders, to improve and strengthen the Chapter 343 (environmental review) process.

Section 3 Traditional Background

3.1 Overview

This section focuses on the traditional background of Maunakea. For the purposes of this background section, the subject Project area is defined as the entire summit area of the mountain, including its many culturally-significant landscape features and natural resources (Figure 5). Because Maunakea is such a prominent landform, and because Hawaiian traditions recognize its connections with many other places, more distant associations with other parts of Hawai‘i Island and with other islands are also documented and assessed.

This section includes important examples and excerpts from previous studies of the cultural significance of Maunakea to Hawaiians including Kanahele and Kanahele (1997) and Maly (1998, 1999, 2005); numerous examples and observations are also included from an excellent website maintained by Nā Maka o ka ‘Āina (2008).

Maunakea is a sacred cultural landscape to Native Hawaiians. It is symbolic of Wākea (the ‘Sky Father’ to Hawaiians), home of Poli‘ahu, the goddess of snow and foe of Pele (the fire goddess), and of many other resident deities and supernatural entities (e.g., Līlīnoe, Kūkahau‘ula and Mo‘oinanea); home of Waiau, the highest permanent lake in the Hawaiian Islands; location of the highest and most extensive basalt quarry in all of Polynesia and perhaps the entire world; and numerous trails, *ahu* (stone markers), religious shrines and cinder-cone *pu‘u* (hills) (Figure 6).



Figure 5. The summit region of Maunakea showing some of its main cinder-cone *pu‘u* and an astronomical observatory, top center of the image (source: Ziegler 2002)

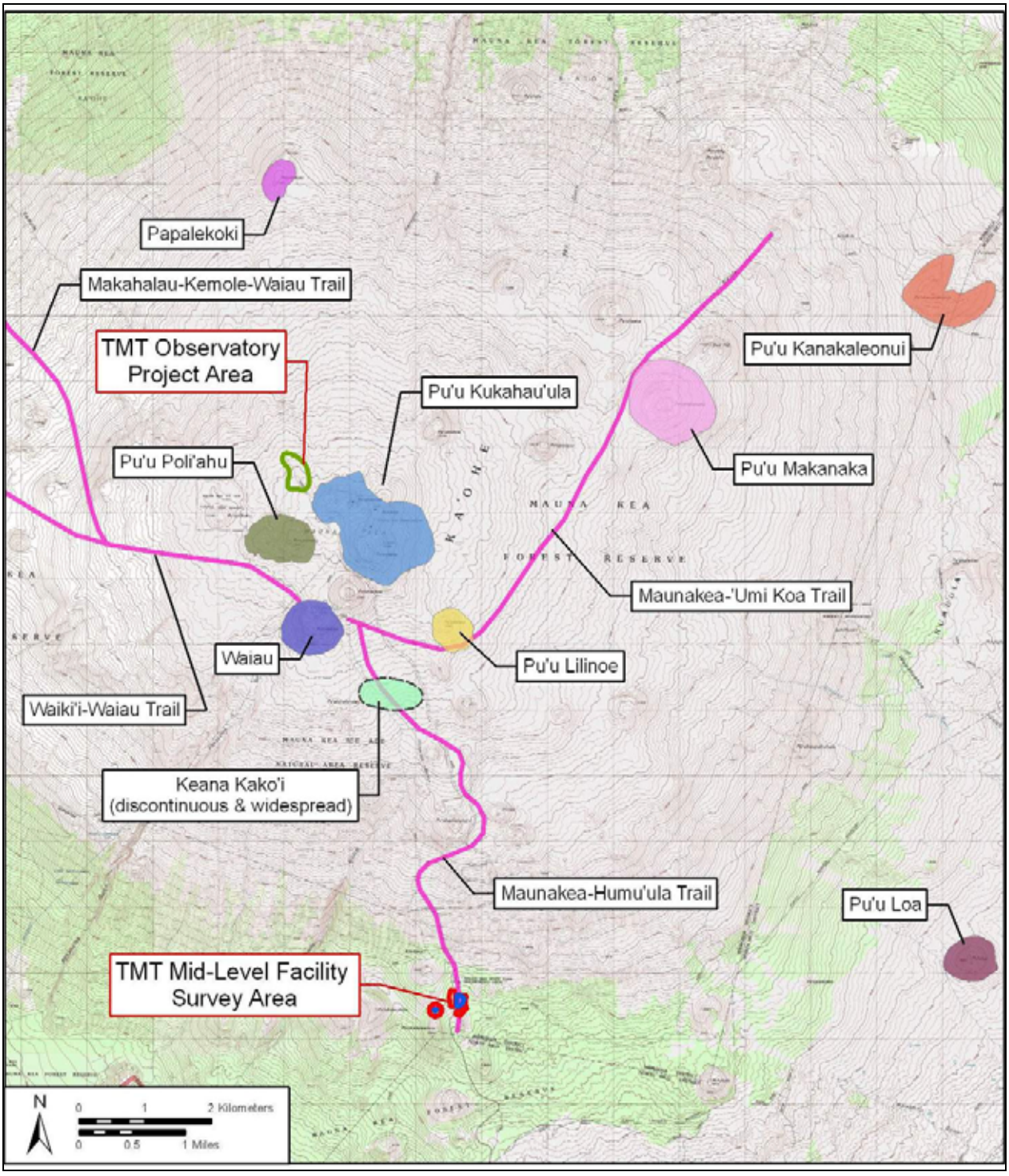

Figure 6. Culturally significant landscape sites and features in the vicinity of the Project area

3.2 Place Names

Translations presented without attribution in this subsection are from Pukui et al. (1974). Spelling and diacriticals also follow Pukui et al.'s (1974) usage.

3.2.1 Mauna Kea or Maunakea: Why is Maunakea spelled as one word?

In Pukui's et al.'s (1974) "Place Names of Hawaii" Mauna Kea is listed as two words "Mauna" and "Kea" and is literally translated as "white mountain (often the mountain is snowcapped)" (Pukui et al. 1974:148). A recent 2008 article in the Office of Hawaiian Affairs newspaper "Ka Wai Ola" presents a good argument for spelling Mauna Kea as one word—Maunakea. The article is presented in full below:

> By Larry Kimura
>
> Hawaiian names, both personal and place names, are usually made up of several root words combined together to represent the person or place. Hawaiian tradition is to write these root words together as a single word, for example, Kamehameha not Ka Mehameha, Kalākaua not Ka Lā Kaua, Waikīkī not Wai Kīkī, Keauhou not Ke Au Hou. The Hawaiian tradition is different from the English one, as in English the parts of a place name are sometimes written separately, e.g., Mount Vernon, New York, Red River Valley. It is also common in English to write "native" names as separate words: Sitting Bull, Crazy Horse, Red Cloud.
>
> The Hawaiian tradition is based in the Hawaiian grammar of the oral language that marks separate words differently from names. In the case of the two mountains on Hawai‘i Island that scientist from outside Hawai‘i have come to dominate, Maunakea and Maunaloa, American English spelling traditions have been imposed on earlier Hawaiian spelling traditions. The earlier Hawaiian spelling traditions can be seen in places with the same name where American scientist have not had as much of an influence, e.g., Maunaloa on Moloka‘i, Maunakea Street in Honolulu, and the Maunakea family name. Older Hawaiian writings also include examples of Maunakea and Maunaloa written as one word when referring to the mountains on Hawai‘i.
>
> Larry Kimura is an assistant professor at Ka Haka ‘Ula O Ke‘elikōlani College of Hawaiian Language, University of Hawai‘I at Hilo. (Vol. 25, No. 11, November 2008:16)

For this CIA, both spelling variations will be used. The two word format—Mauna Kea—will be used to address official entities such as the Mauna Kea Science Reserve and when citing content from other sources such as books or past, published interviews. For all other uses in the text, the name of the mountain will be written as one word—Maunakea.

Maunakea translates literally as white (*kea)* mountain (*mauna*), so named for its breathtaking snow-capped summit. However, according to Nā Maka o ka ‘Āina (2008) and other authorities on Hawaiian culture (e.g., Kepā Maly, Pualani Kanahele), Maunakea has numerous other

meanings and translations. It is a short version of Mauna a Wākea, a name that refers to the sky father, Wākea; this would be one of its *kaona* (hidden or more subtle meanings). An excerpt from Maly's testimony to the Hawai‘i Island Burial Council in 2000 (reproduced by Nā Maka o ka ‘Āina 2008) effectively illustrates this point:

> When I spoke with *kupuna* about Mauna Kea, some of them believed that the name shouldn't be translated literally "white mountain."
>
> Mauna Kea, not just simply the "white mountain" because it's periodically snow-covered. But that it is Mauna Akea, Ka Piko a Wakea. The summit, the *piko* that ties this earth to Wakea, the God father who is the sky.
>
> They see it as the *piko kaulana o ka 'aina*, the famous peak, summit of the land. But that peak, or *piko*, is also what we would call navel or belly button. It's that which connects you back to the generations preceding you.
>
> *'Aha ho'owili mo'o*, this line, this cord that connects the Hawaiian people from these lands, from these islands, which were the children of the gods or creative forces of nature, back to their cosmic origins.
>
> Not just "white mountain." The mountain of Wakea, the progenitor of the Hawaiian race.

Waiau, the permanent lake located within Pu‘u Waiau near the summit of Maunakea at approximately 13,020 feet elevation, translates as "swirling water," and is associated with the snow goddess Poli‘ahu.

Pu‘u Kūkahau‘ula, which is the highest of several cinder-cones peaks around the summit of Maunakea, is located less than one mile southeast of the Project area. According to Nā Maka o ka ‘Āina (2008), Kūkahau‘ula translates as "[the peak of] Kū of the red-tinted snow," in reference to the light effects of the rising sun on this, the highest of peaks of Maunakea.

Pu‘u Poli‘ahu is named for Poli‘ahu, "the woman who wears the snow mantle of Mauna Kea"; Poli‘ahu, which is also the name of a land division on Maunakea, is translated as "garment [for the] bosom (referring to the snow)" by Pukui et al. (1974) and as "Snow goddess of Mauna Kea. *Lit.* Bosom goddess" by Pukui and Elbert (1986).

Maly and Maly (2005:200) include a citation by W.D. Alexander regarding the naming of Pu‘u Poli‘ahu. As the peak was nameless, Alexander called it "Poliahu" because he believed it to be "a poetical name, being that of the demigoddess with snow mantle who haunts Mauna Kea" (Maly and Maly 2005:200). This assignation of names to various places and peaks of Maunakea by non-Hawaiians was not an uncommon occurrence (Maly and Maly 2005).

Pu‘u Līlīnoe, also known simply as Līlīnoe, is one of the major peaks (approximately 12,956 feet elevation) near the summit of Maunakea; Līlīnoe translates as "mists," and is associated with a goddess of mists by the same name, sister of Poli‘ahu.

Other main *pu‘u* in the summit area include **Pu‘u Kanakaleonui**, which translates as "loud-voiced man"; **Pu‘u Mākanaka**, which translates as "hill crowded with people (*mā-* is short for *maka*)"; and **Pu‘u Loa**, or the "long hill." It is worth stating that there are many places named

pu‘u loa in the Hawaiian Islands, since it is a fairly generic descriptor. Another *pu‘u* is **Papalekōkī** , which Pukui et al. (1974) do not define.

Keanakāko‘i (or **Ke-ana-kāko‘i**), literally “the adze-making cave” (Pukui et al. 1974:103), is named for an ancient and most famous basalt quarry complex extending up to 12,400 feet in elevation on the southern slope of Maunakea. It is important to note that this place name is also fairly common in the Hawaiian Islands, and refers more generally to places at which excellent basalt for tool-making can be obtained. This particular Keanakāko‘i on Maunakea, however, is the finest such source in the islands (see discussion below).

Hale Pōhaku, literally “stone house,” refers to the two stone cabins constructed by the Civilian Conservation Corps (CCC) in 1936 and 1939 at an elevation of 9,220 feet on the southern slope of Maunakea. L.W. Bryan, who served as the Territorial Forestry Office and oversaw the construction of the “stone houses,” also named them Hale Pōhaku.

3.3 Mo‘olelo Associated with Specific Place Names

3.3.1 Maunakea

There are several references to associations between Maunakea and other islands, including an overlook and *pali* (cliff) at Haleakalā Crater on Maui:

Hahai‘o Kaha‘i me Haui iā Pele i ka ‘āina o Maui,
hakakā lākou i ke alo o Kamohoali‘i.
Pū‘ā‘ā ka iwi o Pele,
mākole ka maka o Kānemilohai i ka uahi.
Hoaka ke ko‘i‘ula o Pele i luna o ‘Alenuihāhā,
kūhaka lunalilo‘o Mauna Kea i ka ‘ihi‘awa‘awa.

Kaha‘i and Haui pursued Pele to the land of Maui
where they battled in Kamohoali‘i’s presence,
Pele’s bones scattered in the crater of ‘Alenuihāhā,
where Kānemilohai’s eyes are inflamed by smoke.
The red cloud of Pele flames above ‘Alenuihāhā
where Mauna Kea rises abovethe storm. (Landgraf 2003)

Pukui provides two relevant *‘ōlelo no‘eau* (proverbs or poetical sayings) dealing with Maunakea: 1) Mauna Kea, kuahiwi ku ha‘o i ka mālie (Mauna Kea, standing alone in the calm) and 2) Poli‘ahu, ka wahine kapa hau anu o Mauna Kea (Poli‘ahu, the woman who wears the snow mantle of Mauna Kea) (Pukui 1983:234, 294). These sayings reflect a number of important Hawaiian beliefs and values about Maunakea, including her unique status as the unparalleled “top of the world,” her calm and reassuring presence, and her gifts of *hau* (snow).

A common reference to Maunakea is as the most visible landmark of the islands. Hence, the Maunakea summit has become symbolic for the Hawaiian Islands. In Fornander’s “The Legend of Kila (*He Ka‘ao no Kila*),” the ruling chief of Kaua‘i, Mō‘īkeha commands his son Kila to set sail in a double canoe for the Society Islands. As they leave the relative safety of the waters of the Hawaiian Islands they have their first strife with malevolent monster demi-gods of the deep when “they sailed on until the islands of Hawai‘i here were blotted out of sight and the land

disappeared and all that could be seen was the top of Maunakea…(*Holo aku la lākou a nahā nā moku o Hawai‘i nei, a nalowale ka ‘āina, koe o Mauna Kea, ‘a‘ole i nalowale*)" (Fornander 1919: Volume IV:160-161).

In Fornander's "Story of ‘Umi: One of the Most Noted of Hawaiian Kings (*He Mo‘olelo no ‘Umi: Kekāhi Ali‘i Kaulana o ko Hawai‘i Nei Pae‘āina*)," the ruling chief ‘Umi-a-Līloa leads a war party out of Waipi‘o, Hāmākua, to attack Hilo:

> Up through the mountains of Mauna Kea and right back of Kaūmana, running towards Hilo, was a short cut over the mountains to the trail of Poli‘ahu and the well of Poli‘ahu at the top of Mauna Kea, the trail leading down to Hilo. It was an old trail for those of Hāmākua, of Kohala and of Waimea to take when going to Hilo. Therefore, preparations were made and the army ascended the Mauna Kea mountain and descended on the upper side of Hilo…
>
> *Aia ma ke kuahiwi a ma ka mauna o Mauna Kea, a mauka pono o Kaūmana iho i kai o Hilo, he alanui pōkole ma ke kuahiwi, o ke alanui o Poli‘ahu a me ka punawai o Poli‘ahu, iluna pono o Mauna Kea, a iho ma ka ‘ao‘ao ma Hilo. He alanui kahiko ia, no ko Hāmākua, no ko Kohala, a me ko Waimea, ke hele ma Hilo. Nolaila, ho‘omakaukau iho la ka pi‘i o ka huaka‘i kaua ma Mauna Kea, a iho ma ka ‘ao‘ao maluna o Hilo*…(Fornander 1919: Volume IV:224-225)

As Fornander (1919) documents in "Legend of Kūapāka‘a (*He Ka‘ao no Kūapāka‘a*)," the hero, Kūapāka‘a, is sailing in a double canoe with the ruling chief Keawenuia‘umi past Kaua‘i for Kaula Rock. When the ruling chief and his men fall asleep, Kūapāka‘a turns the canoe around and sails straight for the Big Island and: "…when they saw the top of Mauna Kea above the mist, passing and repassing in the distance like a pointed cloud. At this the men all woke up at the call ‘There is Hawaii' (… ‘*ike aku la lākou i ka piko o Mauna Kea i loko o ka ‘ohu, e mā‘alo ana me he ‘ōpua la. O nā kānaka a pau o luna o ka wa‘a, aia ‘ae la lākou, ‘aia o Hawai‘i'*)" (Fornander 1919: Volume V:124-125). This is another account of Maunakea as a significant landmark for long-distance voyagers in Polynesia.

Fornander also recounts "Tradition of Kamapua‘a (*Ka‘ao no Kamapua‘a*)," the pig deity sees the fires of Pele, the goddess of volcanoes, and begins to chant:

The fire by Lonomakua	*O ke ahi a Lonomakua la,*
Of the woman Pele	*A ka wahine a Pele*,
It is burning in the uplands of Puna	*Ke a ala i uka o Puna*,
By the white snow of Mauna Kea	*I ka hau a‘ia‘i o Mauna Kea*
The smoke darkens the heaven	*I ka uwahi pō i ka lani*

(Fornander 1919: Volume V:340-341)

Here, the brilliant whiteness of the snows (*hau a‘ia‘i*) of Maunakea provide poetic contrast with the darkening smoke (*uwahi pō*) of Pele.

In Fornander's "Legend of Pūpūkea (*Ka‘ao no Pūpūkea*)," is an account of several columns of Hawai‘i Island warriors rushing to repel an attack by the Maui ruling chief Kamalalawalu with the forces converging in the vicinity of Hōkū‘ula Hill in Waimea. Some 112,000 (*ehiku lau mano kānaka*) defenders from Ka‘ū District are related to have approached "from ‘Ōhaikea

between Mauna Kea and Hualālai (*Ma ‘Ōhaikea mai, mawaena o Mauna Kea a me Hualālai*)" (Fornander 1919: Volume V:436-451).

Fornander (1919) provides an account of "Famous Men of Early Days (*Po‘e Kaulana o ka Wā i Hala*)" he tells a story of Uma of Pūehuehu, Kohala, who lived in the time of Kamehameha I and was of very small stature (*‘u‘uku loa*). He was an expert in the art of bone-breaking (*akamai loa ia i ka lua*). Uma has a number of adventures dispatching brigands and muggers as he proceeds from Pu‘uhue in southern Kohala to Kapia at Waimea, looking toward Maunakea (*e nānā ala ia Mauna Kea kuahiwi*), proceeding on to Manauea Stream and on to Pu‘u o Moeawa at Mahiki between Waimea and Hāmākua, and then on to Kaupakuea in upper Hilo. The passing reference to Maunakea appears to serve as a geographic reference to Kapia. Kapia may be the first place from which Maunakea can be seen as one traverses the mid-slope of the west side of the Kohala Range arcing around to the southeast. The account notes that at the time "there was much robbery amongst the people in lonely places (*he nui loa ka pōwā ana o nā kanāka ‘oia wā ma nā wahi mehameha*)," and certainly suggests that the trails around the north slope of Maunakea were among such lonely places (Fornander 1919: Volume V:500-501).

Fornander also tells of "The Flood in Hawaii in the Olden Times (*No Ke Kaiakahinali‘i Ma Hawaii Nei*)" is an odd account of the goddess Pele bringing "the sea of Kahinali‘i" to Hawai‘i at a time when "here in Hawaii in the earliest times there was no sea (*ma Hawaii nei mamua loa, ‘a‘ole he kai*…)" (Fornander 1919: Volume V:524-525). Pele poured out the sea from her head submerging almost all of the land except for the highest peaks including Maunakea (…*ua koe iki ‘ae kekāhi wahi, ‘oia no o luna o Haleakalā, a me Mauna Kea a me Mauna loa, ‘a‘ole i nalowale loa…)* and then caused the sea to recede to what it is today.

In Thrum's (1907) *Hawaiian Folk Tales*, *A Collection of Native Legends*, a chapter on "Pele and the Deluge" appears to have been borrowed from the preceding Fornander account or shares a common source, and relates effectively the same story.

Kalākaua's *Legends and Myths of Hawaii* details an account of "Umi, the Peasant Prince of Hawai‘i" which includes a number of passing references to Maunakea (such as comparing the color of an old priest's hair to the snows of Maunakea) but one account merits particular mention (Kalākaua 1888:249-315). In a side bar story about the fabulous conch shell trumpet known as the Kiha-pū is the following vignette:

> In obedience to the revelation of a *kaula* [seer] of great sanctity, he [Kiha] had secretly deposited it [the Kiha-pu] in a cave near the summit of Mauna Kea and retired to a valley below. Near the middle of the following night a sound unearthly and terrible came echoing down the mountain-side, followed by a hurricane which uprooted trees and tore great rocks from their fastenings and hurled them into the gorges below. The earth trembled as if a volcano was about to burst forth, and a ruddy light hung about the summit. The sound ceased, the wind fell to a whisper, and Kiha rose to his feet in the darkness and said: "It is well. The great [deity] Lono has kept faith. He has blown the sacred trumpet, and henceforth it will have the voice of a god!" The next morning he repaired to the cave, and found the shell, not where he had left it, but on the top of a huge rock with which the entrance had been forever closed. He raised the trumpet to his lips and such sound as his heart desired came forth at the bidding of his breath. He

> breathed a simple call to his subjects, and it was heard the distance of a day's journey. He gave a battle-blast, and his ears were stunned with the mingled cries and groans of conflict. He ventured an appeal to the unseen, and to a weird music around him rose gnomes, fairies and grinning monsters. He returned elated to the palace, and more and more, as its strange voices were heard, did the Kiha-pu become an object of awe and wonder. (Kalākaua 1888:254)

Thus the summit region of Maunakea is associated with the actions of deities, transformation of the Kiha-pū, and the imparting of qualities of awe and wonder.

Also in Kalākaua's *Legends and Myths of Hawaii* regarding Lono and Kaikilani is an account of the prowess of the ruling chief Lonoikamakahiki: "He outran the fleetest…as in bringing a ball of snow from the top of Mauna Kea" (Kalākaua 1888:322). Thrum's *Hawaiian Folk Tales* also has a chapter on Lono and Kaikilani that describes Lono as the deity Lono whom we encounter "reclining on the bosom of a cloud that rested over Mauna Kea" (Thrum 1923:108-116).

Kalākaua's account of: "Kahavari, Chief of Puna" is a brief sidebar discussion of the demi-god "Kana" who had the capacity to elongate himself so as to walk between the islands of the Hawaiian chain (Kalākaua 1888:501-507). It is asserted that when Kana waded back from the southern lands of Kahiki "he hung his mantle to dry on Mauna Kea, which was then an active volcano" (Kalākaua 1888:503). The tale seems to play on the height of the mountain and appears to provide an alternate explanation for whose cape explains the summit mantle of snow.

In Thrum's (1907) *Hawaiian Folk Tales* is a chapter on Hawaiian "Legends Resembling Old Testament History." Thrum relates the following:

> In the Hawaiian group there are several legends of the Flood. One legend relates that in the time of Nu‘u, or Nana-nu‘u (also pronounced *lana*, that is floating), the flood, kaiakahinali‘i, came upon the earth and destroyed all living beings; that Nu‘u, by command of his god, built a large vessel with a house on top of it, which was called and is referred to in chants as "*He wa‘a hālau Ali‘i o ka Moku*," the royal vessel, in which he and his family, consisting of his wife Lilinoe, his three sons and their wives, were saved. When the flood subsided, Kāne, Kū, and Lono entered the *wa‘a hālau* of Nu‘u, and told him to go out. He did so, and found himself on the top of Mauna Kea (the highest mountain on the island of Hawai‘i). He called a cave there after the name of his wife, and the cave remains there to this day – as the legend says in testimony of the fact. (Thrum 1907:20)

3.3.2 Hāloa and Kalo on Maunakea

Hawaiian genealogy reveals the importance of *kalo* (taro) and the reasons Hawaiians have such a sacred connection to this plant and to Maunakea. According to Hawaiian mythology, the first man was born from the taro plant. Wākea, the sky father, and Papahanaumoku, the earth mother, on the summit of Maunakea, birthed a child who was premature.

> The first-born son of Wākea was of premature birth (*keiki alualu*) and was given the name of Haloa-naka. The little thing died, however, and its body was buried in the ground at one end of the house. After a while, from the child's body, shot up a

> taro plant, the leaf of which was named *lau-kapa-lili*, quivering leaf; but the stem was given the name Haloa.
>
> After that, another child was born to them whom they called Haloa, from the stalk of the taro. He is the progenitor of all the peoples of the earth. (Malo 1951:244)

Hāloa is therefore both plant and man. “Wākea’s stillborn son is reborn as a taro plant which produces his second son, a human child Hāloa” (Kanahele 1995:18). Taro therefore becomes a metaphor for life, because both need to be rooted in good soil and nourished with waters of Kāne. The kalo stalks and Hawaiians both grow towards the sun, striving to be nearer to the heavenly spirit, and as every plant must die, so too will every human. What remains of the plant lives on for the next generations. Because of this close interconnection between life and *kalo*, *kalo* and *poi* (pounded taro thinned with water) thereby became the main staples of the Hawaiian diet (Kanahele 1995:18).

For nutritional and spiritual significance *lo‘i kalo* became vital for Hawaiian way of life. The work was for men and required marshland, a large supply of *kalo* cuttings, and advanced irrigation systems (Kanahele 1995:19-22).

3.3.3 Kūkahau‘ula

Kūkahau‘ula, or Kū of the red-tinted snow, is Maunakea’s highest *pu‘u.* The following *mo‘olelo* about the love affair between Kūkahau‘ula and Poli‘ahu (another nearby peak named for the goddess of snows) comes from the July, 1931, edition of the *Paradise of the Pacific*, and was recounted by Ahuena (source: website maintained by Nā Maka o ka ‘Āina 2008):

> The Betrothal of the Pink God and the Snow Goddess
> The Pink Snow Is Always Seen Upon Mauna Kea
> by Ahuena
> (edited)
>
> Tell me one of your many legends, Puna, some tale belonging to the Big Island of Hawaii …something different, something altogether apart from the lore of Pele, goddess of Volcanoes, creator of the Islands.
>
> So spoke a tawny-skinned young girl to her indulgent old Hawaiian nurse whose bent form bespoke four score years and more.
>
> Her devoted old nurse sat on the edge of the mat, facing her.
>
> Let us finish this task first…while I tell you the legend of the betrothal of the Pink God and the Snow Goddess of Mauna Kea. The Pink God's devotion to the Snow Goddess of Mauna Kea is most wonderful to behold. He is known as the most constant lover on the island of Hawaii.
>
> “How beautiful!” exclaimed the maiden. “What a pleasure it would be to see them in real life — but continue with the story, please.”
>
> Then the old nurse’s voice floated out in a low tremulous chant, apparently chiding the young girl for her impatience —

The youths of Kohala never travel unprepared;
Their kapa togas are already on;
They heed not the rain nor the wind
for their shoulders are ever kept warm.
So worry not for thou shalt hear
The story of the Pink God of Mauna Kea
whose glowing beam is seen afar,
And she of the snow-white bosom
Whose heart melts at his caress.

"Listen," continued Puna, "the Pink Snow is always seen on Mauna Kea, the great white mountain that towers above and almost touches the blue heavens. Its summit of snow-clad peaks clings to the clouds that float near the sun, at Hikiana (the Beginning), where the rosy Kipu‘upu‘u (chilling) rain continually dwells and comes sweeping down to the district of Waimea and at Lanimamao, and away up on this great white mountain dwells a beautiful snow-white maiden whose name is Poliahu…who wears a wreath of the silvery, snow-white hina-hina blossoms that grow upon the mountain tops.

She is known as the Snow Goddess of Mauna Kea. She is the favorite daughter of the red-headed god, Ka-ne, Creator of Waters, and the Goddess of the Mist called Hina. Her nurse's name is Lihau (the Chilling Frost).

Ka-ne, her father, created a silvery swimming pool with beautiful clear water within it for Poliahu, upon the summit of Mauna Kea, reflecting the heavens, forming a basin behind the snow-clad peaks. And in this wonderful, cool basin of Wai-au…he placed a Merman there, as a sentinel, to guard over it and keep a loving watch over the Snow Goddess. The name of this favored sentinel was Moo-i-nanea. [note, this description of Moo-i-nanea as a male is almost certainly in error, as these supernatural water spirits, *mo‘o,* were always female in Hawaiian traditions.] It was, and is, he that drives all admiring lovers from there, all who dare climb the mountain slopes and steep precipices to catch a glimpse of Poliahu and chant poems of love and admiration to her. Others he entrances until they become numb and fall asleep before they can behold the face of the beautiful Snow Goddess as she passes by on her way to the icy pool.

But there was a devoted lover whom he helped to cross the kapu pool, for he found this lover to be constant and true despite his trials and disappointment.

This lover was the handsomest and most daring man that he had ever seen. He was known as Ku-kahau-ula (The Pink Tinted Snow's Arrival), the Pink-Tinted Snow-God of Mauna Kea, who made daily pilgrimages to court the Snow Goddess at morn and in afternoon.

Throwing his pink kapa toga over his shoulders, and starting down on the first sun's ray, beyond Haehae, the Land of Desire at the eastern gateway of the sun at Kahiki (the Beyond), he tried to approach as near as possible the place where she dwelt upon the snow-capped mountain. He watched her each day as she played

with the kini-akuas (fairies) amongst the silversword (hina-hina) near the pool, and, sometimes further down near the fern belt. But her faithful attendant, Lihau (the Chilling Frost), was always with her.

Each day he became more fascinated and made every effort to reach her abode and court her — win her for his bride — but Lili-noe, another sprite (the Fine Rain) drove him back, and at other times when he started, Pele's sister at the eastern gateway of the sun endeavored to entice him away, all striving to prevent him visiting Poliahu, at Mauna Kea.

Undaunted, he continued his pilgrimages, sending his beam towards Mauna Kea. One day when Poliahu had grown into womanhood, the handsome prince espied her, identifying her by her fine soft white kapa robe that Hina, her mother, had beaten out so beautifully from the bark of the Wauke plant with her magic kapa beater, until it resembled soft white clouds when finished. Her nurse, Lihau, wrapped it around her.

Poliahu was coming slowly down the mountainside almost to where plant life grew when he saw her, and immediately was enraptured with her beauty, beholding her from his place of vantage. Her sparkling face and divine form were radiantly beautiful, and it seemed to him that she even out-rivaled the silvery-white hina-hina blossoms. Throwing his pink kapa toga over his shoulder again, he hastened to greet her, but her nurse, Lihau (the Chilling Frost) and Kipu‘upu‘u (the Hail) came out and found her. It became so chilly he withdrew his beam.

However, that did not weaken his resolution to court her. The next day he departed earlier than usual on his love quest — for he planned all night how this feat of winning the Snow Goddess for his own could be accomplished, and when dawn arrived he departed bravely, but Lilinoe (the Fine Rain) chased him away again. Again and again he made the attempt at each new dawn of day and near sunset, approaching closer and closer, until one day Poliahu's mother, Hina (Goddess of Mist) discovered him just as he was nearing the Snow Goddess' abode. She immediately covered the mountain with mist and sent out Lilinoe (the Fine Rain), and then the biting, black, drizzling rains, Kua-uli and Kipu‘upu‘u to sweep across the forest, all in her anger and fear of losing her beautiful snow-white child.

So, the Snow Goddess was hidden from view, and he had to return alone to the Land of Paradise, disappointed.

Another dawn came and he started again, wearing his usual pink kapa robe, full of hope, and determined to win his heart's desire that day.

Hina, who was on guard, saw him and sent the biting black rain after him. He glided back and forth and waited until the rain had disappeared, when he departed again, his pink kapa so vivid as he traversed the heavens that its reflection caused a glorious rainbow to arch. When the sentinel Merman saw the rainbow caused by the radiant form of the Pink God reflected in the mist, he understood the omen of love and took pity on him, and blew his conch shell, calling out to him:

“Oh, Magnificent Pink Lord, come tomorrow at dawn and I will show you the way to meet Poliahu and conquer Hina; come with thy iridescent pink robe; part the Gray Veil of Night, and send thy red glow to fascinate her;

“I have watched thee daily as thou sailed the heavens in quest of thy loved one, at morn and in afternoons, and am convinced of your love; come to the swimming pool; be not afraid of Lihau’s anger; you can overcome her coldness.”

Ku-kahau-ula did as he was told, and as he started down in all his radiant beauty, he saw Moo-i-nanea beckoning and he came a little nearer to the topmost peak with his pink kapa cloth outspread prepared to throw one end of it over the shoulder of the Snow Goddess.

Poliahu, seeing him at that moment, called out to her mother in ecstasy and delight.

“Oh, Hina! Behold the handsome one as he stands at the very edge of the sun’s ray — all ray himself — and his rosy form is sending a warmth to my bosom. He is wearing a pink helmet and is swathed in a pink cape. Look, mother Hina! Call to him to come nearer that I may chant a message of aloha to him.”

Hina was beside herself with fear and grief at the possibility of losing her daughter, for she saw that his beauty had attracted Poliahu, and again, she sent the biting, driving rain and the cold, white mist over the land until the Pink Snow God was lost in the fog and it took him some time to find his home. He became discouraged, and he chanted to the sentinel of the pool, appealing to him to come to his assistance, for he was burning with an unquenchable love for Poliahu.

“Lead me over the swimming pool, to my beloved; to the gods Ka-ne and Hina that they may know of my devotion.”

“‘Then,’ the sentinel called to him, ‘come, brave one of the sky, but you must first conceal your beautiful pink kapa robe from view until you arrive at the pool; then take it out and wear it that you may go forward and snare the goddess with it. But you must come humbly, steadily and stealthily, spreading your radiant pink kapa well out as you approach the Goddess of the Treasure Bosom, Queen of the Snow.’

“Ku-kahau-ula followed the instructions minutely. The sun’s ray glided over the swimming pool causing a rainbow to arch, turning the silvery waters to a shimmering pink. As the god approached the spot where the snow-white goddess was reclining upon a couch of snow and hina-hina blossoms, clad in her soft white kapa robe, her faithful nurse was watching over her in the sacred stillness of the mountains.

“He advanced slowly, his pink robe outspread, radiantly gilding the brow of Mauna Kea with its glorious hue, until it was almost noon, chanting softly to her of his love, in the stillness of god's acres until he was close enough to throw his brilliant pink toga over her shoulder. Drawing her within his arms, he wrapped the robe entirely around her until they both were concealed within its folds.

“The Merman, Moo-i-nanea, blew the conch-shell that the world would know of the betrothal, and chanted these words:

Ku-kahau-ula and Poliahu, Oh!
These two were betrothed in the Chilling Frost
In the cold region of Mauna Kea;
They are the residents of the uplands,
The children of the thicket of wild-woods
The thicket that radiates their love
From the summit of Mauna Kea
Is most beautiful to behold;
‘Tis there the pink Sun’s beam
Embraces and kisses the snow.

“And, from these early days, when the gods were betrothed on the heights of Mauna Kea we have followed the tradition of their marriage ceremony, the chieftain men, folding the feather cape of kapa around the chosen maiden, just as the sun’s ray is reflected on the snow mountain and turns it pink at morn and noon and the treasure-heart of the goddess melts and overflows with love and feeds the mountain streams with her refreshing gift for man and nature to thrive upon.

“You have heard of the waters of Poliahu that our ancient and noble chieftains of that great island preferred to any other, to quench their thirst with, and how each day, starting at early dawn, carrying their water gourds all the way up the steep slopes of Mauna Kea, to a place called Pohaku-loa to fetch the drinking water from the melted snow accumulated there, bestowed by the goddess, for their feudal lords.

“Well, child, that is the aloha of Ku-kahau-ula and Poli-ahu who were betrothed in the cold region.”

Then, as the story ended, and a chant floated out upon the air and faded away, the young girl sighed, and said, dreamily:

“Thank you, Puna,” and smilingly gazed out toward the glinting blue sea of Waikiki and whispered,

“I, too, shall watch for the arrival of the glorious sunbeam that brings happiness and plenty, called the Pink God (Ku-kahau-ula) of Mauna Kea.”

3.3.4 Poli‘ahu

Poli‘ahu lives within Lake Waiau atop Maunakea, from which she emerges each winter and to which she returns with the summer sun. She and her sisters are closely associated with Maunakea and are sometimes referred to as the “Four Sisters.” At other times, Poli‘ahu’s sisters are referred to as her maidens (Beckwith 1976:222). The four sisters were born as fully grown women who had great talents and wisdom. Waiau is the guardian of the lake that bears her name. The lake provides drinking and bathing water where Waiau bathes Poli‘ahu. Waiau sometimes assumes a bird form to fly to sources of sweet water to fill her drinking gourd. Līlīnoe is the goddess of the mists of the mountain. She maintains Poli‘ahu’s hair so that it will float like a cloud at the

summit. The fourth sister, Kahoupokane is the goddess of Hualālai. Known as a master kapa maker, the sound of thunder is said to be Kahoupokane beating her kappa while during heavy rains, Kahoupokane is tossing water on her kapa while she beats it (Ka‘ahele Hawa‘i 1999).

There are many *mo‘olelo* regarding Poli‘ahu, usually in association with her sisters, and also with other major gods and goddesses such as Hina (‘Moon Goddess’), Wākea, Kāne, Kū, and others that date from very ancient Hawaiian cosmological times. Westervelt (1915), for example, translated and published a lengthy story entitled “Ke Au Mele Mele, The Maid of the Golden Cloud,” a brief portion of which is reproduced below. This small part of the legend ties the natural phenomenon of snow atop Maunakea to Poli‘ahu’s mischievous nature:

> [Referring to a high chief of the Hilo area] The chief looked up Mauna Kea and there saw the mountain women, who lived in the white land above the trees. Poliahu stood above the precipices in her kupua-ano (wizard character), revealing herself as a very beautiful woman wearing a white mantle.
>
> When the chief and his friends came near the cold place where she was sitting, she invited them to her home, inland and mountainward. The chief asked his friends to go with him to the mountain house of the beauty of Mauna Kea.
>
> They were well entertained. Poliahu called her sisters, Lilinoe and Ka-lau-a-kolea, beautiful girls, and gave them sweet-sounding shells to blow. All through the night they made music and chanted the stirring songs of the grand mountains, The chief delighted in Poliahu and lived many months on the mountain.
>
> One morning Paliula in her home above Hilo awoke from a dream in which she saw Poliahu and the chief together, so she told Wakea, asking if the dream were true. Wakea, by her magic power [note, in many other legends and *mo‘olelo,* Wakea is a male form], looked over the island and saw the three young men living with the three maidens of the snow mantle. She called with a penetrating voice for the chief to return to his own home. She went in the form of a great bird and brought him back.
>
> But Poliahu followed, met the chief secretly and took him up to Mauna Kea again, covering the mountain with snow so that Wakea could not go find them. (Westervelt 1915)

McDonald and Weissich (2003), citing Westervelt’s classic *Hawaiian Legends of Volcanoes* (1991), discuss a special *lei* (Lei Pāpahi) dedicated to Poli‘ahu:

> *Lei-o-Poli‘ahu* is a striking *lei,* a composition primarily of silver and white to commemorate the snow goddess Poli‘ahu. Hawaiian mythology features several snow maidens with white mantles, all of exceptional beauty, wit, and wisdom. They were adventuresome and were enemies of Pele, the volcano goddess. Poli‘ahu, the best known of the snow goddesses, is clearly visible each year as her dazzling mantle of white turns the great mountain Mauna Kea into a “white mountain.”
>
> *‘O Poli‘ahu ke kua wahine o ka mauna nui*

‘O kona mau panuhele
‘O ka ‘a‘ahu hau ma Mauna Kea
‘O ka hau po‘i ma Waiau
‘O ka noe lana wale ma Lilinoe
A ka nohoanu lahilahi
Ka pua ke‘oke‘o a lū ka poni
A ka lau hinahina
He ‘ālana pono na ke akua

Poli‘ahu, the goddess of the great mountain
Whose favorites are
The mantle of snow on Mauna Kea
The icy shroud on Waiau
The drifting mist on Lilinoe
And the delicate *nohoanu*
That delicate flower with a touch of purple
And glistening silvery leaves
A prescribed offering for the goddess
(McDonald and Weissich 2003:70)

Lei-o-Poli‘ahu is made of white plants and plant-parts such as the white flowers and silvery leaves of *nohoanu* (*Geranium cuneatum*), the white *liko* (newly opened colored leaves) and *mu‘o* (leaf buds) of *‘ōhi‘a* (*Metrosideros* spp.), *pa‘iniu* (*Astelia* spp.), *pūkiawe* and white *limu* (seaweeds, algae, lichens, mosses and liverworts), in this case a type of lichen typically collected from branches and tree trunks at high elevations—areas identified with Poli‘ahu. These botanical components of the Lei-o-Poli‘ahu can be found “along the eastern segment of the long trail in the saddle between Mauna Loa and Mauna Kea that connects Hilo and North Kona” (McDonald and Weissich 2003:72).

In his retelling of the Story of ‘Umi-a-Līloa (the 16th century ruler of Hawai‘i), Kamakau describes the time when ‘Umi was mistreated by his in-laws at Hilo, and names a trail and a spring at the summit of Maunakea called “Poli‘ahu”:

> As soon as they were released in Hilo, ‘Umi and his companions returned to Hamakua and went down to Waipi‘o. There he conferred with his chiefs and his father’s old war leaders. It was decided to make war on the chiefs of Hilo and to go without delay by way of Mauna Kea. From back of Ka‘umana they were to descend to Hilo. It was shorter to go by way of the mountain to the trail of Poli‘ahu and Poli‘ahu’s spring at the top of Mauna Kea, and then down toward Hilo. It was an ancient trail used by those of Hamakua, Kohala, and Waimea to go to Hilo. (Kamakau 1992:16)

In Kalākaua’s *Legends and Myths of Hawaii* (1888:455-480) account of: “Laie i ka Wai,” a *kupua* (supernatural chief) of Wailua, Kaua‘i, named Aiwohikupua is sailing the seas of Hāmākua, Hawai‘i, and “saw a woman of extraordinary beauty reclining on a cliff by the shore. She was graceful in every movement and wore a snow-white mantle. They landed and made her acquaintance. Her name was Poli‘ahu of Mauna Kea” (Kalākaua 1888: 462). She relates that she

is also supernatural (“*kupua*”). They promise to marry and exchange mantles. Eventually Aiwohikupua returns in state to claim Poli‘ahu. “The three mountains [understood as Mauna Kea, Mauna Loa and Hualālai] were covered with snow, which was the sign promised by Poli‘ahu.” Aiwohikupua and his party “were met by Poli‘ahu, Lilinoe, Waiau and Kahoupokane, the three later being mountain goddesses. The men suffered from cold but on being apprised of the fact Poli‘ahu and her friends removed their snow mantles, causing snow on the mountains to retire to its usual limits” (Kalākaua 1888: 467). The couple sailed to Kaua‘i but Poli‘ahu soon learns of the fecklessness of Aiwohikupua: “Poli‘ahu was enraged and returned to Mauna Kea.” Poli‘ahu repeated thwarts Aiwohikupua’s love life by sending waves of cold or heat over the object of his affections: “Poli‘ahu sent the chill of her snow mantle upon her rival, and she was benumbed with cold…” When Aiwohikupua met his new bride at noon the next day to consummate their marriage “Poli‘ahu put on her sun mantle, and a scorching heat almost consumed her rival” (Kalākaua 1888: 468).

3.3.5 Poli‘ahu and Pele

Poli‘ahu, the snow goddess, and Pele, the volcano goddess, engaged in legendary battles to control Maunakea. The following legend is often told and relates how the outcome of an *hōlua* (sled) competition established control over portions of the mountain and formed the peninsula of Laupāhoehoe.

> Pele loved the holua-coasting—the race of sleds, long and narrow, down sloping, grassy hillsides. She usually appeared as a woman of wonderfully beautiful countenance and form-a stranger unknown to any of the different companies entering into the sport.…
>
> Poliahu and her friends had come down Mauna Kea to a sloping hillside south of Hamakua. Suddenly in their midst appeared a stranger of surpassing beauty. Poliahu welcomed her and the races were continued. Some of the legend-tellers think that Pele was angered by the superiority, real or fancied, of Poliahu. The ground began to grow warm and Poliahu knew her enemy.
>
> Pele threw off all disguise and called for the forces of fire to burst open the doors of the subterranean caverns of Mauna Kea. Up toward the mountain she marshaled her fire-fountains. Poliahu fled toward the summit. The snow-mantle was seized by the outbursting lava and began to burn up. Poliahu grasped the robe, dragging it away and carrying it with her. Soon she regained strength and threw the mantle over the mountain.
>
> There were earthquakes upon earthquakes, shaking the great island from sea to sea. The mountains trembled while the tossing waves of the conflict between fire and snow passed through and over them. Great rock precipices staggered and fell down the sides of the mountains. Clouds gathered over the mountain summit at the call of the snow-goddess. Each cloud was gray with frozen moisture and the snows fell deep and fast on the mountain. Farther and farther down the sides the snow-mantle unfolded until it dropped on the very fountains of fire. The lava chilled and hardened and choked the flowing, burning rivers.

> Pele’s servants became her enemies. The lava, becoming stone, filled up the holes out of which the red melted mass was trying to force itself. Checked and chilled, the lava streams were beaten back into the depths of Mauna Loa and Kilauea. The fire-rivers, already rushing to the sea, were narrowed and driven downward so rapidly that they leaped out from the land, becoming immediately the prey of the remorseless ocean.
>
> Thus the ragged mass of Laupahoe-hoe formed, and the great ledge of the arch of Onomea, and the different sharp and torn lavas in the edge of the sea which mark the various eruptions of centuries past. (Westervelt 1916:60-62)

3.3.6 Līlīnoe

This peak of Maunakea, Līlīnoe, is associated with *mo‘olelo* about a legendary “woman of the mountains” who was reportedly buried on Maunakea. Kamakau, whose description makes it evident that Līlīnoe was understood by post-Contact Hawaiians to have been of great antiquity, makes two related references to this legendary figure:

> It was on old custom to hide the bones of chiefs who were beloved, as ‘Umi’s bones were hidden by Koi, in order that they might not be made into arrows to shoot rats with, into fishhooks, needles for sewing tapa, or *kahili* handles, as is still done today. There is a story told about the bones of Pae which illustrates this custom. Pae was a kahuna and high chief in the time of ‘Umi son of Liloa [i.e., early 16th century] and a descendant of Lilinoe, the woman of the mountains…(Kamakau 1992:215)
>
> The year 1828 is notable for the visit of Ka-‘ahumanu to Hawaii to fulfill a vow that she made to attempt the recovery of the bones of Lilinoe on Mauna Kea where her body was said to have lain for more than a thousand years in a well-preserved condition, not even the hair having fallen out. Others deny this and say her body was too well-hidden ever to have been found. Her [Līlīnoe] offspring count from Hua-nui-i-ka-la‘ila‘i; she was the ancestress of ruling chiefs, and from her line was born ‘Umi-ka-lani…It is said that Ka‘ahumanu did not find the bones of Lilinoe, but only those of Liloa…[and others]. (Kamakau 1992:285)

3.3.7 Hale Pōhaku

L. W. Bryan, of the Territorial Forestry Office for the island of Hawai‘i from 1922 to 1949, and from 1949 to 1961 the Territorial Forester, built the two stone houses at Hale Pōhaku with the Conservation Corps in 1936 and 1939 (Rosendahl 1999:C-6). He named Hale Pōhaku after a *heiau* (temple, place of worship) (Maly, personal communication 2009).

‘Umi-a-Līloa, the renowned mid 1500s king, constructed *heiau* in honor of Halulu, the god who provided his power. The following excerpt from Maly and Maly (2005:28-29) tells of ‘Umi’s heiau:

> …He (‘Umi) also built a *heiau* (temple) below Pohaku Hanalei, it is called the ahua o Hanalei (altar of Hanalei); and on the side of Mauna Kea, by where one

> travels to Hilo, he built the third of his temples, at the place called Puukekee [also written Puu Keekee in historical texts]; and there at Mauna Halepohaku he built the fourth of his temples; there, it is said, Umi dwelt with his many people. It is said that Umi was a chief who dwelt upon the mountain, it was because of his love of his people, that he (‘Umi) returned and dwelt in the middle of the island [Ahu-a-Umi], that is where he dwelt with his beloved people. His commoners lived along the shores, and they brought food for them (in the uplands), from one side of the island to the other… [Ke Au Okoa; Mei 22, 1865; Maly, translator] (Maly and Maly 2005:28-29)

3.4 Cinder Cone Peaks

Numerous cinder cone *pu‘u* are located around the Maunakea summit area. The main peaks in the vicinity of the Project area include: Pu‘u Kūkahau‘ula, which is the highest of several cinder cones peaks around the summit of Maunakea, Pu‘u Līlīnoe, Pu‘u Kanakaleonui, Pu‘u Mākanaka, Pu‘u Papalekōkī, Pu‘u Kanakaleonui, Pu‘u Poli‘ahu and Pu‘u Waiau.

From a geological perspective, these cinder cones formed during the latest phase of shield-building of the volcano. The nearly symmetrical shape of these formations is a truly remarkable and beautiful sight; most of these *pu‘u* are *wahi pana* and all are associated with specific *mo‘olelo* that connect the landscape, genealogy and actual and/or legendary people, demi-gods and -goddesses and gods and goddesses.

Kealoha Pisciotta, in an interview reproduced by Nā Maka o ka ‘Āina (2008), has this to say about the many *pu‘u* of the Maunakea summit region:

> Another level of the desecration is the leveling of the *pu‘u*, or the cinder cones. The cinder cones are sacred in and of themselves because they make up some of the *kino lau*, or the divine bodily manifestations of the gods.
>
> For example, you can look up and see the image of Poli‘ahu laying down. She’s the woman of the mountain. That’s her place. And when it’s covered with snow, it appears as though she’s lying on a bed of clouds, a ring of clouds. And you can see her very clearly.
>
> Unfortunately though, Poli‘ahu’s image and bodily form is being destroyed. They are altering the images of our deities because the *pu‘u*[s] are being leveled and the telescopes are being built on top of her.

3.5 Lake Waiau

Lake Waiau, situated within Pu‘u Waiau, is the highest permanent lake in the Hawaiian Islands at 13,020 feet elevation, and one of the highest permanent lakes in the world. Its area extent varies throughout the year, but is typically on the order of a couple hundred feet in diameter and is full of algae and microscopic life. It is generally assumed that in this otherwise arid region, this lake is permanent, on account of the underlying substrate that consists of a permafrost zone only three meters below the ground surface. This permafrost zone blocks the downward seepage of water into the porous bedrock (Ziegler 2002).

Some Hawaiian perspectives on Waiau's remarkable qualities are provided by Nā Maka o ka ‘Āina (2008):

> That glacier formed Lake Waiau, and it gave birth, I believe, to a lot of the springs that we now have. Some of that water is very, very old. Waiau is another of the *kupua* [supernatural being]. Waiau is the *kupua* of Lake Waiau on Mauna Kea. So Waiau is the keeper of all these hidden waters. Under Mauna Kea, under the lake and all the way through that whole area are large streams of water. And Waiau as the *kupua*, is the keeper of all those springs and hidden reservoirs, the great water supply of that island (the words of Keawe Vredenburg)
>
> There's a mystery about the lake and that is that it doesn't seem to have enough water to actually maintain itself. People say, gee, it's not that deep of a lake and it should evaporate because in the higher altitude there's less moisture. It's very arid. However, they [scientists] think that there is an ice cap down through the lava tube. So it holds the water in the lake (the words of Kealoha Pisciotta).

Lake Waiau is home of the goddess of snow, Poli‘ahu, and is guarded by the supernatural water spirit (*mo‘o*) known as Mo‘o-i-nanea, or "the matriarch of all *mo‘o* gods and goddesses," according Nā Maka o Ka ‘Āina (2008). Waiau is located along the major Waiki‘i-Waiau Trail (see Figure 6).

Westervelt relates that Waiau was one of the "four maidens with white mantles" in Hawaiian legends (Westervelt 1916:56), but:

> …has been almost entirely forgotten. There is a beautiful lake glistening in one of the crater-cones on the summit of the mountain. This was sometimes called "The +Bottomless Lake," and was supposed to go down deep into the heart of the mountain. It is really forty feet in its greatest depth—deep enough for the bath of the goddess. The name Wai-au means water of sufficient depth to bathe.
>
> (Westervelt 1916:56)

According to Nā Maka o ka ‘Āina (2008),

> Water captured in the *piko* (the center) of a taro leaf, the nodes of bamboo or the coconut is considered pure and sacred water because it has not touched the ground. Similarly and even more so, the water of Lake Waiau, suspended high above in the realm of Wakea, is considered the most sacred.
>
> Hunters and other regular visitors to the mountain collect the water from Waiau and bring it back to the family to drink for good health.
>
> Water from Waiau continues to be used in rituals of dedication, such as the blessing of a new canoe.
>
> Waiau is also an area where families take the *piko*, or umbilical cords of their babies, to bury, and where the bones or ashes of deceased family members are placed.

Maly’s (1999) research demonstrates that the waters of Waiau were considered to be highly sacred by Hawaiians in the 19th century:

> Mauna Kea falls in the senior line genealogy. During the 1880’s, Emma Rooke, the wife of the late Alexander Liholiho Kamehameha, and David La‘amea Kalakaua were in competition for the position of ruling chief for this kingdom of Hawai‘i. Both of them needed to prove their connection to the senior line and connect back to a *wahi pana* [legendary or storied place].
>
> David La‘amea Kalakaua went to Kanaloa-Kaho‘olawe to bathe in the waters of the ocean god Kanaloa. Emma went to the top of Mauna Kea to bathe in the waters of Waiau. The ceremony was to cleanse in Lake Waiau at the *piko* of the island. The water caught at Lake Waiau was considered pure water of the gods much like the water caught in the *piko* of the *kalo* leaf is thought of as being pure therefore it was used medicinally. (Nā Maka o ka ‘Āina 2008)

3.6 Mauna Kea Adze Quarry

This brief subsection is based primarily on Kirch’s (1985) summary. The Mauna Kea Adze Quarry (State Inventory of Historic Properties [SIHP] No. 50-10-23-4136), also known as Ke-ana-kāko‘i “the adze-making cave” (Pukui et al. 1974:103)”, is located on the southern slopes of the mountain, at elevations up to 12,400 feet. The site was listed on the National Register of Historic Places in 1969, and the Hawai‘i State Register of Historic Places in 1981.

The quarry occupies an area of at least 4,800 acres and is the largest site of its kind in all of Polynesia; in fact, there are very few quarry sites of its kind and size in the entire world (Figure 7 and Figure 8). Kirch explains:

> The attraction that drew prehistoric Hawaiians to these inhospitable heights, inducing them to brave sudden and frequently severe winds and snowstorms, was a single flow of extremely hard and dense blue-black basalt, probably the best single source of adz rock in the archipelago. The flow had erupted at a time when the summit of Mauna Kea was capped with glacial ice, with the sudden cooling effect causing the extreme density of the basalt. (Kirch 1985:179-180)

Archaeological surveys of the quarry site have identified hundreds of features, including “extraction areas…workshops, open-air shelters, shrines, overhang shelters, and rockshelters” (Kirch 1985:180). Plant and animal food debris has also been recovered in excavation, which has yielded radiocarbon-dated hearth materials from as early as the fifteenth century. Other evidence suggests the quarry was likely used up until the time of European contact (i.e., late 18th century).

Abbott (1992), citing Allen (1981), notes that *pōpolo* (glossy nightshade, *Solanum americanum*) seeds have been recovered in excavations at the Mauna Kea Adze Quarry and dated to A.D. 1650.

Paul Cleghorn, who analyzed much of the Maunakea quarry material for his dissertation (1982) and has conducted extensive experiments with its properties and production techniques, characterized the makers of these tools as follows:

.



Figure 7. A representative large debris pile of discarded flakes and adze preforms at the Maunakea quarry site (source: Kirch 1985)



Figure 8. Detail of one of the rockshelter sites associated with the Mauna Kea Adze Quarry showing many preforms (source: Kirch 1985)

> …there was a tremendous amount of standardization at the Quarry—standardization in adze form, standardization in size proportions, and standardization in procedure. This high degree of standardization supports the contention that the adze makers were craft specialists.
>
> This study has also provided details on the development of behavior at the Quarry. It appears that expert craftsmen worked at the escarpment where there was abundant raw material. Novices or, perhaps more accurately, apprentices foraged for suitable raw material on the outwash plain, where they practiced their skills. (Cleghorn 1982:343)

3.7 Religious Shrines

As discussed in significant detail below (see Section 5), archaeologists have documented at least 79 religious shrines in the Maunakea summit region. Unlike traditional *heiau* in lower altitudes throughout the Hawaiian Islands—which were commonly constructed in the form of stone platforms, enclosures, walls, and other such features—the shrines atop Maunakea almost exclusively consist of large slabs of basalt that have been uprighted into vertical positions. Sometimes these upright slabs are balanced on small rock piles, *ahu,* or cairns, but frequently these slabs are situated directly atop exposed bedrock.

Some of these shrines are associated with informal stone-tool workshops and evidence of temporary site occupation (shelter areas). Archaeologist Pat McCoy, who has spent extensive time studying these sites, believes at least some of the sites were used as locations for performing traditional ceremonies related to “rites of passage” (McCoy 1999)

3.8 Burials

The subject of the presence of burials in the Maunakea summit region is a topic of considerable disagreement between the scientific, archaeological perspective, on one hand, and Native Hawaiian perspectives, on the other. The details are presented in full below (see Section 5.4.1). While historic accounts and *mo‘olelo* tell of the presence burials on Maunakea (Maly and Maly 2005), archaeological evidence until recently, was relatively limited concerning confirmed human burials in the summit region. Prior to 2005, archaeological authorities on Maunakea, including Pat McCoy, had documented only one confirmed burial site (with multiple burials) and four possible burial sites in the summit region (McCoy 1991). All of these sites are located on Pu‘u Mākanaka to the northeast of the subject Project area. However, McCoy (1999:28) also comments:

> There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rockshelter or overhang. The basis of this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridgetop amongst any of the shrines. There in fact appears to be a clear separation between burial locations and shrine locations.

His comments appear to be apt as current in progress work by McCoy and Nees has documented 28 sites designated as burials and possible burials (McCoy et al. 2008).

There are widespread perceptions among many Kānaka Maoli (Native Hawaiians), some of which are backed by various types of documentary evidence, that the area holds or once held many more burials than archaeologists have been able to document. The following information regarding burials on Maunakea is from a website maintained by Nā Maka o ka ‘Āina (2008); it has been reproduced here verbatim (except for formatting changes):

> The whole mountain throughout history was used as a burial ground of the highest born and most sacred ancestors. And like the kupuna say, so many generations that they have turned to dust. But their spirit remains. (Kealoha Pisciotta, Mauna Kea Anaina Hou, excerpt from Mauna Kea – Temple Under Siege)
>
> I am Hawaiian. Our people are up there. (Manu Aluli Meyer, Philosopher of Education, interview)
>
> There’s many of our kupuna’s and ali‘i’s buried on top that mountain, many more burial sites that have never been found. (Lloyd Case, Public meetings on Mauna Kea Science Reserve Master Plan, May, 1999)
>
> Our ancestors were buried there for generations. They don’t bury only on the surface. They buried layers and layers and layers and layers, generations through generations, all the way to the top. You cannot cut, you cannot cut the mountain. You must preserve and protect. (Hannah Reeves, Public meetings on Mauna Kea Science Reserve Master Plan, May, 1999)
>
> In the olden time, it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial. (W. D. Alexander, “The Ascent of Mauna Kea, Hawaii”, in the September 20, 1892 issue of the Hawaiian Gazette)
>
> This high altitude area was also used as burial grounds. In particular, the cinder cones at and below the summit region…have been identified as burial areas. (Kepā Maly, From Mauna Kea – Kuahiwi Ku Ha‘o i ka Mālie, A Report on Archival and Historical Documentary Research Ahupua‘a of Humu‘ula, Ka‘ohe, districts of Hilo and Hamakua, Island of Hawai‘i, Kumu Pono Associates and Native Lands Institute, 1997)
>
> Boundary Commission testimonies for ahupua‘a in Hamakua district include references to burials on cinder cones. (M. J. Tomonari-Tuggle. Bird Catchers and Bullock Hunters in The Upland Mauna Kea Forest; a cultural Resource Overview of the Hakalau Forest National Wildlife Refuge, Island of Hawai‘i, International Archaeological Research Institute, Inc., August 1996)

The accounts of late 19th and early 20th century visitors to the mountain in conjunction with native boundary testimony, establish the use of both the mountain's upper slopes and the summit plateau as burial grounds.

Other observations of "graves" or "uncovered graves, eroded by high winds"…specifically locate burials within the summit plateau and suggest that interments in loose cinders were not necessarily marked by surface features or structures. (McEldowney 1982, McCoy 1982)

All of the known and suspected burials in the Science Reserve are located in cairns situated on the tops of cinder cones.

There are numerous references to human burials on the northern and eastern slopes of Mauna Kea, some at elevations that would fall within the boundaries of the Science Reserve. The practice of burying the dead in remote, high elevation areas may have been a common practice, based on the information collected by Thomas Thrum:

> The use of the craters within Haleakala as burial places, far removed from places of habitation, is quite in keeping with ancient Hawaiian practice. Distances and difficulties were no bar to faithful execution in carrying out the instruction of a dying relative or friend. (Thrum 1921)

There are four other sites in the surveyed areas of the Science Reserve that have been identified as possible burials.

There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rockshelter or overhang. The basis for this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridgetop amongst any of the shrines. There in fact appears to be a clear separation between burial locations and shrine locations. (McCoy 1999)

Eben Low's obituary: Ebenezer P.K. Low, 89, a man who loved the Big Island ranch country died Sunday. He has asked that his body be cremated and the ashes strewn across the top of Mauna Kea. His daughter Clorinda Lucas, said that his request will be taken care of. Mrs. Annabelle Ruddle of Hilo, his eldest living daughter, flew to Honolulu for the private services. His full name was Ebenezer Parker Kahekawaioumaokauaamaluihi Low. (Maly 1999)

And in the olden days, when our grandparents, they die…then that's when we take the people where they want to go. Like my grandparents, they came from Kalapana side so they like to be up Mauna Kea mountain facing towards Kalapana. In 1944, we took them up there.

And not only us. There’s lot of kupuna been buried up there on the mountain besides my kupuna. Lot of people take the bone up there.

But people come over here that don’t have aloha for our kupuna, they don’t care. Now the mountain get lot of building. We don’t know if the bones have been dug out or the bulldozer push them over the side.

And they’re still finding bones, people’s bones that coming out from Mauna Kea. And that’s what I don’t like. I like them leave alone. (Arthur “Aka” Mike‘ele Mahi, Interview, May 2005)

Hawaiians and observatory staff have mentioned over the years the rumors of burials being disturbed and destroyed. Has there been any attempt by UH/IFA to investigate persistent rumors that Hawaiian burials have been dug up during construction activities? (Sierra Club comments on Draft EIS, Mauna Kea Science Reserve Master Plan)

Archaeological surveys promised by IFA [Institute for Astronomy] in 1985 remain unfinished despite concerns from Native Hawaiians, archeologists and others that burials may be disturbed during continued telescope construction. These concerns arise from long-standing oral histories which say that the summit of Mauna Kea is the burial ground of the highest born and most sacred ancestors. Nineteenth Century archaeological surveys also confirm that Native Hawaiian burials were “commonplace” on the upper slopes of Mauna Kea. (Nelson Ho, “Astronomy director’s response disappointing”, Viewpoint, Hawai‘i Tribune Herald 7/11/96)

All of the current observatories and/or telescopes were built without the completion of archaeological surveys. So how can they know if they disturbed any sites or not?

Some of the pu‘u’s, the cinder cones, in order to accommodate the telescope foundations, were just leveled. They were leveled in some cases as much as 40 feet. It’s also important to us because the pu‘u’s are the burial places. And we don’t have any way of knowing if our burials were disturbed or not. (Kealoha Pisciotta, Mauna Kea Anaina Hou; interview, Mauna Kea – Temple Under Siege)

Would bulldozing cemeteries be allowed anywhere else in the world? (Carol Nervig, testimony before University of Hawai‘i Board of Regents, June 2000)

The bones, the ‘ohana up on the mountain. Walking on our ancestors, stepping on our ancestors. (Richard Kupihea Romero, Public meetings on Mauna Kea Science Reserve Master Plan, May, 1999)

And how dare you put an observatory on top there, on our graves, on the grave site of my ancestors. How dare you do that? (Reynolds Kamakawiwo‘ole, Public meetings on Mauna Kea Science Reserve Master Plan, May, 1999)

We cannot turn our back on our ancestors and say, “You know what, ancestors, can you just move your bones now?” No. We won’t do it. We will fight in every way possible we can.

If it was your church, I would expect you to do the same. If it was your graveyard or the graveyard of your mother or your father or your grandfather, I would expect you to do the same. (Ali‘i ‘Aimoku Ali‘i Sir Paul K. Neves, Royal Order of Kamehameha I, Moku o Mamalahoa, Heiau Helu Elua; testimony, NASA town meeting on Keck Outrigger Telescopes Project, October 2001)

The practice of removing burials for development has a long history in Hawai‘i. In the late 1980’s, when over one thousand bodies were removed for the construction of a beach resort on Maui, public opposition and outrage came to a head and forced the developers to move their site. Legislation was passed to establish burial councils on all islands to protect ancestral remains.

Today, laws call for Hawaiian families to be notified when potential development may impact the burial sites of their kupuna, or ancestors. But in the very act of protecting family burial sites, the burial councils are forced to reveal their locations.

And sorry, but I feel it personally. It hits me when somebody tell me my kupuna is buried there and I gotta prove ‘em. Our belief is that the secret places, where they stay and how they kept it, is supposed to remain secret. (Member of Hawai‘i Island Burial Council, Council meeting 3/30/2000)

Under burial law, where known or possible burials exist, a burial treatment plan must be created. We know that the pu‘u’s are the burial sites. We don’t know all the burials that are here. And, that’s why we need to resolve the burial issues on Mauna Kea. (Kealoha Pisciotta, Mauna Kea Anaina Hou; interview)

In the past, there may have been some misunderstanding or cases where people might have found bones and those bones were probably misplaced or whatever. And so, in order to avoid that kind of misunderstanding, what we’re attempting to do is hire a cultural monitor and an archeologist who will be there at the time of the construction so that there would not be any misunderstanding and any mistrust, so that the Hawaiian community would feel that there is someone who is actually watching what the construction crew is doing.

So this is the one step that NASA’s taking to try to get someone like that on board. So we will not only have a cultural monitor who’ll be there during construction, but we’ll also have an archeologist who will also be available, who are trained to know what to look for. (John Lee, NASA; town meeting on Keck Outrigger Telescopes Project October 2001)

3.9 Trails

As depicted in Figure 6 (above), there are several trails traversing the Maunakea summit region including, from the west, the Waiki‘i-Waiau Trail leading up to Waiau; from the northwest, the Makahālua-Kemole-Waiau Trail also leading up to Waiau; from the northeast, the Maunakea-‘Umi Koa Trail, leading to and from the Hāmākua area; and, from the south and leading to the Mauna Kea Adze Quarry, the Mauna Kea-Humu‘ula Trail.

3.10 Oli (Chants), Pule (Prayers) and Mele (Songs)

There are many different *oli* (chants), *pule* (prayers) and *mele* (songs) about Maunakea and its summit region. The following examples and brief accompanying comments are from the Nā Maka o ka ‘Āina website (2008). These examples date from different times periods: some are modern, some are post-Contact in age, and some are much older (e.g., excerpts from the Kumulipo or creation chant). These *oli, pule* and *mele* associate Maunakea with the original progenitors of life in Hawai‘i, including Wākea and Papa, with the mountain’s status as the *piko* of the *mokupuni* (island), and with various mountaintop deities:

> In some genealogical chants, Mauna Kea is referred to as “Ka Mauna o Kea” (Wakea’s Mountain), and it is likened to the first-born of the island of Hawai‘i (Pukui and Korn 1973). A *mele hanau* (birth chant) for Kauikeaouli (Kamehameha III) describes Mauna Kea in this genealogical context:
>
> O hanau ka mauna a Kea
> Born of Kea was the mountain
>
> ‘Opu‘u a‘e ka mauna a Kea
> The mountain of Kea budded forth
>
> ‘O Wakea ke kane, ‘o Papa
> Wakea was the husband, Papa
>
> ‘O Walinu‘u ka wahine.
> Walinu‘u was the wife
>
> Hanau Ho‘ohoku he wahine
> Born was Ho‘ohoku, a daughter
>
> Hanau Haloa he ali‘i,
> Born was Haloa, a chief
>
> Hanau ka mauna,
> Born was the mountain,
>
> He keiki mauna na Kea...
> a mountain-son of Kea
>
> A Social Impact Assessment
> Indigenous Hawaiian Cultural Values
> of the Proposed Saddle Road Alignments
> Kanahele, Pualani K. and Edward L.H. Kanahele 1997

Mauna Kea is the *piko* of the island and this is another reason this area is considered sacred. This piko is the initial provider of the land mass of Hawai‘i *mokupuni*. Hawai‘i was also the first child of Papa and Wakea as stated in “Mele a Paku‘i”:

‘O Wakea Kahikoluamea ea
Wakea the son of Kahikoluamea

‘O Papa, Papa-nui-hanau-moku ka wahine
Papa, Papa-nui-hanau-moku the wife

Hanau o Kahiki-ku, Kahiki-moe
Kahiki-ku and Kahiki-moe were born

Hanau ke ‘apapanu‘u
The upper stratum was born

Hanau ke ‘apapalani
The uppermost stratus was born

Hanau Hawai‘i i ka moku makahiapo
Hawai‘i was born, the first-born of the islands

Ke keiki makahiapo a laua
The first born child of the two

Wakea laua ‘o Kane
Of Wakea together with Kane

‘O Papa Walinu‘u ka wahine
And Papa of Walinu‘u was the woman

In 1980, Tutu Kawena Pukui shared a mele (chant) she had composed for Mauna Kea with me.

O Poli‘ahu i ke kualono o Mauna Kea
Poli‘ahu is on the mountaintop of Mauna Kea

Noho ana i ka lau o ke kuahiwi
Dwelling on the expanse of the mountain.

Wahine noho anu o uka o Lihu‘e
Woman who dwells in the cold above Lihu‘e [on the Waimea plain]

E ku ana iluna o ke ki‘eki‘e
Standing atop the heights

Ho‘anoano wale ana i Pali-uli e...
Awe-inspiring [as seen from] Pali-uli...

Excerpts from Mauna Kea – Kuahiwi Ku Ha‘o i ka Malie, A Report on Archival and Historical Documentary Research, Ahupua‘a of Humu‘ula, Ka‘ohe, districts of Hilo and Hamakua, Island of Hawai‘i, by Kepā Maly, ©1997 Kepā Maly, Kumu Pono Associates and Native Lands Institute

Maunakea
translation by Mary Kawena Pukui

E aha ‘ia ana o Mauna Kea
What is doing with Mauna Kea?

Kuahiwi ‘alo pu me ka kehau
Mountain ever moist with dew

Alawa iho ‘oe ia Mauna Loa
Take a glance at Mauna Loa

Kohu moa uakea i ka malie
It is like a white cock standing in the calm

Ku aku au mahalo o ka nani
I stand and admire the beautiful scene

Ka haale a ka wai hui a ka manu
The rippling of the cold water of the birds

Kau aku ka manao a e ike lihi
Think constantly and to glimpse

Ka uwahi noe a o Kilauea
Of the gray, misty smoke of Kilauea

Ke hea mai nei Halemaumau
Halema‘uma‘u is calling

‘Ena‘ena i ke ahi a ke wahine
She who is ever burning with the woman’s fire

Ka wahine kui pua lehua o Olaa
The woman who strings the lehua blossoms of ‘Ola‘a

I hoa hoouipo no ka Malanai
Is the sweetheart of the Malanai wind

I ahona Puna i ka hone a ke kai
Relieving Puna in the sweetness by the sea

Ke ala o ka hinano ka‘u aloha
And the fragrance of the hinano I love so well

Aloha ia uka puanuanu
I love the chilly uplands

I ka hoopulu ia e ke kehau
in the wet and the snow

Haina ia mai ana ka puana
This is the end of my chant

Pulu elo i ka wai a ka Naulu.

Soaked, drenched in the water of the sudden shower.

Aia na kulu pakaua ko loku mau la ma na Kona i keia mau la.
There are dripping raindrops downpour unceasing days there at Kona to this day.

Ola aku la no hoi ia mau kini!
lived that return many.

Section 4 Historical Background

4.1 Overview

Historical documents about Maunakea focus on early observations by explorers, missionaries and others as well as on scientific expeditions to the summit area. This information often provides bits and pieces of Native Hawaiian perceptions and ideas about the mountain, although these are invariably intermixed with biased views of the natives, themselves, held by those who created the documents. These early observations also inform us about how climatic and natural-resource conditions have changed over the last 200 years.

More recently, starting in the 1960s, Maunakea has been home to numerous astronomical observatories, the construction of which is a direct result of the finest conditions for such scientific work on the planet. It is worth mentioning at this point that the initial construction of these observatories predated the Native Hawaiian renaissance of the 1970s that included a revival of the Hawaiian language and led directly to the contemporary Hawaiian sovereignty movement and other cultural revivals.

4.2 Early Post-Contact Period

The first recorded ascent of Maunakea was in 1823 by the missionary Joseph Goodrich (who lived 1794-1852). Like many missionaries, the Yale-educated Goodrich was also a naturalist and he published his observations on Hawai‘i Island volcanoes in the *American Journal of Science* in 1826 and 1829. According to records, the preacher hiked from Waimea to the Maunakea summit and back to Waimea in one 24-hour marathon. He approached via Kawaihae and Waimea. In the vicinity of Waimea he spent the night (at approximately 2,700 feet elevation). Leaving early, and approaching the summit from the north, he followed a steep ravine reaching the tree line at about 9,000 feet elevation approximately 15 miles from Waimea where he rested for a few hours recording the temperature at 43° F at sunset. At 11:00 PM, he pushed on in bright moonlight encountering snow at 1:00 AM and recording a temperature of 27° F. Goodrich attained the highest of several summits around 3:00 AM noting the presence of a pile of stones which he assumed had been constructed by Hawaiians. He roughly retraced his steps back to the vicinity of Waimea. Given that all of his time above 9,000 feet was in the dead of night and the distance he needed to cover, few details were recorded. Goodrich made a second trip up Maunakea in 1825 noting dead sheep on one of the cones at an estimated 13,612 feet elevation and speculating they had been driven there by wild dogs. For 150 years, the near perfect Pu‘u Hau Kea (elevation 13,441 feet), as it is presently known, was popularly known as the “Goodrich Cone” (see Kilmartin 1974:13; Macdonald et al. 1983:18, etc.) in his honor.

Hitchcock (1911) described several early scientific ascents of Maunakea (Figure 9 through Figure 13):

> Several of the party of the Blonde [i.e., the H.M.S. Blonde] ascended Mauna Kea in July, 1825, accompanied by a “missionary and botanist.” Rev. Mr. Goodrich of Hilo writes of an ascent made by him in August 27, 1825. He brought back specimens of the “granite” [i.e., basalt] from the summit, as well as the fine

> grained basalt used for the manufacture of adzes. James Jackson Jarves climbed to the summit in 1840, bringing back specimens of "augite, hornblende and olivine." He looked into Mokuaweoweo and reported that there were no signs of activity, not even ascending vapors. In the early part of January, 1841, Dr. Charles Pickering of the Wilkes Exploring Expedition, made the ascent and noted the same features mentioned by his predecessors, such as the ice and several cones of volcanic origin. In a desolate and gravelly plain he found a few plants suggestive of a colder climate, probably the same that were brought back by Mr. Preston and named authoritatively, such as *Cystopteris fragilis, Trisetum glomeratum, Poa annua* and *Deschampsia australis.*

The English botanist David Douglas (for whom the common name of the Western American Douglas Fir [*Pseudotsuga menzies*] was named) carried out scientific ascents of Maunakea and Maunaloa and died of mysterious circumstances (at the age of 36) on the slopes of Maunakea in 1834 (Ziegler 2002).

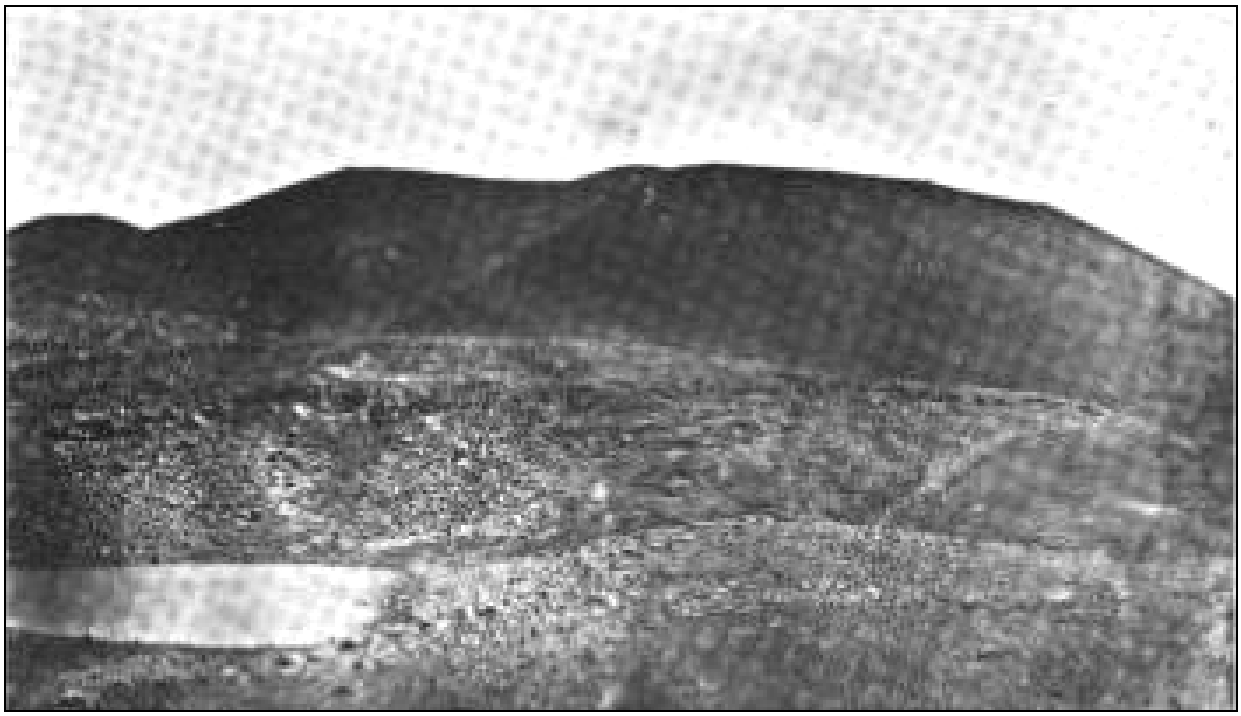

Figure 9. Photograph of cinder cones of Maunakea with Waiau (lower left) (Brigham 1909)

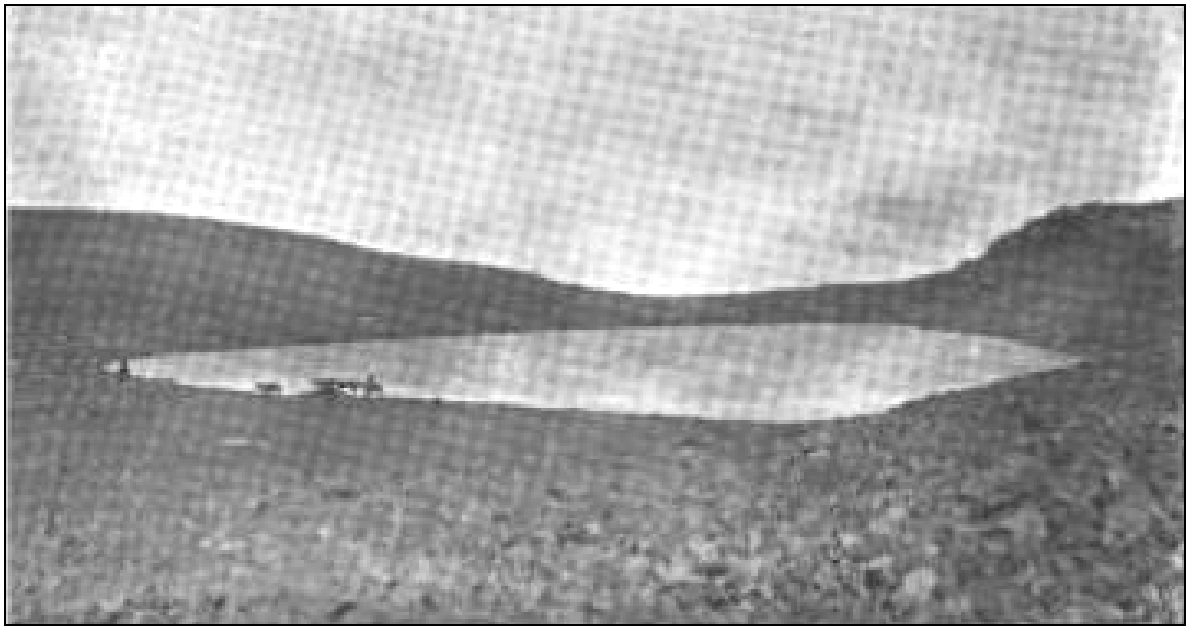

Figure 10. 1909 photograph of Lake Waiau from Brigham



Figure 11. 2009 photograph of Lake Waiau (source: CSH Researcher Brian Cruz)



Figure 12. Photograph of cinder cones of Maunakea from Hitchcock (1911)

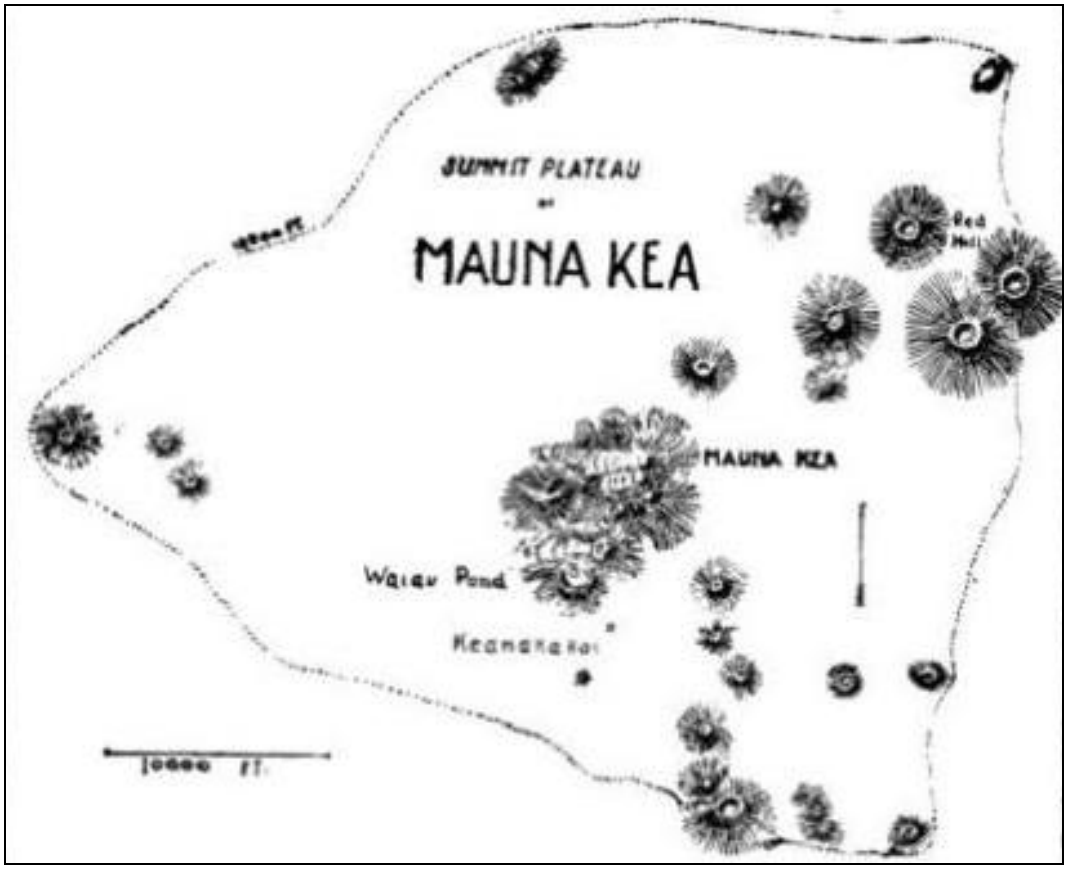

Figure 13. Hitchcock’s copy of W.D. Alexander’s 1892 map of the summit region

4.3 The Māhele

The Organic Acts of 1845 and 1846 initiated the process of the Māhele, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848, the crown and the *ali‘i* (chiefs, royalty) received their land titles. The *ahupua‘a* of Ka‘ohe was designated as Crown land, and on January 27, 1848 was relinquished by Victoria Kamamalu to Kamehameha III (Buke Mahele, 1848:5–6). In March of the same year, Kamehameha III gave Ka‘ohe to the Government Land inventory (Buke Mahele, 1848:191). These same records state that four native claims were registered in Ka‘ohe Ahupua‘a (Table 1) but only one was awarded.

Table 1. LCA claims in Ka‘ohe Ahupua‘a

LCA	Claimant	District	Ahupuaa	Ili	Award
08297	Kookooku	Hāmākua	Koholalele, Ka‘ohe	Lipelau	Awarded 1 āpana in Koholalele
10180	Malao, Tatina	Hāmākua	Kemau 2, Kaohe	Kahaumake, Manele, Haleolono	Awarded 2 āpana in Kemau 2
03705B	Koolau	Hāmākua	Ka‘ohe		Awarded 1 āpana in Ka‘ohe
03722B	Keopohaku	Hāmākua	Ka‘ohe		None

The following testimony was provided as Native Testimony in support of Koolau’s claim on October 30th, 1848:

> Keopohaku, sworn, He has seen in Kaohu ahupuaa of Hamakua, Hawaii, 10 sections.
>
> Section 1: House site: All konohiki boundaries, 2 houses for Koolau, no fence.
>
> Section 2: All konohiki boundaries, 1 cultivated taro kihapai.
>
> Section 3: Mauka, Kohala, Makai also by konohikiHilo by Nuumalolo's land. 1 cultivated taro kihapai.
>
> Section 4: All konohiki boundaries, 1 cultivated potato kihapai.
>
> Section 5: Mauka & Kohala by konohiki. Makai by Moano's land. Hilo by konohiki. 1 cultivated banana and coffee kihapai.
>
> Section 6: Koholalele ahupuaa: All konohiki boundaries, 2 cultivated banana kihapai.

> Section 7: All konohiki boundaries, 1 cultivated coffee kihapai.
>
> Section 8: All konohiki boundaries, 1 cultivated arrowroot kihapai.
>
> Section 9: All konohiki boundaries, 1 cultivated arrowroot kihapai.
>
> Section 10: All konohiki boundaries, 1 cultivated taro kihapai.
>
> Land from Keopohaku in 1836; no one has objected to him.
>
> (Native Testimony; 389v4)

Of the ten *āpana* that Koolau claimed, he was awarded only one 7-acre *āpana*. This was the sole *kuleana* award in Ka‘ohe Ahupua‘a. This single awarded kuleana claim indicates coffee, arrowroot, banana, and taro were all cultivated in the lands of Ka‘ohe.

The 1862 S.C. Wiltse map of Humu‘ula (Register Map 668/Figure 14) and the 1892 C.J. Lyons map of Ka‘ohe, Hāmākua and Humu‘ula (Register Map 1641/Figure 15) show the summit portion of the Project area. Questions related to the location of the eastern boundary of Ka‘ohe and the western boundary of the *ahupua‘a* of Humu‘ula, led to an investigation by the Commissioner of Boundaries in the late 19th century. The 1892 map is likely related to that decision.

Testimonies regarding *ahupua‘a* boundaries were initially heard in 1873, although the Ka‘ohe and Humu‘ula boundary was not completely documented. Additional testimonies were provided and a determination was made. In 1891 the boundary was determined to run along the Kaula Gulch (Foster 1893:455). This area supported the habitats of two native bird species:

> From the mass of evidence taken we find that in ancient time the main value of the land of Kaohe was the “uwa‘o,” a sea-bird, whose habitat was the dry, rocky and elevated portion of the mountain. The habitat of the bird “oo,” whose feathers were valuable, was in the mamane of Humuula. So the bird-catchers, retainers of the chief to whom Humuula was assigned, were limited to this area on which to take the “oo,” and could not take the “uwa‘o,” for those belonged to Kaohe. (Foster 1893:456)
>
> The “uwa‘u” bird is also spelled *‘ua‘u*; this is a dark-rumped petrel.

During a discussion of the testimony, court documents note that:

> The kamaainas of forty years ago [1851] were less likely then to be mistaken as to the correct boundaries of lands than those of these days. They lived on the lands, pursuing their occupations under the chiefs of gathering feathers, canoe making and getting articles of various kinds from the mountains. (Foster 1893:458)

McEldowney’s (1982:A-10) ethno-historical summary of the Maunakea summit region provides Boundary Commission Testimony of a man named Haiki for the disputed boundary. He asserts that: “my parents told me Humuula went to Kaluakaakoi and Poliahu. We used to go there after adzes for Humuula people.”

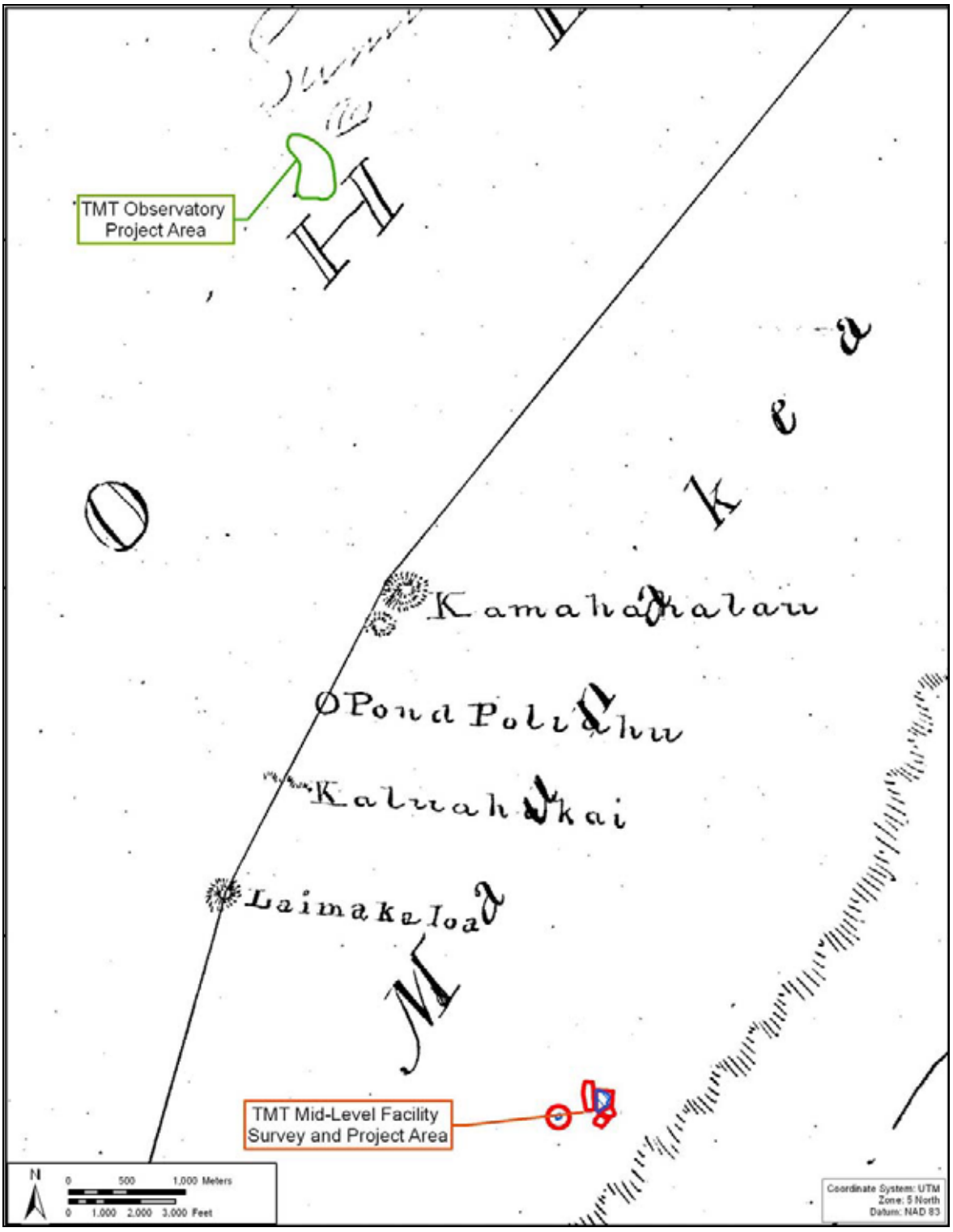

Figure 14. Portion of 1862 S.C. Wiltse map of Humu‘ula (R.M. 668) showing the location of the Project areas

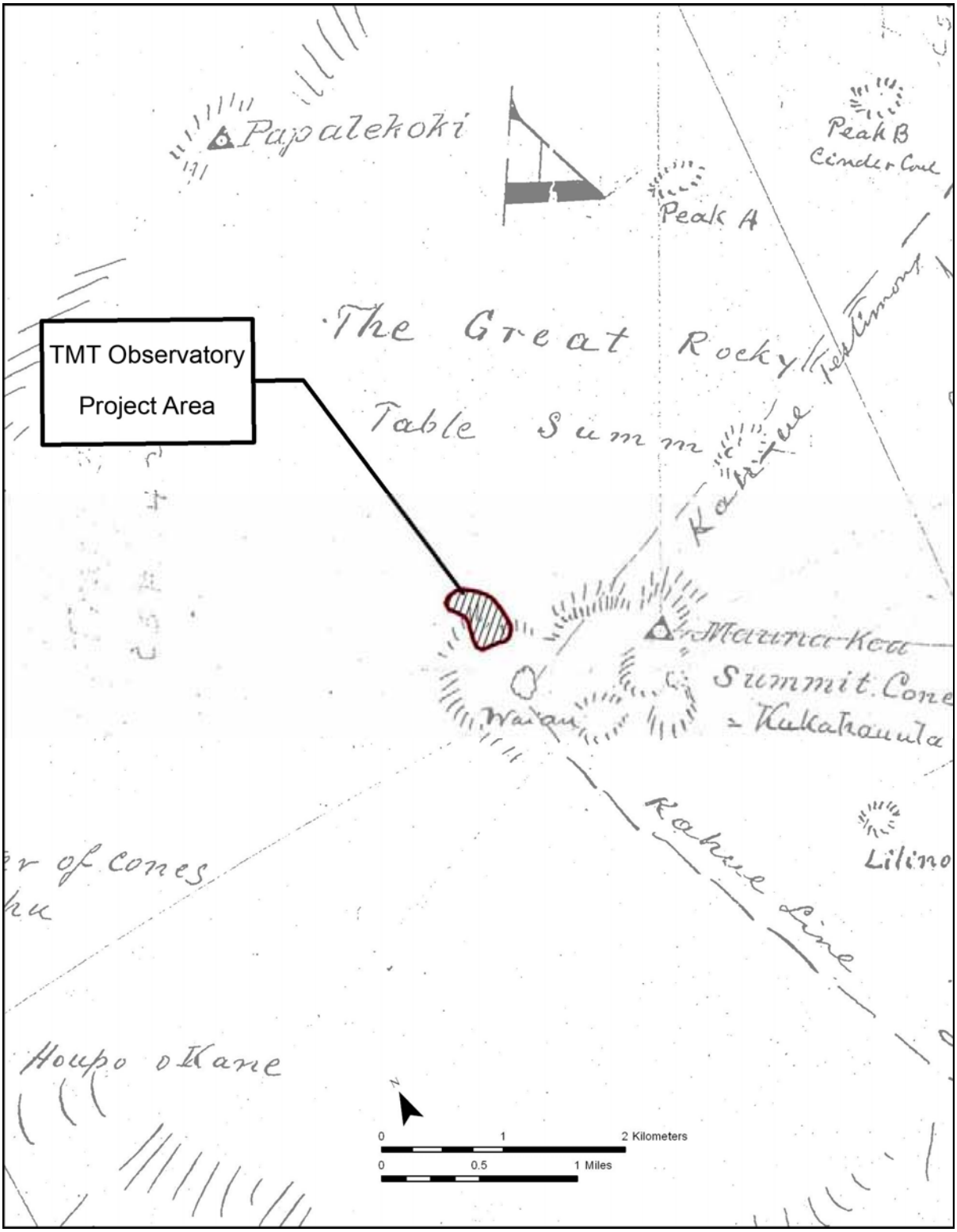

Figure 15. Portion of 1892 C.J. Lyons map (R.M. 1641) of Ka‘ohe, Hāmākua and Humu‘ula showing the location of the TMT Observatory Project area

Maly’s 1999 archival study included a reference in border testimony to burials within Ka‘ohe Ahupua‘a:

> [Pu‘uokihi] it belongs to Kaohe and above that is where people were buried in old times, when people used to make fishhooks from the bones. [Testimony of Kahue, 1880, BCB, Hawai‘i, B:444] (Maly 1999:D-4).

4.4 Middle 19th Century

Wilkes (1856) discusses a scientific ascent of Maunakea in 1841 by Drs. Pickering and Brackenridge. Many of the details describe the long journey of ascent beginning in Hilo, rather than describing the summit region, itself; however, some of the details provide important observations about the presence and distribution (especially elevation) of natural resources that differ from contemporary data. These mid-19th century observations, in conjunction with modern data, provide comparative information about long-term change on the mountain.

Wilkes’ description of Pickering and Brackenridge’s ascent begins near Hilo, and mentions the names of Native Hawaiian guides and their chief:

> They [Pickering and Brackenridge] were furnished with guides, among them Sandwich Jack, our bullock-driver, whose true name was Dawson, though he went by the sobriquet of Billy Lilly. They set out on the 8th of January, attended by natives from Hilo, belonging to [the chief] Kanuha, having agreed to pay each of them fifty cents a day. (Wilkes 1856:200)

After arriving for the night seven miles from Hilo at a dilapidated sawmill belonging to “Mr. Castle” and managed by a man named Simons, there was a disagreement or miscommunication regarding compensation between the Hawaiian guides and porters and their chief (Kanuha), which took a day to resolve. Traveling through a forest of “ohea (Callistemon)” and “koa (Acacia),” they encountered many unique fern species, including an edible one, and watched as one of the young men of the group tried (unsuccessfully) to capture a large bird. They also encountered many heads of cattle, thought to have been introduced by Vancouver in 1795, and Native Hawaiians hunting them. This was despite the fact that “[t]he cattle have been tabooed for five years, from the year 1840, in consequence of the slaughter that had been made among them” (Wilkes 1856:200).

At the location of these observations of feral cattle, described as no higher than 5,000 feet elevation, the expedition noted the presence of frost:

> From these natives [hunters of cattle] they procured some jerked beef, and were told that ice had formed there the night before. The effects of frost on the foliage was evident, and yet the elevation did not exceed five thousand feet. (Wilkes 1856:200-201)

Later, Wilkes states:

> On the 12th, they started at sunrise, and by eleven o’clock found they had cleared the forest. Their altitude was about six thousand feet…The ground was frozen, and the pools of water were covered with a thin ice. (Wilkes 1856:201)

It seems that during this time (1841), the mountain was a much colder place than it is now, when frost and ice do not extend down to the elevation of 5,000-6,000 feet. This may be at least partially explained by the fact that the 16th through the mid-19th century was the approximate time of three interspersed global cold periods collectively known as the "Little Ice Age."

Regarding the vegetation on Maunakea, Wilkes (1856) states that, unlike Maunaloa—where vegetation stops at around 7,000 feet elevation, vegetation on Maunakea "continued to twelve thousand, and a few scattered plants may even be found within a few hundred feet of the top of Mauna Kea." He also notes that *māmane* (*Sophora chrysophylla*) "occupies a belt eleven thousand feet high" on Maunakea, which suggests a significantly higher treeline than at present, where *māmane* occur no higher than above 9,000 feet elevation.

4.5 Late 19th century

Bryan (1915), describing Hitchcock's 1885 ascent of Maunakea, noted:

> When not covered with snow the surface of the plateau of Mauna Kea is described as a desolate gravelly plain on which occur five or six species of plants resembling those of the colder climates of high altitudes. As reported by Professor MacCaughey, the lake at the summit [Waiau], though very cold throughout the year, supports a luxuriant growth of green algae. (Bryan 1915:152)

W.D. Alexander, Surveyor General, ascended Maunakea along the Waimea-Waiki‘i trail in 1892. His description of the route is as follows:

> A wagon road made by the owners of the Humuula Sheep Ranch leads from Waimea around the western and southern sides of Mauna Kea. On the western side of the mountain it passes through a region which only needs more rainfall to make it a superb grazing country. The ancient forests here, as at Waimea have been nearly exterminated, but a fine grove of mamane trees still survives at the Auwaiakeakua Ranch. The manienie grass is gradually spreading and will in time add immensely to the value of the land. At the half-way station, called Waikii, water tanks and a rest house have been provided for teamsters.

4.5.1 Humu‘ula Sheep Ranch

In 1897, 137,200 acres of Ka‘ohe Ahupua‘a were leased by the Humu‘ula Sheep Station Company. The lease state was described as, "Subject to homestead reservation: term, 15 years" (Mitchell 1903:586).

The Humu‘ula Sheep Station Company began as the Waimea Grazing & Agricultural Company, which by the mid 1860s, leased most of the upper elevations of Ka‘ohe, as well as Waimea and Humu‘ula. Frank Spencer, the owner, sold the leases.

One of these leases was sold to Parker Ranch. Parker Ranch held the lease to most of the Ka‘ohe mountain lands until 1905 when leases were withdrawn on lands between the 7,500 and the 9,500-foot elevation to establish the Mauna Kea Forest Reserve (Maly and Maly 2005:522). Parker Ranch continues to utilize lower portions of Ka‘ohe for grazing (Maly and Maly 2005:viii).

Parker Ranch continued to hold land in the Humu‘ula lands and continued their ranching activities. Initially focusing on sheep ranching until 1964 when it ended its sheep program, Parker Ranch carried out it’s cattle operations until the end of their lease in August of 2002 (Maly and Maly 2005:vii).

4.6 Twentieth Century

In 1936, the CCC carried out improvements to the old Maunakea-Humu‘ula Trail from near the main base of the sheep station at Kalaieha to the summit (Bryan 1938). The first stone cabin at Hale Pōhaku was constructed at approximately the same time. The second stone cabin was built in 1939. L.W. Bryan, at that time the Acting Territorial Forester, wrote in a 1938 article that the original stone house measured 16 by 20 feet and was equipped with a 2,000 gallon water tank and a large stove. The summit road only extended to Hale Pōhaku in 1938 (Bryan 1938:38).

Starting in the early 1960s, Maunakea was promoted as a prime location for developing astronomical facilities by a group of business leaders on Hawai‘i led by Mr. Tetsuo Akiyama. A road was built to the summit in 1964, with the support of then Governor John A. Burns. After testing at the top of the mountain showed superb conditions for astronomical observations, two facilities were constructed by the University of Hawai‘i at the end of the decade. By the turn of the millennium, Maunakea was home to a total of 13 astronomical facilities, making it “the largest concentration of telescopes in the world” with facilities being operated by astronomers from ten countries (Juvik and Juvik 1998).

Some of the most important recent discoveries in the field of astronomy have taken place at observatories on Maunakea, and proponents and advocates of these facilities have stressed that this work in many ways represents a continuation of the long tradition of Polynesian celestial observation and navigation that was integral to the initial discovery and peopling of the Hawaiian Islands (Juvik and Juvik 1998). At the same time, many Kānaka Maoli (or Native Hawaiian) individuals and groups have become increasingly opposed to any additional development atop Maunakea; a sacred mountain which should not be subject to additional ground disturbance, vehicular traffic, trash and human wastes.

The Onizuka Center for International Astronomy Visitors Information Center was constructed in 1986 within the vicinity of Hale Pōhaku.

4.7 Previous CIA and Cultural Studies for Maunakea

Several extensive cultural studies and management plans have been previously carried out for Maunakea. This section summarizes these studies. Some of these studies, particularly Maly (1999) and Maly and Maly (2005), have provided details for the current study.

Management plans for Maunakea dating from 1977 to 2000 are listed on the Mauna Kea Comprehensive Management Plan website (http://www.mkcmp.com/about). Table 2 was taken from the website and summarizes the management plans written for Maunakea.

Table 2. Maunakea Management Plans

Year	Description of Management Plan	Approved by
1977	*Mauna Kea Plan*. Adopted by DLNR to serve as policy framework for the management of Mauna Kea. The plan divided Maunakea into five management areas and described acceptable uses and management controls for each area. (1998 audit report)	BLNR (Board of Land and Natural Resources)
1980	*Hale Pōhaku Master Plan*. Prepared by DLNR to address the mid-level facility at Hale Pōhaku. Served as a guide to UH in the design and construction of the astronomy mid-level facility. The plan incorporated the needs of the six telescopes in the operation at that time, allocated space for public restoration and set controls for future expansion. (1998 audit report).	
1982	*Research Development Plan (RDP) for the Mauna Kea Science Reserve and Related Facilities*. UH approved the RDP as its own research development plan for the Mauna Kea Science Reserve and Hale Pōhaku facilities. The RDP was to serve as a programmatic master plan for the continued development of the Mauna Kea Science Reserve.	UH Board of Regents
1983	*Mauna Kea Science Reserve Complex Development Plan*. UH developed this plan to facilitate the implementation of the specific research facilities identified in the plan. The plan consisted of two components. The first component was a complex development plan to provide the physical planning framework to implement the UH Research Development Plan. The objective of the document was to guide and control development in order to preserve the scientific, physical, and environmental integrity of the mountain. The second component was the environmental impact statement (EIS) to evaluate the general impact of implementing the actions proposed in the complex development plan and propose mitigating actions for potential negative impacts. (1998 audit report).	UH Board of Regents
1985	*University of Hawai‘i Mauna Kea Management Plan*. Revised management plan to address concerns from DLNR and the public. BLNR retained management control over the commercial activities. (1998 audit report)	BLNR
1995	*Revised Management Plan for the UH Management Areas on Mauna Kea*. Adopted by UH and DLNR to improve control over commercial uses in the summit area. All management responsibilities, except those related directly to astronomical facilities or the summit road, are transferred back to DLNR. This plan replaced and superseded the 1985 Management Plan. (1998 audit report)	BLNR

Year	Description of Management Plan	Approved by
2000	UH Mauna Kea Science Reserve Master Plan. Adopted by the UH Board of Regents as the policy framework for the responsible stewardship and use of university managed lands on Maunakea. Master Plan created a new management structure, housed within the University of Hawai‘i at Hilo, as the local management authority over Maunakea. UH also established the astronomy precinct, which confines astronomy development to 525 acres within the MKSR. (2000 audit report).	UH Board of Regents
2008	*Preliminary Draft Report: Cultural Resource Management Plan for the University of Hawai‘i Management Areas on Mauna Kea, Ka‘ohe Hamakua, Island of Hawai‘i TMK (3) 4-4-012, 015*	Draft

This section reviews relevant previous cultural research in the Maunakea summit region (Table 3). Several CIA and cultural study reports have been previously prepared since the 1980s for the Maunakea summit region.

Table 3. Cultural Studies in the Maunakea Summit Area

Reference	Comments
McEldowney 1982	First ethnographic study prepared and included in an EIS. No consultations were conducted.
Kanahele and Kanahele 1997	Cultural assessment for the proposed realignment of the Saddle Road, detailed discussion of cultural values, protocols and practices
Maly 1998	Archival and historical documentary research, including “limited” oral historical interviews not formally part of the study
Langlas et al. 1999	Archaeological Inventory Survey and cultural assessment along Saddle Road and Hawai‘i Defense Access Road
Maly 1999	Oral history and consultation study including 22 interviews, and 3 interviews dating 1956-1967 translated by Maly
PHRI 1999	First Cultural Impact Assessment study prepared for the University of Hawai‘i Mauna Kea Science Reserve Master Plan Project Area. Basis of the study was Maly (1999)
Maly and Maly 2005	The study’s Executive Summary appears in Appendix B of this current document. Study includes extensive background research and oral histories and recommendations that have been ongoing since 1996.

4.7.1 McEldowney (1982)

Holly McEldowney (1982), then of the B. P. Bishop Museum Department of Anthropology, produced an Ethnographic Background report for the Maunakea Summit Region for the Research

Corporation of the University of Hawai‘i as part of an EIS for a Mauna Kea Science Reserve Master Plan. The data are presented in three sections addressing 1) myths and legends and “oral traditions,” 2) land use practices and cultural activities and ,3) a study of place names.

McEldowney (1982:A-5) starts by relating a tradition of the goddess Poli‘ahu from Haleole’s (1863) story of Lā‘ieikawai. While McEldowney relates this as a “Hawaiian tradition recorded by S. N. Haleole,” Lā‘ieikawai has increasingly been recognized as a “romance” that undoubtedly utilized pre-Contact traditions and motifs but was self-consciously more in the nature of a work of imagination than a recordation of traditional legends. Haleole’s traditions of Poli‘ahu, however, have almost nothing to do with Maunakea (although “Līlīnoe” is given as the name of one of Poli‘ahu’s companions). McEldowney also discusses Westervelt’s accounts of Poli‘ahu and opines that Westervelt “took the unwarranted license to assign each of the ‘goddesses of the snow covered mountains’ to specific localities” (McEldowney 1982:A-6). This appears to be the case as popular assignations of the names of deities to specific land-forms are modern appellations. McEldowney then briefly discusses mentions of Maunakea, Poli‘ahu, Līlīnoe in works by Fornander, Kamakau, Kalākaua and Thrum. She notes the common case (as exemplified in Haleole’s Lā‘ieikawai and Fornander’s Hawai‘i Loa legend) of characters and themes inserted into more recent versions of older legends. McEldowney notes that “Otherwise Mauna Kea is mentioned only briefly and rarely as the backdrop to more compelling events, or to characterize the attributes of a figure or an event by analogy” (McEldowney 1982:A-7).

McEldowney points out that: “Several early accounts report that Hawaiians were reluctant to travel or serve as guides on inland journeys, or that they professed no knowledge of these areas, leading to the false impression that these regions constituted a wilderness unknown to the Hawaiian people” (McEldowney 1982:A-7, A-8). This generality is even more pronounced for the summit plateau of Maunakea, where almost all early post-Contact visitors made the final ascent to the summit without native guides. The only report of Hawaiians on Maunakea prior to the 1870s Boundary Commission accounts is Kamakau’s reference to Ka‘ahumanu’s 1828 visit “to Hawaii to fulfill a vow that she had made to attempt the recovery of the bones of Lilinoe on Mauna Kea…” (Kamakau 1992:285). It is unclear whether Ka‘ahumanu or her retainers actually ascended the mountain but: “It is said Ka‘ahumanu did not find the bones of Lilinoe….” (Kamakau 1992:285).

McEldowney relates western visitors’ accounts of Hawaiians acquiring birds, hardwoods, fine-grained basalt, sandalwood and wild cattle in this region (McEldowney 1982:A-8, A-9). The first specific Hawaiian account of activities on the mountain discussed in the McEldowney study is in the Boundary Commission Testimony of a certain Haiki who asserts: “my parents told me Humuula went to Kaluakaakoi and Poliahu. We used to go there after adzes for Humuula people” (McEldowney 1982:A-10). As McEldowney notes: “Haiki’s overall testimony and placement of the boundary was rejected by the commission” (McEldowney 1982:A-10).

Similar to her study of legends, myths and early accounts of land use, McEldowney’s accounts of place names also emphasizes the dearth of information, the lack of specificity of that information, and the suspicious nature of the paucity of early data. McEldowney points out that guides and informants were often familiar with land features but traveled from landmark to landmark rather than on trails. She notes that access to the mountain in the second half of the 1800s appeared to utilize ranching establishments (Humuula Sheep Station, Umikoa Ranch) and

may not have related to pre-Contact approaches (McEldowney 1982). Many Hawaiian place names were noted to be modern.

4.7.2 Kanahele and Kanahele 1997

Kanahele and Kanahele are native cultural practitioners and authorities on Native Hawaiian customs, beliefs, and practices (Maly 1999:D-18). The cultural assessment was conducted for the proposed realignment of the Saddle Road (Hwy 200). The study discussed the broader cultural impacts addressing the cultural and natural landscape from the summit of Maunakea down to the ocean. This is evident in their following conclusions:

> The native Hawaiian was a creature of the land and his environment was his environment was his life line. He recognized and practice respect for hierarchy of *hiapo* for man and land alike. The mountain is sacred because it the sacred child of Wākea. It is also the nourishment source for our land. The mountains and the land were genealogically connected to him through the original ancestor, Wākea and Papa. The mountains or land, water and sky were a necessary part of life cycle. (Kanahele and Kanahele 1997 as cited in May 1999:D-21)

4.7.3 Maly 1998

Maly (1998) conducted archival and historical documentary research for Maunakea from August 1996 to March 1997 for the Native Lands Institute: Research and Policy Analysis. The study "reported on Native Hawaiian traditions, history culture, practices, and beliefs; and post contact history for the summit and mountain slopes of Mauna Kea" (Maly 1998:1). Maly also mentions that he conducted "limited oral historical interviews" that were not "part of a formal study of Mauna Kea" (Maly 1998:61). Individuals that were interviewed expressed a strong attachment to Maunakea's landscape and those interviewed "feel disheartened about the highly visible presence and impact of the telescopes and development on the summit" (Maly 1998:61).

4.7.4 Langlas et al. 1999

Langlas conducted and archaeological inventory as well as cultural assessment for the proposed realignment of the Saddle Road (Hwy 200). As part of the cultural assessment, Langlas interviewed several area present and past residents. Information acquired in the interviews provided details on both pre- and post-Contact land uses, including trails, adze manufacture, bird catching, cattle hunting, and ritual sites.

4.7.5 Maly 1999

In 1999 Maly prepared an oral history and consultation study with archival literature research for an update of the Mauna Kea Science Reserve and Hale Pōhaku Complex development plan for Group 70 International. Since the author had previously researched and reported on the same Maunakea summit area from August 1996 to May 1998, this study "focused on oral history interviews, limited archival research, and development of an overview of several recent studies which provide important historical documentation of Mauna Kea" (Maly 1999:iii). During the study, 22 individuals were interviewed. Maly also spoke to over 100 people in the course of the study. The general consensus was that the construction of additional observatories was

“inappropriate due to their deep respect for Mauna Kea”; two of the individuals hesitated to support additional development; and one individual stated the observatories “provided important knowledge to mankind” and the benefits outweighed the concerns (Maly 1999:25). The basis of the concerns is related to the “cultural attachment” of Native Hawaiians to Mauna Kea. Maly explains that cultural attachment:

> …embodies the tangible and intangible values of a culture. It is how a people identify with and personify the environment (both natural and manmade) around them. Cultural attachment is demonstrated in the intimate relationship (developed over generations of experiences) that people of a particular culture share with their landscape – for example, the geographic features, natural phenomena and resources, and traditional sites etc., that make up their surroundings. This attachment to environment bears direct relationship to beliefs, practices, cultural evolution, and identity of a people. In Hawai‘i, cultural attachment is manifest in the very core of Hawaiian spirituality and attachment to landscape, the creative forces of nature which gave birth to the islands (e.g., Hawai‘i), mountains (e.g., Mauna Kea) and all forms of nature, also gave birth to *na kanaka* (the people), thus in Hawaiian tradition, island and mankind share the same genealogy. (Maly 1999:27)

4.7.6 PHRI 1999

In 1999, Paul H. Rosendahl, Ph.D., Inc. (PHRI) prepared a Cultural Impact Assessment study for the University of Hawai‘i Mauna Kea Science Reserve Master Plan Project Area. The basis of the study was “the oral history and consultation study carried out by Cultural Resources Specialist Kepā Maly” [Maly’s 1999 study – see above] (PHRI 1999:ii). The document notes that a good faith effort was made to “identify the full range of Native Hawaiian cultural practices, features, and beliefs” associated specifically with the Science Reserve project area. PHRI recommended that “a comprehensive plan for both the short-term and long-term management of the Science Reserve Master Plan project area is vital for the protection and preservation of significant traditional cultural resources.”

Three places that have been identified by SHPD as traditional cultural properties and documented in the PHRI study are: 1) Kūkahau‘ula, the summit (Site 21438), 2) Līlīnoe (Site 21439), and 3) Lake Waiau (Site 21440). Other traditional places that may qualify include: 1) Pu‘u Poli‘ahu, 2) Pu‘u Mākanaka and Kaupō, 3) Kūka‘iau-‘Umiko Trail, and 4) Mauna Kea-Humu‘ula Trail (see Figure 6).

4.7.7 Maly and Maly (2005)

Maly and Maly (2005) prepared a study for the Office of Mauna Kea Management (OMKM) that:

> compiled a detailed collection of archival-historical records, and conducted oral history interview with *kūpuna* and elder *kama‘āina*, pertaining to the *ahupua‘a* (native land divisions) of Ka‘ohe, Humu‘ula and neighboring *‘āina mauna* (mountain lands) of Mauna Kea, on the island of Hawai‘i. (Maly and Maly 2005:v).

The document includes research and interviews that Maly and Maly have been conducting since 1996. Additional research, including translations of Hawaiian documents and oral history interviews were conducted for the study. Compiling historic documentation of the traditions and history of Mauna Kea into a single document was one of the study's primary goals (Maly and Maly 2005:v). The study's Executive Summary appears in Appendix B of this document.

In addition to the interviews, the study cited numerous sources among which are included native accounts translated from Hawaiian language sources, Kingdom and government records, post-Contact visitors' journals, ranching and lease records and narratives from the many scientific expeditions.

The study looked at not solely the summit of Maunakea but adapted a broader perspective encompassing the *ahupua‘a* of Ka‘ohe, Humu‘ula and neighboring *‘āina mauna* (mountain lands) as well and acknowledging Maunakea as a sacred landscape (Figure 16 and Figure 17).

As Maly and Maly point out, an additional purpose of this study was to address the native lore associated with traditional knowledge of the heavens. Some of their conclusions in this regard are that:

> as is the case in all areas of Hawaiian life, the traditions, customs and practices associated with the *‘oihana kilokilo* (astronomy) and *kilo hōkū* (observing and discerning the nature of the stars) were deeply tied to the spiritual beliefs of the Hawaiian people. The stars are physical manifestations of the gods who created the heavens, earth, and humankind, or are body-forms granted to select individuals or beings of nature (Maly and Maly 2005:vi)

Based upon their research, Maly and Maly were able to document 270 Hawaiian names for stars.

The study also discusses the land uses of Maunakea and the traditional knowledge and practices associated with it, including such places and activities as: Maunakea, Pu‘u o Kūkahau‘ula, Waiau, Pu‘u Poli‘ahu and Pu‘u Līlīnoe, heiau and *ahu*, trails, resource collection sites, shelters, water collection, and bird hunting.

4.8 Summary Observations

The majority of the cultural studies previously conducted regarding Maunakea are based upon archival and historical research. Maly's 1999 study was the first study to conduct more intensive consultation with community members. The interviews from Maly (1999), and the other studies in which interviews were conducted, particularly Langlas et al. 1999 and Maly and Maly 2005, presented several themes common throughout all of the studies. These themes address both cultural observations as well as development concerns.

Overall Cultural Themes:

- Maunakea is the most sacred place, for some, too sacred to even talk about
- Spirituality and healing qualities are attributed to being on Maunakea; still visited in present times for prayer and restoration

- The landscape of Maunakea is a “significant facet” of a Hawaiian’s identity (Group 70 International 2000:V-13)
- Maunakea holds significance for community members as individuals and as Hawaiians
- “In both its genealogical associations and its physical presence on the island landscape, Mauna Kea is a source of awe and inspiration for the Hawaiian people. In Hawaiian practice elders are revered – they are the connection to one’s past – and they are looked to for spiritual guidance. Because of its place in the Hawaiian genealogies, Mauna Kea, the landscape itself is a sacred ancestor.” (Maly 1999:D-25)
- Burial sites are present in the upper heights of Maunakea (between 7,000 ft and 12,000 ft elevation)
- Maunakea is still actively utilized for cultural practices including the gathering of resources, prayer, and the releasing of cremated human remains

Thematic Development Concerns/Recommendations:

- No further development of observatories on Maunakea
- No further development of Maunakea
- Reservations regarding development do not completely eliminate further development if concerns can be satisfactorily addressed
- Protection of landscape, including view planes is a major concern; the high visibility of the observatories and their impact on the landscape is not favorable
- Effect on the rest of Hawai‘i must be considered when addressing development on Maunakea; in traditional Hawaiian context, Maunakea is Hawai‘i, not just the summit
- Must facilitate access to and use of traditional sites and resources for those continuing their cultural practices on Maunakea; cultural practitioners and community members with ties to Maunakea should be consulted
- Sites of existing or obsolete observatories should be recycled for use in further development
- State of Hawai‘i – University of Hawai‘i should be grateful for their use of Maunakea’s resources and use them wisely

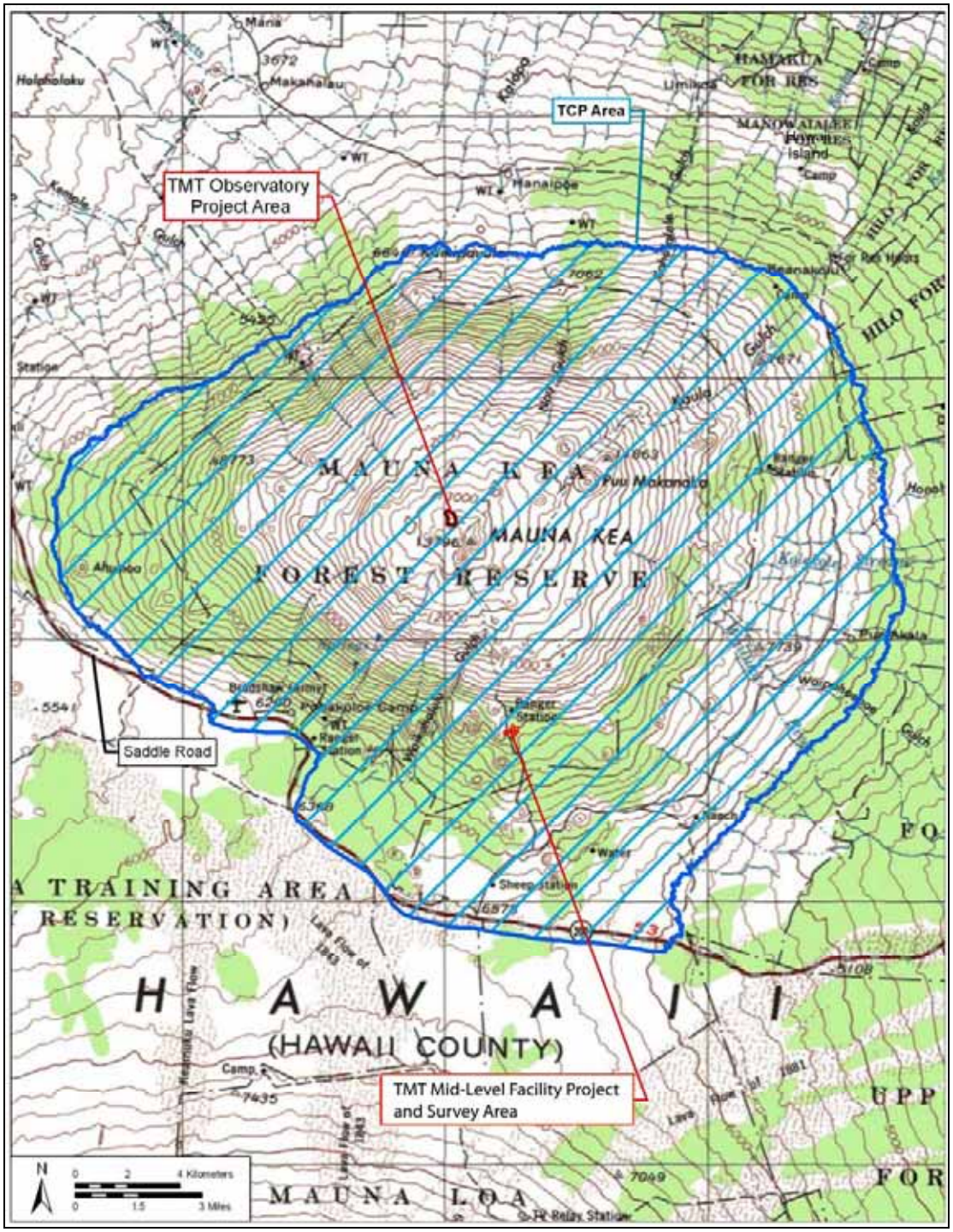

Figure 16. Map showing the proposed Traditional Cultural Property boundaries at the Maunakea summit region down to the 6,000 foot elevation contour based on Maly (1999)

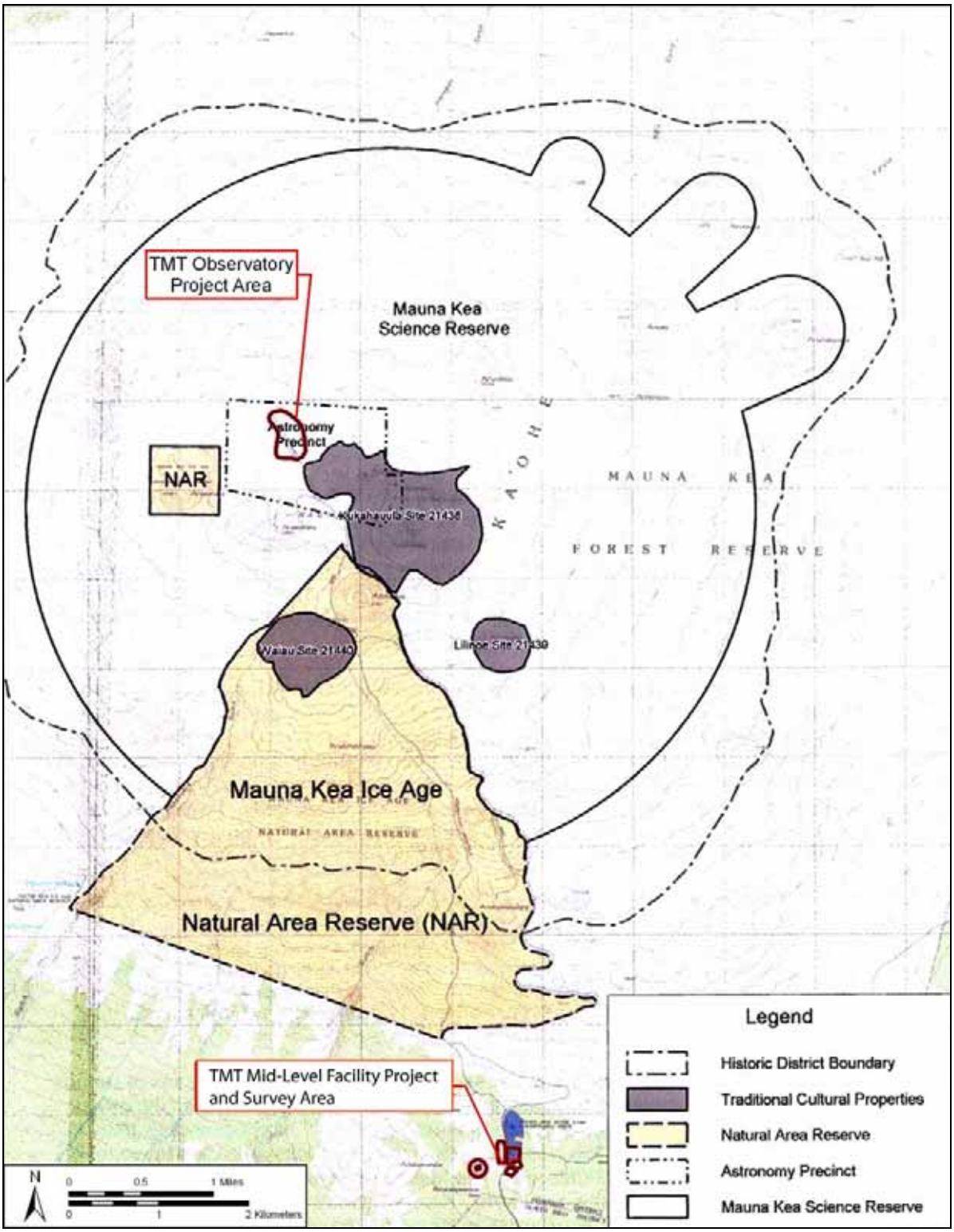

Figure 17. Map showing the three SHPD designated TCPs in the Maunakea summit region (adapted from McCoy et al. 2008:2-25)

Section 5 Archaeological Research

5.1 Overview

This section reviews relevant previous archaeological research in the Maunakea summit region. The single most outstanding aspect of the archaeological record around the Project area is the high number of shrines to the virtual exclusion of all other types of sites. At least 79 shrine sites (three that are also lithic workshops) have been documented in the summit region, comprising approximately 83% of known sites in the region. Shrines typically consist of one or more large basalt slabs turned upright and arranged in different formations (Figure 18), sometimes associated with other foundation stones or rock piles (i.e., “cairns”). Several burials or possible burials have been documented in the summit region. A few stone markers and sites of unknown function have also been documented. Overall, the very high proportion of shrines near the summit is noteworthy and unique in comparison to most other places on Hawai‘i Island.

Numerous historic properties have been previously documented in the Maunakea summit region (Figure 19). There are also a large number of remains present that do not qualify as historic properties (Figure 20). These remains are referred to as “find spots” and are either clearly modern or their age and function is unable to be determined (McCoy et al. 2008:2-1).

Five archaeological sites—all shrines—have been documented within approximately 1,000 feet of the TMT Observatory Project area: three of these (16171, 16172 and 21200) consist of single uprights; Site 16172, the closest site to the TMT Observatory Project area, is approximately 250 feet north of the northern boundary of the Project area. The other two sites are a pair of cairns with several uprights (16170) and a pair of uprights (16169). As discussed above (Section 3.9), several trails pass through the summit region; the closest to the Project area is about 1.5 miles to the west and south (see Figure 6).

Several historic properties have also been identified in the area surrounding the Hale Pōhaku Project area (Figure 21). These sites include primarily stone tool workshop locations and shrines.

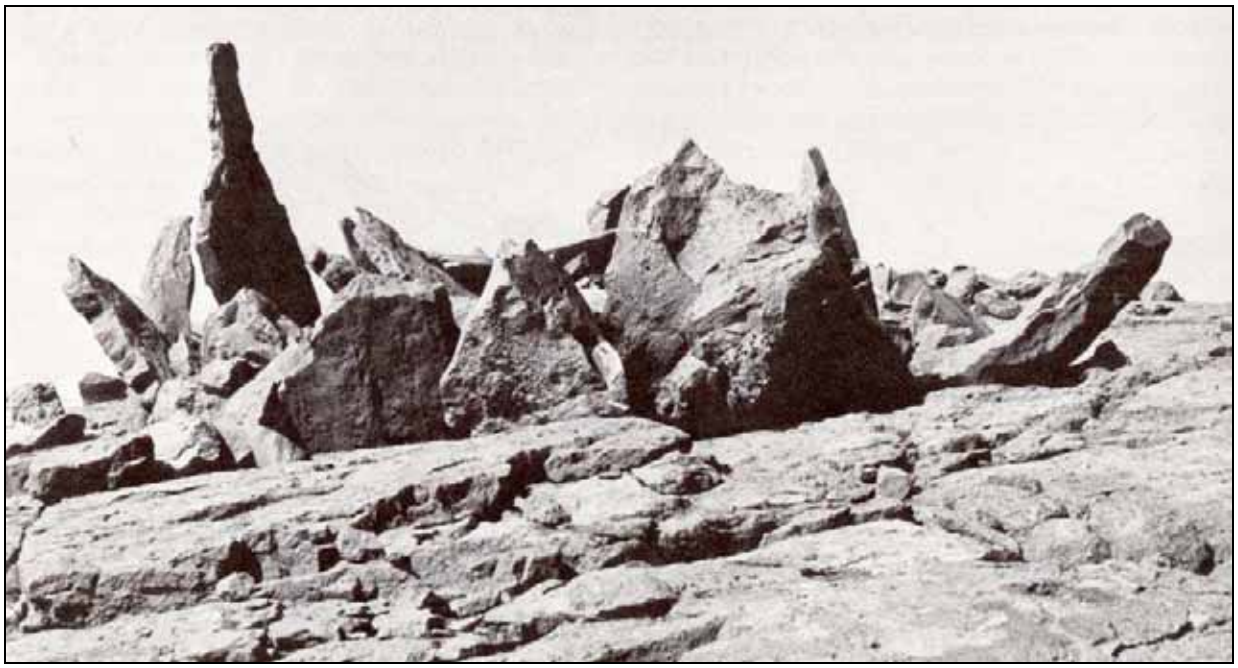

Figure 18. Traditional Hawaiian religious shrine at the Mauna Kea Adze Quarry (source: Kirch 1985)

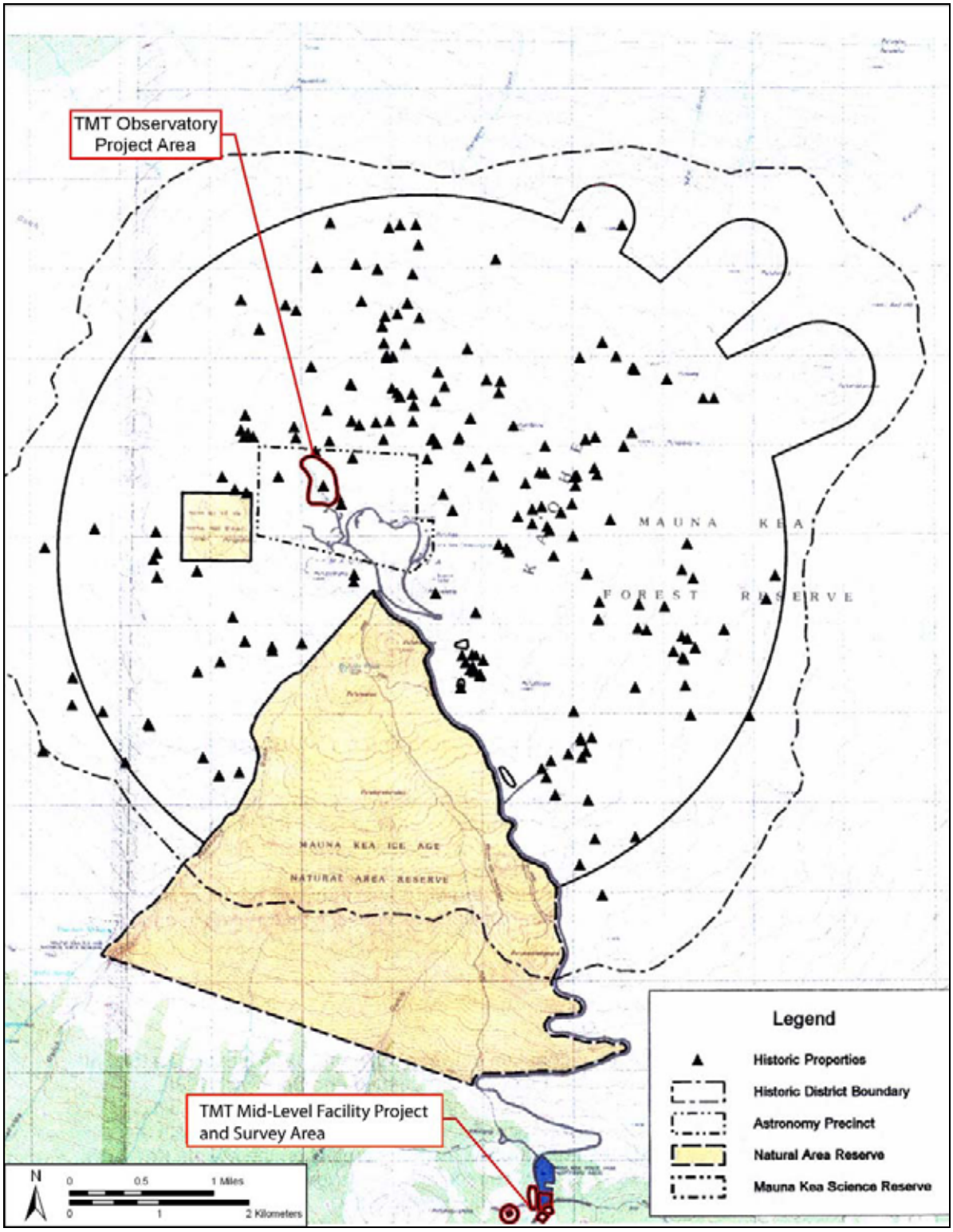

Figure 19. Map showing historic properties in the Maunakea summit region (adapted from McCoy et al. 2008:2-16)

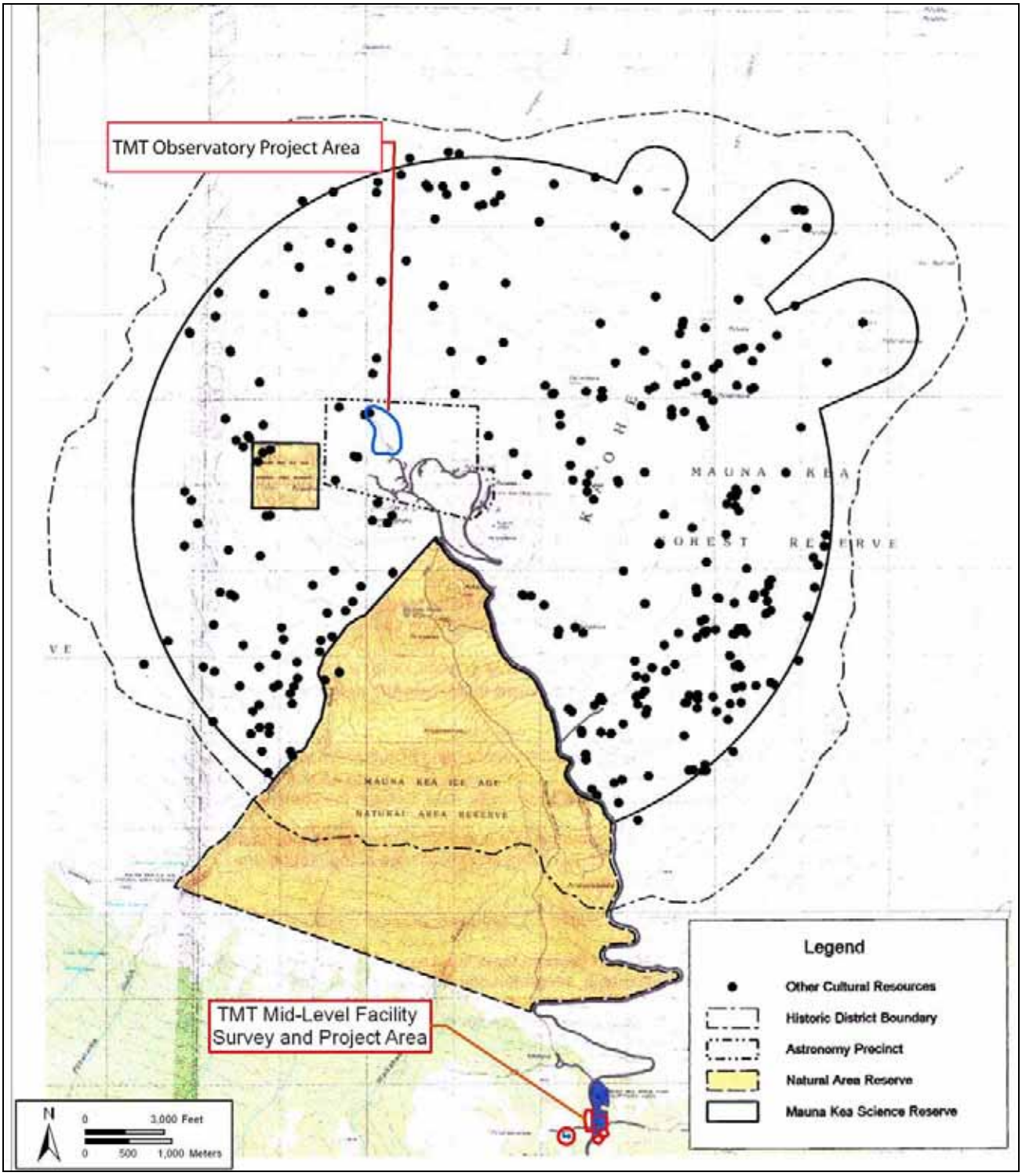

Figure 20. Map showing find spots in the Maunakea summit region (adapted from McCoy et al. 2008:2-33)

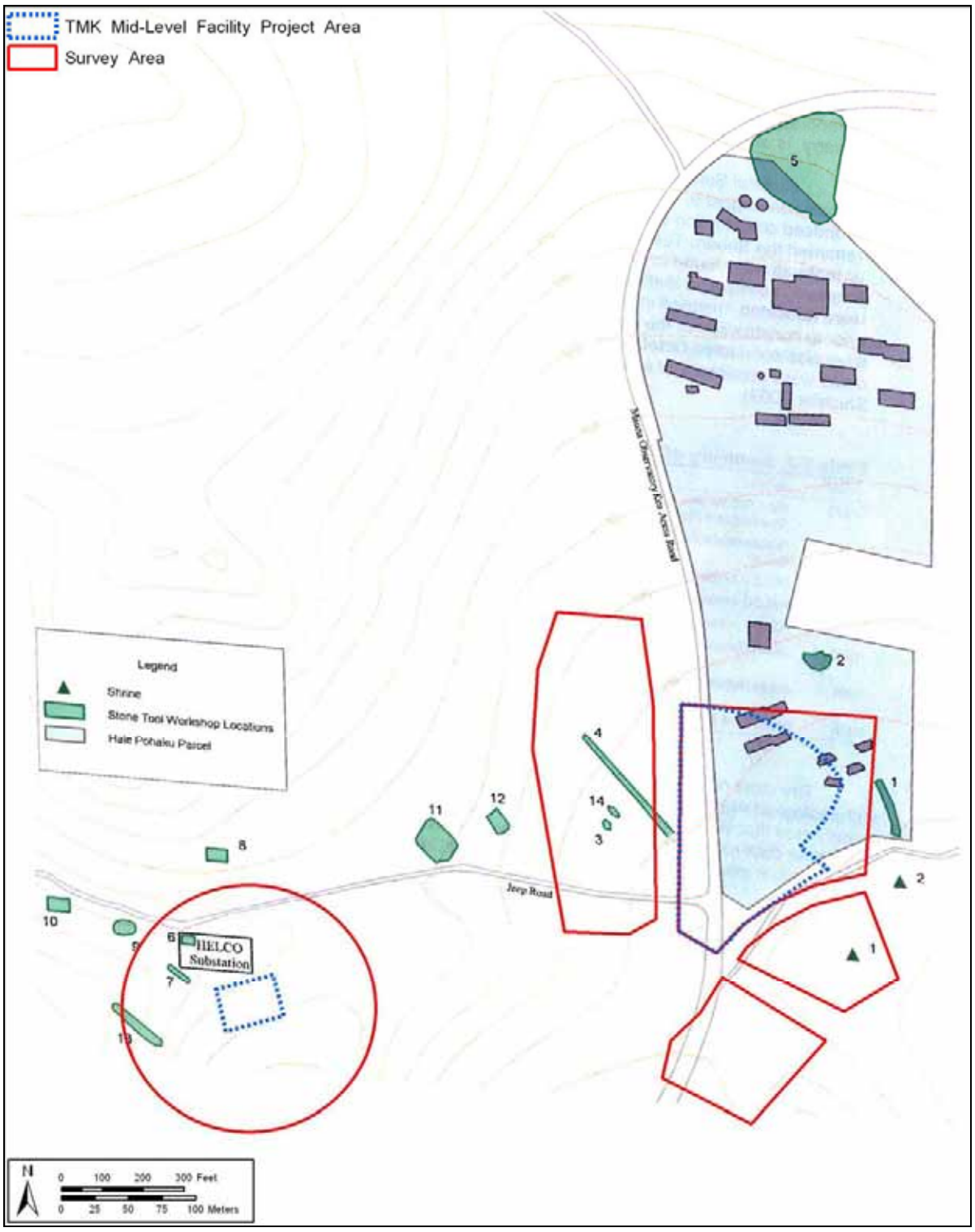

Figure 21. Map showing historic properties near the TMT Mid-Level Facility Project area (adapted from McCoy et al. 2008:2-21)

5.2 Early Observations

Early documentation of archaeological sites in the upper reaches of Maunakea was somewhat anecdotal and ad hoc. McEldowney's (1982:A-11) summary of the ethnographic background of the Maunakea summit region notes:

> Although most accounts speak in general terms, those that specifically locate the presence of human bones, "graves," "burial caves" or mortuary features indicate that burials are "not uncommon" between 7,800 ft and 13,000 ft elevation along the northern and eastern slopes of Mauna Kea (Alexander 1892; Preston 1895:601; Gregory 1921; Aitken 1935:48; Gregory and Wentworth 1937:1720; Kilmartin 1974:15; Bryan 1927:106; Hamakua Site Records, Dept. Anthro, B.P. Bishop Mus.).

On the first recorded ascent of Maunakea in 1823, Rev. Goodrich (see Section 4.2) noted the presence of a pile of stones which he assumed had been constructed by Hawaiians. Goodrich's time on the mountain, however, was extremely brief and his observations about archaeological matters, at least, were quite cursory.

William D. Alexander described a trip up Maunakea with a surveying party, and observed:

> That same afternoon [July 25, 1892] the surveyors occupied the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills [the "summit"] and a little over 13,000 feet in elevation. Here, as at other places on the plateau, ancient graves are to be found. In olden times it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial. (cited in McCoy 1999)

McCoy discusses a visit in 1975 to the summit of Līlīnoe in which he described two adjacent cairns on the eastern rim and comments that: "If the cairns that were recorded in 1975 were in fact the same graves [as described by William D. Alexander in 1892] the remains had been removed sometime prior because no human bone was visible at that time" (McCoy 1999:27). It is also possible that Alexander was in error in his assessment of the function of the cairns.

Jerome Kilmartin (1974) published a brief reminiscence reflecting on his involvement in a 1925 United States Geological Survey project to map the Lake Waiau topographic quadrangle. That 1925 work put him in the summit region for more than five months in 1925. He did not return again until 1971. Kilmartin's 1925 U.S. Geological Survey work was facilitated by the Umikoa Ranch based at approximately 3,500 foot elevation above Kūka‘iau in Hāmākua. The team established a base camp at Pu‘u Kihe (7,821 feet elevation), where water and forage were available, and a summit camp (Camp 3) of four tents at Lake Waiau.

Kilmartin reported little archaeological detail, but did note that at Pu‘u Mākanaka (elevation 12,414 feet):

> On the rim I found a partially uncovered grave, eroded by high winds, with an incomplete human skeleton. This was unknown as far as I could discover, to anyone familiar with the area. The name Pu‘u Mākanaka means "Hill crowded with many people" and the grave must have been ancient. (Kilmartin 1974:15)

He also notes:

> Ancient stone piles, quarries, walls, platforms, and burial caves are sufficient evidence that early Hawaiians were familiar with Mauna Kea's highlands. Stone chips from adze manufacture are found near a cave at 12,360 feet. …(Kilmartin 1974:13)

It may also be noted in passing that the U.S. Geological Survey party created archaeological sites of their own (and perhaps many):

> …the wind was so strong I thought surely we would be blown away. However the *ahu* (stone pile) that we built did give a little protection after I had made a setup with the plane table only two feet above the ground. (Kilmartin 1974:15)

Kenneth Pike Emory was the first person to have described the distinctive shrine features of Maunakea in a brief, popular piece published in *Paradise of the Pacific* magazine (April 1938). Emory was struck by the "immense quantity of chipped stone" and posited that the piles of debitage were "the largest so far recorded anywhere in the world." He concluded that the evidence of "chips and rejects" was the result of skilled adze makers and that "they were able to create a stone-tool industry on a scale unequaled in the stone-age because of the superior social organization of the Hawaiian people." Emory noted similarities of the shrines to a shrine on Maunaloa photographed by the geologist Dr. T. A. Jaggar in 1919 and also to the shrines of Necker Island. Emory posited that in the shrines "each upright stone stood for a separate god" and referred to them as "*'eho*" ("a collection of stone gods")—a term used in the Tuamotus as well as Hawaii to designate an alignment of upright stones.

Wentworth and Powers (1943) carried out geological studies on Maunakea in 1939 that noted archaeological sites in the Hopukani and Liloe Springs area. They noted stone walls that they interpreted as a trap to impound wild cattle that frequented the springs and certain older sites:

> In the area to the east and up the slope from the springs are numerous small heaps of pre-European stone adz workings. Certain lava caves contain evidence of habitation, suggesting that the springs were frequented by adz workers. The latter not only secured adz material from lava flows in places but carried on a surprising amount of casual prospecting on dense basalt boulders included in the moraines and outwash strewn several thousand feet down the mountain. (Wentworth and Powers 1943:544)

Two tables are provided below detailing both previous archaeological studies of the summit region (Table 4) and documented archaeological sites within the summit region prior to the on-going McCoy and Nees study (Table 5).

Table 4. Archaeological Studies in the Maunakea Summit Area

Reference	Nature of Study	Area of Study	Comments
McCoy 1976	“The Mauna Kea Quarry Project: A First Analysis”	Mauna Kea Adze Quarry Complex	--
McCoy 1977a	“Archaeological Investigations at the, Hawaii: Preliminary Results of the 1975-76 Fieldwork”	Mauna Kea Adze Quarry Complex	--
McCoy 1977b	“A Summary of the 1975 Field Investigations”	Mauna Kea Adze Quarry Complex	--
McCoy 1978	Account of the “The B.P. Bishop Museum Mauna Kea Adz Quarry Project.”	Mauna Kea Adze Quarry Complex	--
McCoy 1979	Reconnaissance survey	Hale Pōhaku	--
Allen 1981	Adze quarry analysis thesis	Mauna Kea Adze Quarry Complex	--
McCoy 1981	“Stones For the Gods: Ritualism in the Mauna Kea Adz Quarry Industry, Hawaii.”	Mauna Kea Adze Quarry Complex	--
Cleghorn 1982	University of Hawai‘i Ph.D. dissertation in Anthropology on Mauna Kea Adze Quarry lithics	Mauna Kea Adze Quarry complex in the vicinity of Pu‘u Ko‘oko‘olau	Focuses on technological analysis and experimental tests. Some 534 archaeological site components of 38 designated sites are briefly summarized.
McCoy 1982	Reconnaissance survey	~1,000 acres of the summit and north slope (down to 13,000 ft. elevation)	Documents 22 sites including an open air shelter and 21 shrine sites.
Kam and Ota 1983	Reconnaissance survey	Mauna Kea Observatory Power Line	--
McCoy 1984a	Summary of the 1984 fieldwork	Mauna Kea Summit Region	--
McCoy 1984b	Archaeological reconnaissance	Hopukani, Waihu & Liloe Springs area, west side of Pōhakuloa Gulch between 8,640 and 10,400 ft. elevation	Documents six archaeological sites and a number of find spots (More thorough coverage is presented in McCoy 1986).
McCoy 1985	Reconnaissance survey	~40 acres extending on both sides of the Mauna Kea Observatory Access Way between 9,080 and 9,400 ft. elevation	Preliminary report for Pu‘u Kalepeamoa Site documenting five lithic scatters and two shrines used for the manufacture of hammerstones and octopus lure sinkers. Ritual was an integral part of the manufacturing process

Reference	Nature of Study	Area of Study	Comments
Bonk 1986	Reconnaissance survey	HELCO transmission line and substation	--
McCoy 1986	Report on archaeological investigations	Hopukani and Liloe Springs area located on the west side of Pōhakuloa Gulch well southwest of the Mauna Kea summit region	Documents three sites initially discussed in McCoy (1984). Eight radiocarbon dates indicated use from A.D. 1000-1800; camps used for acclimatization and for procuring water, food (primarily birds) and fuel.
Sinoto 1987	Reconnaissance survey	HELCO transmission line and substation	--
Williams 1987	Reconnaissance survey	Mauna Kea Access Way	--
Hammatt and Borthwick 1988	Reconnaissance survey	Two locations: ~15-acre area between 11,560 & 11,840 ft. elevation, west side of present summit road; ~100-acre area, east side of summit road in a saddle between two cinder cones at 12,100-12,225 ft. elevation	4 sites: Sites 11,076 & 11,077 are probable pre-Contact shrines; Site 11,078 is a probable pre-Contact overhang shelter; Site 11,079 included a probable pre-Contact shrine and a probable pre-Contact *ahu* or cairn with basalt flakes and an adze preform.
Williams 1989	Inventory survey	Mauna Kea Adze Quarry Complex	--
Borthwick and Hammatt 1990	Reconnaissance survey	Two locations (total 2 acres) on summit of Mauna Kea.	No finds – the areas had been “fully graded” for existing telescope facilities.
McCoy 1990	Lithic analysis	Mauna Kea Adz Quarry Complex	--
Robins and Hammatt 1990	Reconnaissance survey	Two locations: 5.1-acre area on Pu‘u Hau Oki cinder cone at summit and a 21-acre lot near Hale Pōhaku	No finds at JNLT summit project area which had been largely graded. In Hale Pōhaku area, three lithic scatters described in McCoy (1985) are discussed.
McCoy 1991	Survey and Test Excavations report	Pu‘u Kalepeamoa Site	--
Borthwick and Hammatt 1993	Reconnaissance survey	Proposed Gemini Telescope location at ~13,700 ft. elevation on a ridge line north of the summit cone	The entire summit ridge on which the Project area was located had been graded for existing telescope facilities. No finds.
McCoy 1999	Analysis of a site complex (Site 50-10-23-16204) that he had described 24 years earlier	East side of Mauna Kea Access Way between 12,240-12,300 ft. elevation just south of Pu‘u Līlīnoe	McCoy posits a ritual significance to the site specifically as a location for a rite of passage.
Hammatt and Shideler 2002	Data Recovery report for two lithic scatters	Sites 50-10-23-10,310 and -10,311 located in the Hale Pōhaku area between 9,080 and 9,160 ft. elevation	Documentation of data recovery of sites identified in McCoy (1985) and Robins and Hammatt (1990). Two radiocarbon dates (A.D. 1260-1410 and A.D. 1510-1950 at 95% probability) were both were thought to be problematic. Possible ritual associations with healing and the deity Kanaloa are explored.

Reference	Nature of Study	Area of Study	Comments
McCoy 2005	Monitoring	Septic tank excavations	--
McCoy et al. 2005	Inventory survey	Mauna Kea Science Reserve	--
McCoy and Nees 2006	Inventory survey	Mauna Kea Science Reserve	--
Hammatt 2009a	Archaeological Assessment	Proposed Thirty-Meter-Telescope Observatory (TMT) Project on the northern plateau of the Mauna Kea summit area, within Area E of the Astronomy Precinct of the Mauna Kea Science Reserve	No findings
Hammatt 2009b	Archaeological Assessment	TMT Mid-Level Facility area at approximately 2,800 m (9,200 ft.) elevation on the southern slope of Mauna Kea	No findings
McCoy and Nees (in progress)	Inventory survey	Mauna Kea summit region	In progress

Table 5. Documented Archaeological Sites in the Summit Region

SIHP #	Elevation	Description	Function
11077	12320	Single upright	Shrine
11079	12313	Lithic scatter of adze manufacturing byproducts and 2 associated cairns	"Workshop" and possible shrine
16163	12880	Platform/pavement with 14 uprights	Shrine
16164	13397	3 to 5 uprights on platform and 1 isolated upright	Shrine
16165	13362	Single row of 2 uprights	Shrine
16166	13422	2 rows of uprights, 8 to possibly 9 total	Shrine
16167	13395	Single row of 2 uprights	Shrine
16168	13098	Semi-enclosure with 21 to possibly 25 uprights	Shrine
16169	13210	Single row of 2 uprights	Shrine
16170	13139	2 cairns with 3 to possibly 4 uprights	Shrine
16171	13087	Single upright	Shrine
16172	13218	Single upright	Shrine
16173	13009	7 dispersed uprights	Shrine
16174	13075	Boulder with 1 to possibly 8 uprights on the side	Shrine
16175	NA	5 cairns with 1 upright each	Shrine
16176	13078	Single row of 3 uprights	Shrine

SIHP #	Elevation	Description	Function
16177	13118	Single row of 3 uprights	Shrine
16178	13236	Single upright	Shrine
16179	13122	Single row of 3 uprights	Shrine
16180	13086	Boulder with 3 uprights	Shrine
16181	13401	Single upright	Shrine
16182	13155	3 to 5 uprights	Shrine
16184	13072	Semi-enclosure with 24 uprights	Shrine
16185	13008	Single row of 3 uprights	Shrine
16186	13076	Single row of 2 and possibly 3 uprights	Shrine
16187	12775	Single row of 9 uprights	Shrine
16188	12857	Single upright	Shrine
16189	12902	Single row of 3 and possibly 4 uprights	Shrine
16190	12956	Single row of 10 and off-set uprights	Shrine
16191	12889	Single row of 4 uprights	Shrine
16192	12842	2 sets of uprights, 6 total	Shrine
16193	12843	Single upright	Shrine
16194	12673	Single row of 12 - 14 uprights	Shrine
16195	NA	2 cairns	Possible burial
16196	12953	Single row of 2 uprights	Shrine
16197	12953	Single upright	Shrine
16198	12930	2-tiered platform with 7 uprights	Shrine
16199	12991	1 and possibly 4 uprights	Shrine
16200	12975	Single row of 5 and possibly 6 uprights	Shrine
16201	12990	Single row of 3 uprights	Shrine
16202	13006	Single upright	Shrine
16203	13145	Single row of 2 and possibly 3 uprights and a lithic scatter of adze manufacturing byproducts	Adze “workshop” and shrine
16204	12332	5 shrines, 26 stone-walled enclosures and a lithic scatter of adze manufacturing byproducts	Adze “workshop” and shrine complex
16248	NA	Series of cairns	Burial
18682	12955	Single row of 3 uprights	Shrine
18683	13012	Single row of 2 uprights	Shrine
21197	13052	2 platforms with a total of 5 uprights	Shrine
21198	13043	Single upright	Shrine

SIHP #	Elevation	Description	Function
21199	12876	Single upright	Shrine
21200	13165	Single upright	Shrine
21201	13087	Single row of 2 uprights	Shrine
21202	13048	Single row of 6 to possibly 7 uprights	Shrine
21203	13034	Single row of 2 uprights	Shrine
21204	12925	3 areas of stacked rock	Unknown
21205	13484	Single upright	Shrine
21206	12754	Single upright	Shrine
21207	12787	Single upright	Shrine
21208	12799	1 to 2 uprights on a boulder	Shrine
21209	NA	Cairn on summit	Unknown
21210	12233	Single upright	Shrine
21211	12275	Single row of 2 uprights on a platform and a lithic scatter of adze manufacturing byproducts	Adze “workshop” and shrine
21212	12385	Single row of 2 uprights	Shrine
21213	12249	3 piles of rocks with 1 upright	Shrine
21214	12241	Single row of 5 and possibly 7 uprights	Shrine
21406	NA	Single upright	Shrine
21407	12952	Single row of 2 uprights	Shrine
21408	12913	Single upright	Shrine
21409	12984	Single upright	Shrine
21410	12801	Single row of 5 uprights	Shrine
21411	12815	Cairn	Marker
21412	NA	Cairn	Marker
21413	NA	Cairn	Possible burial
21414	NA	Cairn	Possible burial
21415	13130	Cairn on boulder	Unknown
21416	12792	Cairn	Possible burial
21417	12974	Cairn	Unknown
21418	12889	3 and possibly 4 uprights on top and to the side of a boulder	Shrine
21419	12495	Single upright	Shrine
21420	12152	Enclosure with 11 and possibly 12 uprights and a nearby stone platform	Shrine
21421	12731	2 cairns, one with a possible upright and an isolated upright	Shrine

SIHP #	Elevation	Description	Function
21422	12847	Single upright	Shrine
21423	NA	Stones on boulder	Marker
21424	12320	4 to 5 uprights on a platform and boulder	Shrine
21425	12523	Single upright	Shrine
21426	12568	Single row of 4 uprights	Shrine
21427	12635	Terrace with possible upright	Unknown
21428	12720	Single upright	Shrine
21429	12719	Single upright	Shrine
21430	13111	Single row of 3 uprights	Shrine
21431	12532	Semi-enclosure with 7 to 10 uprights	Shrine
21432	13044	Single row of 2 uprights	Shrine
21433	12579	Single upright	Shrine
21434	12551	8 stones on a boulder	Unknown
21435	12564	Cairn and boulder with 1 upright	Shrine

5.3 Formal Studies

This section presents additional descriptions of the most important findings of the works summarized in Table 4.

5.3.1 Cleghorn (1982)

Cleghorn (1982) produced his University of Hawai‘i Ph.D. dissertation in Anthropology on Mauna Kea Adze Quarry lithics focusing on technological analysis and experimental tests. Some 534 archaeological site components of 38 designated sites of the Mauna Kea Adze Quarry complex in the vicinity of Pu‘u Ko‘oko‘olau were briefly summarized (sites are referred to by Bishop Museum site nomenclature).

5.3.2 McCoy (1982)

Patrick McCoy (1982) documented reconnaissance-level surveying of approximately 1,000 acres of the summit and north slope (down to 13,000 ft). McCoy notes that:

> Few, if any, archaeological sites were predicted to occur within the boundaries of the Project area, given the high altitude location and presumed absence of exploitable resources, including adze-quality stone, which on present evidence is restricted to the south slope of the mountain. (McCoy 1982)

Thus, it was far beyond expectations when 22 sites were recorded including an open-air (i.e., non-cave and non-rockshelter) shelter and 21 shrine sites. McCoy was quite familiar with the “occupational shrines” near the adze quarries but concluded the function of these shrines located away from the main quarrying area was unknown. McCoy posits:

> …that these structures were erected by travelers, most probably in propitiation of mountain spirits. Such practices are universal in the high mountain regions of the world. (McCoy 1982:A-37)

McCoy does note, however, that the majority of the shrines were located in a narrow 200-foot contour interval band between 12,900-foot and 13,100-foot elevation. He theorizes that this clearly defined vertical zonation site pattern is the result of utilization of a break in slope at the edge of the summit plateau where: “when viewed from either the base of the steep inclined slope directly below, or from the base of the summit cones above, is a relatively flat horizon on which the shrine uprights are silhouetted and therefore visible from some distance” (McCoy 1982). McCoy associates these shrines with “the request for permission to pass over the summit” and notes that this indicates a preponderance of access from the northern, windward side of the islands consistent with the inclusion of the land within Hāmākua District. He further posits that the distribution of the shrines may relate to “the lower margins of snow fields” and possibly, by extension, to the goddess Poli‘ahu. McCoy notes that at least one of the more complex shrine sites, “The placement of offerings and whatever other ritual took place here appear to have been intentionally directed away from Mauna Kea. The possibility of astronomical concepts being operative is explored.” McCoy also suggests that smaller sites were built and utilized by one or a few individuals while more complex shrines were built and utilized by a larger kin group and that perhaps “each structure would represent a separate social unit that had exclusive use rights.” McCoy recommended intensive archaeological survey and avoidance of construction and related activities on or in proximity to known archaeological sites.

5.3.3 McCoy (1984)

McCoy’s (1984) archaeological reconnaissance report for the Hopukani, Waihu, and Liloe Springs area documents six archaeological sites and a number of find spots located on the west side of Pōhakuloa Gulch between 8,640 and 10,400 feet elevation. The work was associated with a Pōhakuloa Training Area (PTA) pipe line project. This preliminary report was elaborated upon in McCoy’s later (1986) study.

5.3.4 McCoy (1985)

McCoy’s (1985) preliminary report for the Pu‘u Kalepeamoa Site documents three archaeological surveys for a proposed new construction laborer camp at Hale Pōhaku located just above and below the Hawaii Institute for Astronomy’s Mid-Level Facility encompassing a total of approximately 40 acres. This project was located on both sides of the Mauna Kea Observatory Access Way between 9,080 and 9,400-foot elevation. Five lithic scatters and two shrines were recorded. These archaeological features were understood as functionally integrated components of a single activity system and one Bishop Museum site number was assigned (lithic scatters nos. 1 and 2 would subsequently be given SIHP Nos. 50-10-23-10,310 and -10,311, respectively). McCoy concluded that the primary activity at the site was the manufacture of hammerstones and octopus lure sinkers from the crystalline dunite and gabro deposits on the slopes of Pu‘u Kalepeamoa but he noted that ritual was an integral part of the manufacturing process. Further research was recommended. The lithic scatters would be subject to further documentation (Robins and Hammatt 1990) and data recovery work (Hammatt and Shideler 2002).

5.3.5 McCoy (1986)

McCoy's (1986) report on archaeological investigations for the Hopukani and Liloe Springs area documents three mid-level sites located on the west side of Pōhakuloa Gulch well southwest of the Maunakea summit region (that were initially discussed in McCoy 1984). These sites included a rock shelter at Hopukani Spring (10,400 foot elevation), the Hopukani Rockshelter (10,160 foot elevation) and an open camp site at Liloe Spring (8,921 foot elevation) Eight radiocarbon dates indicated use spanning A.D. 1000 to A.D. 1800. It was concluded that these camps were used for acclimatization and for procuring water, food (primarily birds) and fuel.

5.3.6 Hammatt and Borthwick (1988)

CSH (Hammatt and Borthwick 1988) carried out an Archaeological Reconnaissance Survey of two locations for proposed antennas for the National Radio Astronomy Observatory. An approximately 15-acre relatively level location between the 11,560 foot and 11,840 foot elevations on the southeastern slope of the summit region on the west side of the present summit road was examined but no archaeological sites were observed. Another approximately 100-acre location on the east side of the summit road in a saddle between two cinder cones at the 12,100 to 12,225 foot elevation was also examined and four archaeological sites were documented (none of which appear to have been previously recorded). Sites 11,076 and 11,077 are probable pre-Contact shrines; Site 11,078 is a probable pre-Contact overhang shelter with a stacked stone alignment; and Site 11,079 had two components: a probable pre-Contact shrine and a probable pre-Contact *ahu*, or cairn, with basalt flakes and an adze preform present. Preservation of the four sites was recommended but it was thought that the antenna project potentially would be compatible with such preservation of the four relatively small and discrete sites in the large acreage.

5.3.7 Borthwick and Hammatt (1990)

In 1990, CSH carried out an Archaeological Reconnaissance Survey of two locations for the proposed Galileo Telescope on the summit of Maunakea. The study was of an approximately 2-acre portion of the summit ridge that (at that time) included the UKRT, U.H. 2.2 m, U.H. 24-inch telescopes and Medical Support facilities. The study notes that previous work (McCoy 1982) had identified no sites in the summit region (above circa 13,330 foot elevation). Borthwick and Hammatt (1990) note that the entire summit ridge on which the project areas were located had been "fully graded" for existing telescope facilities and no archaeological features were observed; no further work was recommended.

5.3.8 Robins and Hammatt (1990)

CSH carried out another Archaeological Reconnaissance Survey in 1990 for the Japan National Large Telescope (JNLT) project at both the summit and the Hale Pōhaku area. The actual JNLT summit construction area was an approximately 5.1-acre area on Pu‘u Hauoki cinder cone in the northern portion of the Mauna Kea Science Reserve approximately 61 m (200 feet) west of the existing W. M. Keck Observatory and 304 m (800 feet) north of a paved "spur road" passing by the Submillimeter Telescope (CSO). The JNLT summit project area had been largely graded although certain undisturbed outcrop formations were present. No archaeological features were identified within the JNLT summit project area.

The Robins and Hammatt (1990) study also included several areas near the TMT Mid-Level Facility Complex (OCIA) including a small dormitory construction area located approximately 134 m (440 feet) east of the Mauna Kea Observatory Access Way at 9,245 foot elevation (where no sites were observed). An approximately 21-acre lot surrounding the dormitory delineated on the west and north side by the Mauna Kea Observatory Access Way and to the south by an existing jeep road was also included in the study. Two archaeological features were newly described and three previously identified sites were recorded in the approximately 21-acre lot. The two newly-described features included a small oval enclosure and a roughly square enclosure that were both thought to be relatively recent constructions (no formal SIHP site numbers were assigned). The three previously-recorded (McCoy 1985) sites included three lithic scatters (lithic scatters nos. 1, 2 and 5) that McCoy had understood as being functionally-integrated components of a single site. Further work at the lithic scatters was recommended. CSH completed a later Data Recovery report (Hammatt and Shideler 2002) for lithic scatters nos. 1 and 2.

5.3.9 Borthwick and Hammatt (1993)

In 1993 CSH carried out an Archaeological Reconnaissance Survey for the proposed Gemini Telescope location at approximately 13,700 foot elevation on a ridge line north of the summit cone. The study notes that previous work (McCoy 1982) had identified no sites in the summit region above circa 13,330 foot elevation. The study notes that the entire summit ridge on which the project area was located had been graded for existing telescope facilities and no archaeological features were observed; no further work was recommended.

5.3.10 McCoy (1999)

McCoy (1999) wrote up an analysis of a site complex (SIHP No. 50-10-23-16204), that he had described 24 years earlier, located on the east side of the Mauna Kea Access Way between 12,240 and 12,300 foot elevation just south of Pu‘u Līlīnoe. The site included five shrines and three enclosure complexes. The complex was notably located 500 m from the nearest known source of worked raw lithic material and was perceived as “isolated.” McCoy noted that when viewed in terms of the natural environment and human productivity, “the location of this site appears to be irrational” (1999:14). Of particular interest were some 26 very small open-air enclosures (typical interior area approximately 1.6 m^2). This led McCoy to posit a ritual significance to the site, specifically as a location for rites of passage.

McCoy goes on to consider the form of the upright slabs of (typically unworked) basalt that were arranged into the many shrines of Maunakea and Site 16204, in particular. McCoy posits that pointed uprights symbolize gods and that flat-topped slabs symbolize goddesses (McCoy assumes that the Hawaiian goddesses Līlīnoe and Poli‘ahu were worshipped). Determining the affinities of the slabs is complicated by the presence of other forms (“angled,” “gabled,” “rounded” and “notched”) and the general difficulty of determining whether a particular stone was an upright at all.

McCoy argues that evidence supporting an unusual ritual function (rites of passage) includes:

- Unusual orientations of four of the five shrines,
- Lack of evidence of habitation,

- Unusual “lack of a cohesive structure” among the lithic byproducts present in the artifact assemblages – suggesting “symbolic manufacture and use,”
- The numerous (26) very small open-air enclosures that were “too small to accommodate a person and a fire hearth” of no obvious purpose and believed to relate to temporary day-time use.

McCoy concludes that the small enclosures “may symbolically represent both a womb and a grave” and that the site “was the locus of initiation rites” related to “formal initiation rites for groups of apprentices” (McCoy 1999).

5.3.11 Hammatt and Shideler (2002)

In 2002 CSH completed a Data Recovery report for two lithic scatters (SIHP Nos. 50-10-23-10,310 and -10,311) located in the Hale Pōhaku area between 9,080 and 9,160 foot elevation. These sites were first recorded by McCoy (1985:11-12) as Lithic Scatter No. 1 (SIHP No. 50-10-23-10,310) and Lithic Scatter No. 2 (SIHP No. 50-10-23-10,311) of the Pu‘u Kalepeamoa Complex. Initially, the University of Hawai‘i Institute of Astronomy planned to preserve the two lithic scatters; however, dormitory construction increased erosion in the vicinity and, in consultation with the SHPD, a data recovery program was developed. Data recovery fieldwork included mapping, surface collection and four 1 m^2 test units (two at each of the two sites). Two radiocarbon dates (A.D. 1260-1410 and A.D. 1510-1950 at 95% probability) were obtained but both were thought to be problematic. It was concluded that the sites were modest, out-lying, open, lithic workshop sites with octopus lure sinker manufacture of both “coffee-bean” and “bread-loaf” morphological types. It was concluded that the location of the sites was associated with a micro-climate of slightly greater moisture, slightly greater soil and slightly greater protection from the wind at the top of a natural drainage that favored *māmane* forest growth—which in turn provided greater protection from the elements, fuel and construction materials. It is suggested that the endeavor to produce octopus lures may have had other purposes than food procurement and the affinities with healing prayers (*pule he‘e*) dedicated to the deity Kanaloa are explored.

5.3.12 Hammatt (2009a)

CSH conducted an Archaeological Inventory Survey for the Thirty Meter Telescope Observatory Project (TMT) in 2008. No historic properties were identified within the approximately 36-acre survey area. Previously identified historic properties in the vicinity of the survey area were found and confirmed to be outside of the survey area. CSH’s effect recommendation for the proposed TMT Observatory Project is “no historic properties affected,” therefore the final report was submitted as an Archaeological Assessment.

5.3.13 Hammatt (2009b)

CSH conducted an Archaeological Inventory Survey for construction staging areas and development of housing in the Hale Pōhaku area in 2009. The project is a component of the TMT Observatory Project and involves the construction of ancillary facilities. Previously identified historic properties in the vicinity of the survey area were found and confirmed to be outside of the survey area. CSH’s effect recommendation for the proposed TMT Observatory

Project Ancillary Facilities is “no historic properties affected,” therefore the final report was submitted to SHPD as an Archaeological Assessment.

5.3.14 McCoy et al. (2009 in progress)

5.3.15 McCoy and Nees (in progress)

As the Hammatt inventory surveys (2009a, 2009b) were being prepared, CSH archaeologists interacted with Dr. Patrick McCoy at the offices of Pacific Consulting Services, Inc. and also within the Project area. This study should greatly advance our knowledge of traditional Hawaiian use of the Maunakea summit region. Though drafts of this extensive survey project are not yet available, McCoy does detail some of the findings in the *Preliminary Draft Report: Cultural Resource Management Plan for the University of Hawai‘i Management Areas on Mauna Kea, Ka‘ohe Hamakua, Island of Hawai‘i TMK (3) 4-4-012, 015* (McCoy et al 2008). As of the publishing of this draft CRMP, McCoy et al. had documented 223 sites in the Mauna Kea Science Reserve, including 93 previously documented sites. These 223 site also include 28 sites which McCoy et al. are designating as burials and possible burials (McCoy et al. 2008:2-20, 2-23).

5.3.16 Traditional Cultural Properties

The SHPD has designated three prominent localities on Maunakea as Traditional Cultural Properties (TCP) due to their cultural significance to the Hawaiian people. Several additional prominent locations in the summit region are also considered culturally significant (see Figure 6). Additionally, a large area on the mountain’s summit has been determined to be eligible for listing on the National Register of Historic Places as a historic district. Maly (Maly 1998:29) has suggested the entire Maunakea summit region down to the 6,000 foot elevation contour be designated a Traditional Cultural Property (see Figure 16).

5.4 Summary Observations

5.4.1 Burials and Possible Burials

McCoy (1999) presents a summary discussion of burials and possible burials on Maunakea noting that there are numerous traditions of burials at high elevations on Maunakea. He begins by presenting the account of Jerome Kilmartin (1974) who in 1925 personally observed human remains on Pu‘u Mākanaka. McCoy relates that in 1991 he and others observed human bones within several cairns on the southern rim of Pu‘u Mākanaka. He also notes that “several other spatially discrete groups of cairns, each comprised of two to three individual cairns, were found on the southern or eastern rim” (1999:26) [of Pu‘u Mākanaka] – suggesting that these may also contain human skeletal remains.

Pu‘u Mākanaka is the only documented place in the uplands of Maunakea in which human remains have been confirmed—although McCoy makes reference to “the well-known burial center at Kanakaleonui” and also to “a small group of cairns on the eastern rim of Pu‘u Waiau that are also believed to be burials” (McCoy 1999).

McCoy (1999:26) then goes on to discuss four “possible burial sites” (16195, 21413, 21414 and 21416). Although no human remains were observed, these were thought to be burials due to the morphological similarity of these cairns to those on Pu‘u Mākanaka and Kanakaleonui, their dissimilarity to other cairns (which are more cylindrical), and their presence on the eastern or southern rim of cinder cones.

McCoy clearly suggests that Site 16195, consisting of two adjacent cairns on the eastern rim of Pu‘u Līlīnoe (recorded by McCoy in 1975), are “possible burials” (1999:27). This conclusion is based on William D. Alexander’s 1892 account of “ancient graves” on the summit of Pu‘u Līlīnoe. McCoy comments that: “If the cairns that were recorded in 1975 were in fact the same graves [as described by William D. Alexander in 1892] the remains had been removed sometime prior because no human bone was visible at that time” (1999:27). It appears that by 1975 these features were no longer graves but may have functioned as graves previously.

McCoy (1999:27) then discusses three possible burial cairn sites (21413, 21414 and 21416) located on the southern and eastern rim of an unnamed cinder cone. This cinder cone is 12,840-foot high and located approximately 1 kilometer northwest of the Mauna Kea Ice Age Natural Area Reserve). McCoy’s discussion indicates that these may well be graves on the basis of form and location.

McCoy concludes:

> There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rockshelter or overhang. The basis of this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridgetop amongst any of the shrines. There in fact appears to be a clear separation between burial locations and shrine locations. (1999:28)

His comments have proven to be apt as current in progress work by McCoy and Nees has documented 28 sites designated as burials and possible burials (McCoy et al. 2008).

In striking contrast to the earlier archaeological data is the belief of some contemporary Hawaiians that the summit region of Maunakea is something of a burial ground (“There’s lot of *kūpuna* been buried up there…” and several similar concerns at www.mauna-a-wakea.info/maunakea/F4_burials.html). Allied with this line of thinking are rumors of burials disturbed and destroyed by prior observatory developments (“Would bulldozing cemeteries be allowed anywhere else in the world?” www.mauna-a-wakea.info/maunakea/F4_burials.html).

5.4.2 Shrines

In McCoy’s analysis of a total of 93 sites identified in the Maunakea summit area Science Reserve some 76, or 81.7%, are classified as shrines (and an additional eight shrines are components of adze manufacturing workshop sites) (McCoy 1999:3). McCoy concludes that; “The vast majority of shrines are conspicuously sighted in the landscape, either on a ridgetop, or at a break in the slope, which generally seems to correspond to either a lava flow margin or a change in the slope of a glacial moraine” (1999:6). McCoy notes that “there are no shrines in the Science Reserve located on top of a cinder cone.”

As previously noted McCoy noted an unusually high density of shrines located in a narrow 200-foot contour interval band between 12,900 and 13,100-foot elevation on the north side of Mauna Kea that he attributes to a visually preferable location (1982:A-37).

5.4.3 Adze Quarries and Manufacturing Workshops

Based upon McCoy's 1999 summary analysis of site typology, the only quarries were in the extreme southern portion of the Maunakea summit area Science Reserve (the Mauna Kea Adze Quarry; SIHP No. 50-10-23-4136). McCoy does describe four adze manufacturing workshops (11079, 16203, 16204 and 21211) defined in part by their location in areas absent of naturally occurring stone-tool quality raw material. All four of these adze manufacturing workshops are on the south face of the mountain on the east side of the main Mauna Kea Observatory Access Way.

Section 6 Community Consultation

6.1 Community Consultation Effort

An effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about Hawaiian cultural practices, resources and beliefs related to Maunakea. This effort was made by letter, e-mail, telephone, and in person. In most cases, letters with a detailed description of the proposed action and conceptual plan provided by Parsons Brinckerhoff, along with an aerial photograph and USGS map of the Project area and two figures depicting proposed TCPs: trails, sites and view corridors adapted from Maly 1999 (see Figures 6 and 16), were mailed to community contacts.

6.1.1 Community Respondents: A Note on Non-Participation

It is important to understand that community response to the proposed TMT and support facilities projects is represented not only by those who agreed to participate in this consultation, but also—and perhaps as importantly—by those who chose not to participate. A number of likely contributors to this cultural impact study by way of their cultural use, knowledge, attachment and generational ties to Maunakea (*‘ohana* that have for generations brought family *piko* and *iwi kūpuna* to the summit), as well as those committed to community advocacy for the protection of Maunakea, declined to provide comment for this CIA. Their reasons for non-participation vary, but generally underscore decades of discontent with how developments on Maunakea (and attendant studies and management plans) have been undertaken. Many are fatigued by multiple cultural studies and public meetings that have similarly sought their *mana‘o*; a subset of this group are frustrated by the continued construction of telescopes on Maunakea with what appears to be little to no attention to their earlier testimonies regarding cultural concerns and sometimes expressed opposition to further development on Maunakea. It is the perception of many community contacts—including those inclined to support the proposed actions—that past recommended mitigation measures have often been ignored (e.g., recycling telescope sites no longer in use, cultural education and protocols for scientists and visitors, access to cultural and natural resources). It is further assumed by these community contacts that the TMT Observatory and TMT Mid-Level Facility Projects will similarly proceed without regard to community consultation outcomes. Instead of participating in this study, to express their disapproval for the proposed projects, a few organizations and individuals committed to protection of Maunakea and cultural activities and resources on the mountain prefer to pursue an independent, legal course of action and/or express their concerns at public forums. The words of one participant in this current cultural impact study (Ms. Ku‘ulei Keakealani) summarize the general sentiment of many (participants and non-participants alike) that the voices of Hawaiian community members have not been heard:

> …there is a harsh reality for some reason that’s on my heart that says, if this already has been stamped with a seal of approval that this is going through…if we are there at that point and that is the game we are in—again that is just a reference because I know by no means is this a game—then what are ways [to respond to this]…It’s beyond having the Hawaiian people recognized or heard or they sit on the board. That’s all wonderful and we need all these things, but then…how much

> have they listened to us? If the majority of the testimony is “No, don’t put that TMT there,” and it still goes in anyway, did it just not matter that we all said, “no, no”?

The results of the community consultation for this CIA, while elucidating many of the key cultural issues surrounding Maunakea, may not reflect the wealth of concerns possessed by many other members of the Native Hawaiian community who chose not to be interviewed for this study. As such, the findings of past and current cultural studies and management plans (see Section 4.7) provide necessary complementary information to this report. In particular, the oral-history interviews of many elders (some now deceased) included in Appendix B of Maly and Maly (2005) and found in Maly (1999) serve as important documentation of many facets of Hawaiian customary practices, understandings of the cultural landscape and ongoing attachment of Kānaka Maoli and *kama‘āina* to Maunakea for further reference.

6.1.2 Community Outreach and Consultation Table

As described in Section 1.1., when the TMT Observatory Project’s CIA consultation was initiated in November 2008, communication with Project proponents indicated that the proposed Thirty Meter Telescope CIA consisted mainly of the actual construction of the TMT Observatory Project within the 36-acre area known as Area E in the Mauna Kea Science Reserve Master Plan. In February 2009, CSH was informed that the TMT Observatory Project will also include a construction staging area located at the 9,000 foot level Hale Pōhaku site, approximately 3.5 miles south of the proposed TMT Observatory Project site. Also included in the proposed TMT Observatory Project description is a new electrical transformer to be installed at the Hawaiian Electric Light Company (HELCO) site also located at the Hale Pōhaku site. For this reason, CSH sent out a second round of community consultation letters in February 2009 to include the additional information regarding the construction staging area and the electrical transformer in order to provide study participants the opportunity for additional comments and concerns.

The change in Project acreage from approximately 6 acres to 3.2 acres in the Hale Pōhaku area is not reflected in the outreach letters below because the community consultation took place from November 2008 to December 2010 when the information regarding the new Project acreage was unknown. Because the original Project area was downsized to a smaller area than what was originally proposed, CSH will not re-initiate further community consultation at this time.

Initial community outreach letters sent to community contacts in November 2008 along with an aerial image and a USGS map were mailed with the following text:

> Cultural Surveys Hawai‘i (CSH) is conducting a Cultural Impact Assessment (CIA) for the proposed construction and operation of the Thirty Meter Telescope (TMT), an optical-infrared telescope on an estimated 4 acres of presently undeveloped land of the 525-acre Astronomy Precinct of the Science Reserve near the top of Mauna Kea. The project would be located in Ka‘ohe Ahupua‘a, Hāmākua District, on the island of Hawai‘i, on a portion of TMK: (3) 4-4-015: 009 and 012. Please see the attached figures: USGS and aerial photographs of the proposed project area, maps of the Mauna Kea summit, considered a Traditional Cultural Property, and other TCPs, including trails, sites and view corridors

adapted from Kepā Maly's 1999 Oral History and Consultation study for the Mauna Kea Science Reserve Master Plan (UH 2000).

The proposed telescope facility would be located within the western portion of the area known as the northern plateau within the Astronomy Precinct. More specifically, the area being considered is the general vicinity of the 36-acre area designed Area E in the Mauna Kea Science Reserve Master Plan (UH, 2000). Area E ranges in elevation from 13,100 to 13,300 feet and is located approximately half a mile northwest of the nine existing optical-infrared telescopes located near the summit at elevations of 13,600 to 13,775 feet. The entire Mauna Kea Science Reserve is designated part of the State of Hawai‘i Conservation District, resource subzone. Ancillary facilities include an access road from the end of the current access road near the summit to the new telescope site would need to be developed.

The purpose of this cultural study is to assess potential impacts to cultural practices, beliefs and resources as a result of the proposed TMT development on Mauna Kea. We are seeking your kōkua and guidance regarding on any of the following:

- **General history and present and past land use of the project area.**
- **Knowledge of cultural sites which may be impacted by future development of the project area - for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the project area, both past and ongoing.**
- **Cultural associations of the project area, such as legends and traditional uses.**
- **Referrals of *kūpuna* or elders and *kama‘āina* who might be willing to share their cultural knowledge of the project area and the surrounding *ahupua‘a* lands.**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.**

In February 2009, new letters which include the additional project information for the construction staging area and the electrical transformer were sent to community contacts with the following text:

Cultural Surveys Hawai‘i (CSH) is conducting a Cultural Impact Assessment (CIA) for the proposed construction and operation of the Thirty Meter Telescope (TMT), an optical-infrared telescope on an estimated 4 acres of presently undeveloped land of the 525-acre Astronomy Precinct of the Science Reserve near the top of Mauna Kea. Previous outreach letters sent to our community consultants for the proposed Thirty Meter Telescope Project CIA did not include a project description for the Hawaiian Electric Light Company (HELCO) electrical transformer, which will supply power to the TMT, and a construction staging area, both of which are located approximately 3.5 miles south of the proposed

TMT site. Information regarding the electrical transformer and the construction staging area was provided to CSH by project proponents on February 13, 2009 and are both included below with the original project description.

The project would be located in Ka‘ohe Ahupua‘a, Hāmākua District, on the island of Hawai‘i, on a portion of TMK: (3) 4-4-015: 009 and 012. Please see the attached figures: USGS and aerial photographs of the proposed project area, maps of the Mauna Kea summit, considered a Traditional Cultural Property (TCP), and other TCPs, including trails, sites and view corridors adapted from Kepā Maly's 1999 Oral History and Consultation study for the Mauna Kea Science Reserve Master Plan (UH 2000).

The proposed telescope facility would be located within the western portion of the area known as the northern plateau within the Astronomy Precinct. More specifically, the area being considered is the general vicinity of the 36-acre area designed Area E in the Mauna Kea Science Reserve Master Plan (UH, 2000). Area E ranges in elevation from 13,100 to 13,300 feet and is located approximately half a mile northwest of the nine existing optical-infrared telescopes located near the summit at elevations of 13,600 to 13,775 feet. The entire Mauna Kea Science Reserve is designated part of the State of Hawai‘i Conservation District, resource subzone. Ancillary facilities include an access road from the end of the current access road near the summit to the new telescope site would need to be developed.

The proposed Thirty Meter Telescope construction staging area will include a temporary dormitory complete with restroom facilities, a cafeteria, and a parking area (Figure 5). The proposed staging areas, located both in and adjacent to the Hale Pōhaku site, will also be used to stage both construction equipment and materials needed for the construction of the TMT. A new transformer will be added to the existing HELCO site near Hale Pōhaku. The new transformer may require an expansion of the fenced-in area at the HELCO site. From there, new wires will be placed in existing underground conduit to provide power to the TMT Observatory.

The purpose of this cultural study is to assess potential impacts to cultural practices, beliefs and resources as a result of the proposed TMT development on Mauna Kea. We are seeking your kōkua and guidance regarding on any of the following:

- **General history and present and past land use of the project area.**
- **Knowledge of cultural sites which may be impacted by future development of the project area - for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the project area, both past and ongoing.**
- **Cultural associations of the project area, such as legends and traditional uses.**

- **Referrals of *kūpuna* or elders and *kama‘āina* who might be willing to share their cultural knowledge of the project area and the surrounding *ahupua‘a* lands.**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.**

At the request of PB, a third phase of consultation was conducted from October to December 2009 (using the outreach letter above). The Project proponents provided the names of community members including Mr. Ed Stevens, Mr. Gene Leslie, Mr. Patrick Kahawaiola‘a, and Mrs. Ululani Sherlock. The other four people contacted (Mr. Paul Chung-Hoon of the Royal Order of Kamehameha, Superintendent Geraldine Bell, Dr. Pualani Kanahele, and Mrs. Cynthia Nazara) were referred by Mrs. Ululani Sherlock. Of these four, one community member, Mrs. Cynthia Nazara, had already been contacted before the additional consulation.

Several (one - nine) attempts were made to contact individuals, organizations, and agencies apposite to the CIA for the subject project. The results of all consultations are presented in Table 6; brief consultation responses and review letters from government agencies are included below the table. Excerpts from more extensive interviews and statements related to the proposed project and its environs are presented in Section 7 below.

Table 6. Community Contacts and Consultation Effort

Name	Affiliation, Background	Comments
Ailā, William	Hui Mālama I Na Kūpuna ‘O Hawai‘i Nei	CSH sent letter on December 5, 2008 and sent revised letter on April 2, 2009.
Akaka, Danny	Director of Cultural Affairs at Mauna Lani and Kahu	CSH mailed letter and maps on December 1, 2008. CSH emailed follow up letter on January 21, 2009. CSH again emailed letter and maps on January 25, 2009 and emailed follow up on February 12, 2009. CSH interviewed Mr. Akaka Jr. on February 24, 2009 after showing him the changes in the Project description. See Section 7 below for full interview.
Ako, Val	Kupuna, Kama‘āina	CSH mailed letter on November 29, 2008 and sent revised letter on February 25, 2009. CSH called on March 25, 2009 and talked with Mr. Ako, who responded with the following statement: “That one I’m in opposition. Enough is enough, but they are not satisfied. They are just for money. There are Hawaiians who want to go ahead with that [TMT] telescope. I’d rather the mountain stay as it is. Enough telescopes already.” In reply to the proposed changes, Mr. Ako stated: “Like I said, enough is enough already.”
Alapai, Howard	Kupuna, Kama‘āina	CSH sent letter on November 29, 2008 and mailed revised letter on February 28, 2009. CSH called on March 26, 2009 and again on April 7, 2009. Mr. Alapai declined to comment.
Arakaki, Aric	Superintendent, National Park Service, Ala Kahakai National	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on

Name	Affiliation, Background	Comments
	Historic Trail	February 28, 2009. CSH emailed a follow up letter and re-sent maps on April 1, 2009.
Ayau, Halealoha	Hui Mālama I Na Kūpuna ‘O Hawai‘i Nei	CSH sent letter on April 2, 2009. Mr. Ayau replied on April 3, 2009 with the following statement: “Aloha no kakou, Our comments are as follows. As many have stated before us, Mauna Kea is kapu [restricted, prohibited]. It is the largest ahu in all of Hawai‘i which contributes to it being a sacred place. There are already many intrusions into its kapu space and adding another such intrusion that serves no spiritual function further diminishes the mana [power] of Mauna Kea. We wonder how Hawaiian spiritual practices would be affected by the building of the TMT Project, whether our akua [God, male and female deities, spirits], kini akua [countless spirits and gods] or ‘aumakua [family or personal gods] would view the TMT has being there to honor their role in our lives or whether they would view it is our continued inability to maintain the kapu of these sacred places. The bottom line is that the TMT like the other telescopes on Mauna Kea lacks spiritual function for cultural practitioners. Mahalo for the opportunity to share our mana‘o on this Project.” Edward Halealoha Ayau Donna Kainaniokalihiwai Kahaunaele
Baybayan, Chad Kalepa	‘Ahahui Kū Mauna	CSH sent letter on April 14,

Name	Affiliation, Background	Comments
		2008. Letter was returned April 20, 2009 as undeliverable.
Bell, Geraldine	Superintendent, Kaloko-Honokohau National Historical Park	Superintendent Bell was referred by Mrs. Sherlock as part of the additional consultation. CSH sent mail on November 2, 2009. On November 5, 2009, Superintendent Bell emailed the following: "Although I live in Waimea, my focus as superintendent of two national historical parks on the westside of the island has been the Kaloko-Honokohau and Honaunau areas. I'm sorry to say that I will not be able to provide you such detailed information regarding the area surrounding Mauna Kea."
Boston, Richard	Kaloko-Honokōhau National Historic Park	CSH sent letter on November 29, 2008. CSH called and left message on January 20, 2009. CSH was contacted on January 20, 2009 and told that Mr. Boston no longer worked at Kaloko-Honokōhau National Historic Park.
Carpenter, Alan	Archaeologist, Hawai‘i State Parks Division	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on February 28, 2009. CSH mailed letter and maps on April 2, 2009.
Cayan, Phyllis "Coochie"	State Historic Preservation Division, History and Cultural Branch Chief	CSH sent letter on November 29, 2008 and mailed revised letter on April 2, 2009. CSH sent an email and left a phone message on April 27, 2009. SHPD sent a memo via email in response to the initial letter pertaining specifically to the TMT Observatory Project area on May 4, 2009. The response is included below this table (Figure 22).
Chang, Clement	Trail and Access Specialist,	CSH sent letter on November 29,

Name	Affiliation, Background	Comments
	Na Ala Hele Trail and Access Program, Department of Land and Natural Resources	2008 and again on January 16, 2009. CSH sent revised letter on February 28, 2009. CSH again mailed letter and maps on April 2, 2009.
Ching, Clarence	Hawai‘i Island *kupuna*	CSH called Mr. Clarence Kukauakahi (Ku) Ching on February 20, 2009. CSH conducted an interview with Mr. Ching on February 27, 2009 in Hilo. Follow up interviews were conducted on May 6, 2009 and August 20, 2009. See Section 7 below for full interview.
Chung-Hoon, Paul	Sir, Royal Order of Kamehameha I	Mr. Chung-Hoon was referred by Mrs. Sherlock as part of the additional consultation. CSH sent mail on November 2, 2009. The letter was returned on November 5, 2009. CSH called on November 10, 2009 but the number was not in service. CSH mailed another letter to the address of the Royal Order of Kamehameha I on November 16, 2009. CSH received an email on November 19, 2009 from Ali‘i Sir Russell Pai, Ku‘auhau O Kona, who stated: “On behalf of Ali‘i Sir Paul Chung-Hoon, Ali‘iaimoku O Kona, we have received your letter concerning the Cultural Impact Assessment for the TMT. Mahalo for the information and we do not have any questions at this time. We are referring the letter to our brothers on the east side, Moku O Mamala Hoa, under the leadership if Ali'iaimoku Pua Ishibashi. Although both Chapters work together on issues, Mauna Kea falls into their

Name	Affiliation, Background	Comments
		jurisdiction. Should they have any concerns or questions, they will contact you."
Elarionoff, Leningrad	Kama‘āina and Hawai‘i Island Burial Council member	CSH mailed letter and maps on December 1, 2008. CSH called and left message with Mrs. Elarionoff on January 26, 2009. CSH called and left message January 29, 2009 and again on January 30, 2009. CSH met with Mr. Elarionoff on January 31, 2009. See Section 7 below for full interview.
Eoff, Karen	Community activist and president of Kohanaiki Ohana	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on March 5, 2009. CSH emailed letter and maps again on April 2, 2009.
Fergerstrom, Harry "Hank"	Hawai‘i Island *kama‘āina*	CSH sent letter on April 13, 2009 and again on April 20, 2009.
Flores, Kalani	Lecturer of Hawaiian History, University of Hawai‘i	CSH sent letter on November 29, 2008 and sent revised letter on April 13, 2009. Mr. Flores replied on April 17, 2009 saying he would provide a written statement for this Project.
Gmirkin, Rick	Archaeologist, Ala Kahakai Trail	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on February 28, 2009. CSH called and left a message on April 8, 2009.
Greenwell, Kelly	Hawai‘i Island Farmer	CSH mailed letter and maps on November 29, 2008. CSH called on December 4, 2008 and met with Mr. Greenwell on December 10, 2008. CSH sent revised Project changes on February 28, 2009. CSH called and left message on March 23, 2009. CSH emailed Project changes on the same day. See

Name	Affiliation, Background	Comments
		Section 7 below for full interview.
Guiles, Peter	‘Imiloa Astronomy Center Executive Director	CSH sent letter on December 5, 2008 and sent revised letter on April 2, 2009.
Halemau, Karin	Hawai‘i Island *kupuna*	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on February 28, 2009. Mr. Halemau replied by phone on March 11, 2009 with the following statement: “My whole feeling is anything concerned with this generation and the next is good…if anything could educate the next generation, which would be good.”
Harp, Isaac	Hawai‘i Island *kama‘āina*	CSH mailed letter and maps on November 29, 2008. CSH sent email follow up on January 16, 2009. Mr. Harp replied via email on January 17, 2009. CSH sent email with revised Project description on March 20, 2009. Mr. Harp replied via email on March 22, 2009. See Section 6 below for full statement.
Hoke, Arthur	Kahu Kū Mauna	CSH sent letter on April 13, 2009. Letter was returned on April 17, 2009. CSH sent another letter on April 21, 2009 to a newer address. CSH sent the letter and figures April 21, 2009 via email.
Kahawaiola‘a, Patrick	Hawai‘i Island *kama‘āina* and president of Keaukaha Community Association	Project proponent PB requested Mr. Kahawaiola‘a be contacted as part of the additional consultation. CSH called and left message on October 20, 2009. CSH called on October 26, 2009 but was unable to reach Mr. Kahawaiola‘a. CSH called on October 30, 2009 and Mr.

Name	Affiliation, Background	Comments
		Kahawaiola‘a indicated that he would like the information mailed to him. CSH mailed information on November 2, 2009. CSH called and left message on November 4, 2009. CSH called on November 9, 2009 and Mr. Kahawaiola‘a stated to call back on Thursday, November 12, 2009 for a November 13, 2009 appointment. CSH called on November 12, 2009 and talked briefly with Mr. Kahawaiola‘a. He stated that he would call back another day. CSH called on November 16, 2009 and left a message. CSH called and interviewed Mr. Kahawaiola‘a on November 23, 2009. See Section 7 below.
Kakalia, Tiffnie	Kahu Kū Mauna	CSH sent letter on April 13, 2009. Letter was returned on April 17, 2009. CSH sent new letter on April 20, 2009 to a newer address.
Kanaele, Kalikokalehua	Hale o Lono	CSH sent letter and maps on January 5, 2009. CSH conducted an interview with Mr. Kanaele on February 13, 2009 in Pāhoa. See Section 7 below for full interview.
Kanahele, Dr. Pualani	Founder of Edith Kanaka‘ole Foundation; Kumu Hula and Cultural Practitioner	Dr. Pualani Kanahele was referred by Mrs. Sherlock as part of the additional consultation. Because of Mrs. Sherlock’s referral, CSH emailed letter and maps on November 5, 2009.
Keakealani, Ku‘ulei	Ka‘upulehu Interpretive Center, Curator	CSH mailed letter and maps on November 29, 2008. CSH emailed follow up on January 17, 2009. Ms. Keakealani emailed CSH on January 18, 2009 and said that she would call CSH.

Name	Affiliation, Background	Comments
		CSH called on February 12, 2009 and met with Ms. Keakealani on February 19, 2009 to discuss project changes. See Section 7 below for full interview.
Keanaaina, Duane	Hawai‘i Island *kama‘āina*	CSH sent letter on November 29, 2008. CSH called on January 27, 2009 and on March 11, 2009. CSH showed revised Project changes on March 20, 2009. Mr. Keanaaina declined to comment.
Kimura, Kaiu	‘Imiloa Astronomy Center Associate Director	CSH sent letter on December 5, 2008.
Kwiatowski, P.F. “Ski”	Author on two books on Hawaiian Petroglyphs and Tattoos	CSH mailed letter and maps on November 29, 2008. CSH called and left message January 13, 2009 and January 30, 2009. CSH emailed revised letter and maps on March 5, 2009. Mr. Kwiatkowski replied on March 6, 2009. See Section 6 below for full statement.
Lee, Reggie	State Department of Conservation and Resource Enforcement, DLNR	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on March 5, 2009.
Leslie, Gene	President, Hawaiian Civic Club of Kona- Kuakini	Project proponent PB requested Mr. Leslie be contacted as part of the additional consultation. CSH attempted to locate Mr. Leslie’s business on October 12, 2009. CSH called and left a message on October 12, 2009 and again on October 13, 2009. Mr. Leslie called on October 14, 2009 and stated he had no further wish to comment, as the letter from the civic club dated July 3, 2009, stated all that he had to say. CSH called on October 30, 2009 and left message asking if Mr. Leslie can refer any club members to CSH to comment on the

Name	Affiliation, Background	Comments
		proposed project. CSH called on November 10, 2009 and November 16, 2009 and left the same message. Mr. Leslie called CSH on November 17, 2009 and stated he does not have any further comments.
Lightner, Leina‘ala	Hawai‘i Island *kupuna*	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter and maps to Mrs. Lightner on February 19, 2009. Mrs. Lightner declined to comment.
Mahi, Arthur	Hawai‘i Island *kupuna*	CSH mailed letter and maps on November 29, 2008. CSH called December 1, 2008 and December 2, 2008. CSH met with Kupuna Mahi on December 3, 2008. CSH called January 21, 2009 and January 26, 2009 and left messages. CSH called January 30, 2009 and February 6, 2009. CSH called with changes regarding Project description on March 11, 2009. See Section 7 below for full interview.
Maigret, Mary Anne	Archaeologist, Division of State Parks, Hawai‘i Island	CSH sent letter on November 29, 2008 and again on January 16, 2009. CSH sent revised letter on February 28, 2009. CSH emailed letter and maps on April 2, 2009.
Mallow, Antoinette Keahiolalo	Kahu Kū Mauna, Hawaiian Civic Club of Hilo, Na Pua No‘eau	CSH sent letter on April 14, 2009 and sent second letter on April 20, 2009.
Mau, Lehua Lopez	Hawai‘i Island Land Trust Executive Director	CSH sent letter on April 14, 2009 and sent second letter on April 20, 2009. However, the second letter was returned.
McDonald, Ruby	Community Resources Manager, Office of Hawaiian Affairs	CSH sent letter and maps on December 12, 2008. CSH emailed revised letter and maps on April 2, 2009. CSH mailed letter and maps on April 3, 2009.
McKenna, Dan	Palomar Observatory,	CSH sent letter on November 29,

Name	Affiliation, Background	Comments
	Superintendent	2008 and again on January 16, 2009. CSH sent revised letter on March 5, 2009. Mr. McKenna declined to comment.
Medeiros, Clarence	Hawai‘i Island *kama‘āina*	CSH sent letter on November 29, 2008. Mr. Medeiros replied December 6, 2008; referred CSH to contact E. Kalani Flores and Burt and Sheila Okin.
Meyer, Manu Aluli	University of Hawai‘i Hilo, professor of education	CSH sent letter on December 5, 2008. CSH sent revised letter on April 14, 2009 and an email on April 20, 2009.
Naleimaile, Sean	Kahu Kū Mauna	CSH sent letter on April 14, 2009 and sent second letter on April 20, 2009. CSH called on April 21, 2009 and Mr. Naleimaile declined to comment.
Nāmu‘o, Clyde	Administrator, Office of Hawaiian Affairs	CSH sent letter on November 29, 2008 and sent revised letter on April 2, 2009. The response to the initial letter pertaining specifically to the TMT Observatory Project area is summarized below this table. In a letter dated May 27, 2009, OHA wrote that the comments provided in the initial response letter of January 9, 2009 remain the same. See Appendix C for OHA letters.
Nazara, Cynthia	Member, Hawai‘i Burial Council	CSH first sent information to Mrs. Nazara on November 29, 2008 and again on January 16, 2009. CSH mailed revised information on February 28, 2009. CSH called and left a message on March 26, 2009. Mrs. Sherlock referred Mrs. Nazara as part of the additional consultation. CSH called on November 16, 2009, November 18, 2009, November 19, 2009 and November 23, 2009 and left

Name	Affiliation, Background	Comments
		messages. CSH called again on November 25, 2009 and Mrs. Nazara stated she will contact CSH soon. CSH called and left a message on December 4, 2009. Mrs. Nazara called on December 4, 2009 and stated that she will make a statement soon. CSH called and talked to Mrs. Nazara on December 7, 2009, at which time she stated that she will email CSH with a statement. CSH called on December 9, 2009 and she said she will send a statement as an individual and not as a Burial Council member. Mrs. Nazara emailed a short comment on December 9, 2009. See Section 7 below.
Neves, Paul K. Ali‘i ‘Aimoku	Sir, Royal Order of Kamehameha	CSH sent letter on December 5, 2008 and sent revised letter on April 14, 2009.
Nihoa, Moke and Lei	Hawai‘i Island *kama‘āina*	CSH sent letter on February 28, 2009. Mr. and Mrs. Nihoa expressed that they are against the proposed TMT Project because of the United States illegal occupation in Hawai‘i.
Okin, Burt and Sheila	Hawai‘i Island *kama‘āina*	CSH emailed letter and maps on January 26, 2009. CSH interviewed Mr. Okin on January 23, 2009. Mr. and Mrs. Okin sent additional statements on February 2, 2009. CSH sent revised Project description via email on March 5, 2009 and March 22, 2009. Mr. and Mrs. Okin had no comment on the Project changes. See Section 7 below for full interview.
Omphroy, Leilehua	Kahu Kū Mauna	CSH sent letter on April 14, 2009. CSH sent a second letter on April 20, 2009.

Name	Affiliation, Background	Comments
Ontai, Kalai	‘Imiloa Astronomy Center	CSH sent letter on December 5, 2008 and sent revised letter on April 14, 2009. CSH sent follow up letter on April 20, 2009.
Pihana, Kimo Keali‘i	Hawai‘i Island Park Ranger and *kupuna*	CSH mailed letter and maps on January 5, 2009. CSH conducted an interview with Mr. Pihana on February 4, 2009. See Section 7 below for full interview.
Pisciotta, Kealoha	Mauna Kea Anaina Hou	CSH mailed letter and maps on January 5, 2009. CSH interviewed Ms. Pisciotta on January 19, 2009. See Section 7 below for full interview and Appendix D for written testimony.
Pau, Puhi	Nā Maka o ka ‘Āina	CSH sent letter on December 5, 2008 and sent revised letter on April 2, 2009.
Sherlock, Ululani	Member, Hawai‘i Burial Council	PB requested Mrs. Sherlock be contacted as part of the additional consultation. CSH emailed letter and figures on October 20, 2009. CSH called Mrs. Sherlock the same day and she indicated she will contact CSH. CSH emailed a follow up letter on October 26, 2009. Mrs. Sherlock emailed CSH the same day, providing several referrals and a follow up question on water run-off. CSH called Mrs. Sherlock on October 30, 2009 and she made referrals, including Paul Chun-Hoon, Kimo Lee, Cynthia Nazara, Superintendent Geraldine Bell and Dr. Pualani Kanahele. She also indicated that she will expand on her email in the future. Mrs. Sherlock sent an email approving use of the last three paragraphs of her email on October 31, 2009. CSH sent a follow up email with answers on

Name	Affiliation, Background	Comments
		November 2, 2009. See Section 7 below.
Soehren, Mr. Lloyd J.	Archaeologist, expert on place names	CSH sent letter and maps on November 29, 2008. Mr. Soehren contacted CSH on December 6, 2008 by email and stated that he does not have "particular knowledge of the project area." CSH did not send the revised Project description to Mr. Soehren.
Spielman, Elisabeth Tita	Resident of Waimea	CSH sent letter and maps on December 5, 2008. In December, in a phone conversation, Mrs. Spielman stated that she "said everything I had to say" for Kepā Maly's report.
Stevens, Ed Stevens	Kama‘āina, member of Kahu Ku Mauna	CSH originally sent letter and figures on April 9, 2009. Mr. Stevens called CSH on April 15, 2009 and asked some questions. He stated that Kahu Ku Mauna would meet on April 22, 2009 and that they may share a statement after the meeting. On October 9, 2009, Project proponent PB requested Mr. Stevens be contacted as part of the additional consultation. On the same day, CSH called Mr. Stevens and arranged for an interview. Mr. Stevens asked if it would be a conflict of interest if he commented as he is with Kahu Ku Mauna. On October 12, 2009, Mr. Stevens was interviewed by CSH after he emphasized he was speaking as an individual, a *kama‘āina* and not as a member of Kahu Ku Mauna. Mr. Stevens called on October 25, 2009 and requested to meet with CSH regarding changes in his statement. CSH called and left

Name	Affiliation, Background	Comments
		message October 26, 2009. CSH met Mr. Stevens on October 27, 2009. CSH emailed Mr. Stevens the revised statement on October 29, 2009. Mr. Stevens called on November 2, 2009, stating he made additional changes. He gave final approval to this second revision on November 3, 2009. See Section 7 below table.
Sterling, Jo-Anne Kahanamoku	Hawai‘i Island *kupuna*	CSH mailed letter and maps on January 27, 2009. Ms. Sterling called CSH on January 30, 2009 and declined to make a comment.
Tamanaha, Miwa	KAHEA: The Hawaiian Environmental Alliance	CSH sent letters and maps on December 5, 2008 and sent revised letter and figures through email on April 4, 2009.
Takamine, Vicky Holt	‘Ilio‘ulaokalani Coalition, president	CSH sent letter and maps on December 5, 2008 and sent revised letter and maps on April 2, 2009.
Ursua, Larry	Hawai‘i Island *kumu hula*	CSH sent letter and maps on November 29, 2008.
Van Gieson, George	Volcano Fire Station Fire Chief	CSH mailed letter and maps on November 29, 2008. CSH called January 26, 2009. CSH interviewed Mr. Van Gieson on February 11, 2009. CSH sent changes on March 9, 2009 via email and called on the same day. CSH called on March 20, 2009 and Mr. Van Gieson provided statement regarding changes. See Section 7 below for full interview.
Young, Charles	Chair, Hawai‘i Island Burial Council	CSH sent letter on November 29, 2008. CSH left message on January 26, 2009 and again on February 12, 2009. CSH sent revised letter on February 28, 2009. CSH called and left message on March 23, 2009.

LINDA LINGLE
GOVERNOR OF HAWAII

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BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
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CONSERVATION AND RESOURCES ENFORCEMENT
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HISTORIC PRESERVATION
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May 4, 2009

LOG NO: 2009.1748
DOC. NO: 0905PC001

MEMORANDUM

TO: Mishalla Spearing, Cultural Researcher
Cultural Surveys Hawai'i, P.O. Box 1114, Kailua, Hawai'i 96734

FROM: Phyllis Coochie Cayan, History and Culture Branch Chief

Subject: **MAUNAKEA 2: Cultural Impact Assessment (CIA) for the proposed construction and operation of the Thirty Meter Telescope (TMT), an optical-infrared telescope on an estimated 4 acres of presently undeveloped land of the 525-acre Astronomy Precinct of the Science Reserve near the top of Mauna Kea, Ka'ohe Ahupua'a, Hamakua District, Island of Hawaii.**
TMK: [3] 4-4-015:009 and 012.

This memo is in response to your request to help assess potential cultural impacts to cultural practices as a result of the proposed construction and operation of the Thirty Meter Telescope (TMT) as described above.

As you may have discerned from the most recent Mauna Kea Comprehensive Management Plan (MCMP) for the UH Management Areas (January 2009) and the public hearings for that plan that Mauna Kea is a very sensitive subject that truly needs and deserves more time to consider all the cultural impacts to this iconic symbol of all cultural connections including but not limited to the genealogical connections, and the spiritual connections to all of the deities in the Hawaiian cosmos and to the kanaka maoli world view.

Some areas that should be addressed include but are not limited to the following mana'o:

1. Mauna Kea is the first sighting for voyaging canoes to arrive safely to our islands in the middle of the Pacific. Mauna Kea is a significant part of the Pacific Rim mythological connections to all the Pacific Rim. The significance of Mauna Kea is not limited to Hawaii only.
2. There is continued debate on the number of telescopes and buildings on the summit. There should be a deaccession of buildings no longer functional before building new structures or perhaps no more development on this sacred mountain.
3. Access for cultural practitioners need to be clearly addressed and defined.
4. The entire summit of Mauna Kea should be treated as one traditional cultural landscape and consider all the impacts to it – not a piecemeal analysis of just the Science Reserve.
5. More community outreach must occur for all cultural impacts on the summit and the proposed area. (Note: see list of contacts in the MCMP.)

This is a short list of the department's concerns. Any questions, please call me at 808-692-8015 or via email Phyllis.L.Cayan@hawaii.gov

C: Nancy McMahon, Deputy SHPO
Theresa Donham, Hawaii Island Archaeologist
Analu Josephides, Hawaii Island Cultural Historian

Figure 22. May 4, 2009 SHPD memo response

6.2 Other Statements

6.2.1 Office of Hawaiian Affairs

In its response letter dated January 9, 2009 (see Appendix C for full letter), OHA describes the ongoing debate surrounding the development on Maunakea and offers several recommendations.

OHA notes that Maunakea is a spiritual, sacred place, home to “wao akua” (dwelling, place of the gods) and where “Papa and Wakea meet in the physical world.” Maunakea stops “the rainclouds which provide pristine life sustaining water known as Kanekawaiola,” thus contributing to “a healthy natural environment, which in turn allows man to thrive.” It is the place where “numerous ahu and iwi kūpuna known to be situated in the summit area provide silent testimony that generation upon generation of Hawaiians” have worshipped and buried loved ones “at the highest point possible to rest in peace.”

At the same time, OHA recognizes the unique atmospheric conditions that make Maunakea an ideal place for observation of even the farthest galaxies and for this reason it hosts “the world’s largest astronomical observatory with telescopes operated by astronomers from eleven countries.”

OHA recommends that due to this 40-year-long debate surrounded the continued development of Maunakea which “has intensified and the divide between the above mentioned perspectives has not changed,” that the, “proposed TMT project should be viewed as one part of this long history.” The letter further states, “With this in mind, your assessment should…consider the overall impacts of development on Mauna Kea.”

OHA also refers CSH to the following individuals and organizations for consultation: Kealoha Pisciotta, Clarence Ching, Reynolds Kamakawiwoʻole, Keʻalakahi Meyers, the Royal Order of Kamehameha I, KAHEA, the Edith Kanakaʻole Foundation, Kahu Kū Mauna and the ʻImiloa Astronomy Center.

CSH later contacted OHA with the additional TMT Mid-Level Facility Project Area description and figures on April 2, 2009. In a response letter dated May 27, 2009 (see Appendix C for full letter) OHA wrote, “Thank you for continuing consultation at this stage. Our comments detailed in our initial response letter dated January 9, 2009 remain the same. We look forward to the opportunity to review the draft assessment and provide additional comments.”

6.2.2 Mr. P.F. “Ski” Kwiatkowski

CSH contacted Mr. P.F. Kwiatkowski regarding the proposed Project and he replied via email on March 6, 2009. Mr. Kwiatkowski is part Polish, Portuguese, and Hawaiian. An expert on Hawaiian petroglyphs and Hawaiian tattoos, he has written two books, *Na Kiʻi Pōhaku: A Hawaiian Petroglyph Primer* and *The Hawaiian Tattoo*. Mr. Kwiatkowski was raised in the Kapahulu area of Oʻahu. He has lived in Hawaiʻi Island for 30 years, and by his own estimate, he has walked and hiked about 80 percent of the island. Mr. Kwiatkowski is a supporter of astronomy, but he questions the way that Maunakea has been “managed” by the University of Hawaiʻi and the State of Hawaiʻi, as well as the proliferation of telescopes through the years.

I will let you know a few things that have always been on my mind regarding Mauna Kea. Firstly, it is a very beautiful and inspiring mountain, not only to the Native Hawaiians of these islands, but to all who view her for the first time. To the Hawaiian, it is a place of awe, silence and reverence. A place filled with story and myth and one of the greatest resources of quality adze material in the entire Polynesian triangle.

Now let's back up a few decades. When the State of Hawai‘i (read: the people who run the government, not the people that actually comprise the State) decided that they would allow telescopes on the top of Mauna Kea, there was no cohesive Hawaiian group or organization to voice a Hawaiian opinion on whether or not there should be anything on the mountain but what nature put there. So, with no opposition, telescopes miraculously appeared at the summit.

When I first saw this, it was a fairly sad sight to see, as the unblemished view of Mauna Kea had suddenly sprouted a pimple, and then another and another and another. My lone voice would not have been sufficient to stop this from happening and many other Hawaiians and non-Hawaiians alike felt the same way. Opposing government was unpatriotic and likened to being a hippie protester.

Fast forward to just a few years ago....The University of Hawai‘i, the entity that "manages" the mountain, now has the authority to do pretty much whatever it wants on the mountain, not taking into account that much of the land it "manages" is actually ceded lands from the Kingdom of Hawai‘i. Whether or not that makes a difference is a moot point, as the will of the people is supposed to be manifested through the State Government, when, in actual fact, it is not.

I am an avid fan of astronomy, have been from the time I got my first plastic telescope at age 9 and saw the craters of the moon for the first time. I have a small 8-inch telescope that allows me to explore the universe from my front yard in the Kohala Mountains. I am not against astronomy or the wonderful results it produces in research. I cannot change the past; the telescopes were put there without any opposition. It is a sense, thought, that the State of Hawai‘i and the University of Hawai‘i will see additional telescopes up there, come hell or high water and "public" opinion be damned.

I do not care to see more of Mauna Kea turned over to PRIVATE use, and I use the word PRIVATE because no one of us is allowed into any of the facilities there unless there is an "open house" where they give people the dog-and-pony show to keep resentment of the existing facilities to a minimum, and even then, not many people take advantage of this once-a-year event. In the past, everyone was allowed access to the recreational winter aspect of Mauna Kea and to a degree that continues, although in a more whimsical way. I say whimsical as sometimes, for no apparent reason, there is a Mauna Kea ranger at the closed gate at Hale Pōhaku telling people that they cannot go up to enjoy the snow as it is not safe. And then, in the very next minute, the ranger allows a small caravan of vehicles

> (with no special equipment of any kind) to proceed through the gate and up to the summit. When questioned, the ranger responded that they were “scientists” as if to imply that they had some mystical power over the elements that we mere mortals did not have. That is like rubbing it in, that the University of Hawai‘i can pick and choose who enters and that we can do nothing about it. Now it comes down to environmental and cultural impact statements and studies, and guess who is going to make those assessments? The fox that guards the henhouse, the University itself is going to make its own assessments!! The fix is in, how blatant can anyone entity be?
>
> Anyway, I have ranted long enough, I have made my position known and I have but one post script. A few years ago some well meaning, but uninformed, Hawaiians erected an ahu, altar, at the summit of Pu‘u Kahau‘ula, the highest point, presently, on Mauna Kea. I researched why they would do such an inappropriate thing and the response I got was “To show the Haole that we were here first.” That particular response showed me that they didn't realize they were doing the very thing they are against. Pu‘u Kahau‘ula is a sacred spot on a revered mountain. Didn't they realize that if the Hawaiians of long ago wanted to put something up there they would have? That site was left alone to leave it pure and unblemished, untouched by man, and then these uninformed people try to make a statement doing the very thing they are against, disturbing the sacredness of that high place. Auwe !!

6.2.3 Mr. Isaac Harp

Mr. Isaac Harp was born 50 years ago in New Orleans. His father was of Native American Cherokee and Irish descent, who met his mother Agnes Puakalehua Nihi-Harp, a pure Hawaiian, in Honolulu while he was stationed in the Navy. In 1963, the young Harp arrived in Hawai‘i. Mr. Harp was involved in commercial fishing from the mid-1980s to the mid-1990s, and he is knowledgeable about traditional fishing practices, thanks in part from knowledge shared by many of his relatives, including Uncle Val Ako. Mr. Harp married his wife Tammy on Kamehameha Day 21 years ago. He has five children: Isaac “Ikey” Chun, 36; stepson Chad Neizman, 30; Samson Harp, 27; Jacob Harp, 20; and Cherish Harp, 19. Mr. Harp remains active in the community and is a Hawaiian cultural practitioner. On January 17, 2009, Mr. Harp shared the following statement via email to CSH.

> In regards to your inquiry for consultation with Native Hawaiians on the proposed Thirty Meter Telescope, please see the attached Resolution from Na Kupuna O Moku O Keawe adopted November 15, 2008 [see Appendix E]. The resolution reflects my sentiment as well as the sentiment of other members of Na Kupuna O Moku O Keawe, elder representatives of descendants of Hawaiian Kingdom nationals residing on the island of Hawai‘i.
>
> Under International Laws of Occupation, when a sovereign nation such as Hawai‘i is lawfully or unlawfully occupied by a foreign nation such as the United States, the occupying nation must apply the laws of the occupied nation rather

> than fabricating their own laws and applying their fabricated laws within the occupied nation.
>
> In relation to the statement above, under International Laws of Occupation, when the governing body of an occupied nation is absent, the elders of the citizenry of the occupied nation represent the lawful authority of governance.
>
> It is well-known and documented that the United States' Newlands Resolution approved by a simple majority of the United States Congress on July 4, 1898 and signed on July 7 by President of the United States William McKinley, purporting to annex Hawai‘i to the United States, was an illegitimate action having no basis in law beyond the borders of the United States.
>
> Additionally, it is well-documented that the large majority of the citizenry of the sovereign Hawaiian Kingdom opposed the United States' desire to annex Hawai‘i as witnessed in several anti-annexation petitions that were submitted to the United States Congress. The anti-annexation petitions clearly blocked any annexation attempt by the United States to annex Hawai‘i. Regardless of the fact, the United States Congress selected to ignore the will of the citizenry of the Hawaiian Kingdom by proceeding with their unlawful attempt to annex Hawai‘i with no Treaty of Annexation. Clearly, there was never a lawful United States annexation of Hawai‘i.
>
> Finally, in 1959 there was a pathetic and unlawful attempt by the United States Congress to establish Hawai‘i as the 50th state of the United States. The statehood ballot that was created for this charade was illegitimate at first because the only choice was statehood, and secondly because United States citizens living in Hawai‘i and United States military personnel stationed in Hawai‘i were allowed to participate in the 1959 vote, which thrice invalidates the statehood process.
>
> Therefore, lacking the support of the lawful governing body, Na Kupuna O Moku O Keawe, the proposal to construct a Thirty Meter Telescope on the Sacred Kanaka Maoli Temple known as Mauna Kea should be gracefully and quietly withdrawn. Na Kupuna O Moku O Keawe further suggests that telescope proponents read the attached resolution [see Appendix E] to gain an increased understanding of why Na Kupuna O Moku O Keawe has taken the position that is expressed in the resolution.

In response to the proposed changes in the Project description involving the electrical transformer and construction of the staging area, Mr. Harp provided the following statement to CSH via email on March 23, 2008:

> It appears that the proponents of the proposed Thirty Meter Telescope Observatory Project (TMT) had planned their release of information for their proposed TMT in segments rather than in its entirety in an attempt to minimize the appearance of the full impacts that would occur by their proposed project. All

aspects of the TMT proposal, including supporting utilities, supporting areas, supporting structures, and supporting activities on our sacred mauna must be disclosed and viewed in its entirety from a cumulative perspective rather than from a fractionalized section-by-section viewpoint. This intentional practice of deception is nothing new to the people of Hawai‘i when it comes to the University of Hawai‘i, in particular their Institute for Astronomy and their astronomy partners. The people of Hawai‘i have been lied to time and time again by the University of Hawai‘i in their quest for world fame to attract prestige and funding from the international community.

The greed of the University of Hawai‘i is insatiable and this appetite is an ongoing threat for all of Hawai‘i and its people regardless of race. Why would the Research Corporation of the University of Hawai‘i voluntarily conduct research activities to enhance the killing power of the war machine of the United States government? What would drive what is supposedly an educational institution to conduct experiments on chemicals and biological agents of warfare? The answer is quite clear: the University of Hawai‘i would do whatever it takes to boost their incoming funding regardless of the source, and boost themselves into the international spotlight regardless of the risks or consequences placed on Hawai‘i and its people.

The University of Hawai‘i has supported and continues to support the unlimited desecration of more and more of our sacred and religious sites on Haleakala and Mauna Kea to quench their yearning for recognition by the international astronomy community. Astronomy interests from around the world have come to Hawai‘i by invitation from the University of Hawai‘i to forever destroy sacred and religious sites, and volcanic landscapes that can never be replaced. To allow and even support such destruction to quench a curiosity for knowledge about the universe is unforgivable.

Hypocrites within the University of Hawai‘i Institute for Astronomy have continually abused the host culture by ignoring expressed spiritual and religious concerns, then they selectively use the host culture to falsely portray themselves as sensitive to the host culture as witnessed on their website http://www.ifa.hawaii.edu/haleakala/cultural/, which is related to the Haleakala observatories. Here they use parts of the maoli kumulipo and go so far as to include on their website:

“Hawaiian Protocol for Sacred Places:

E Ui No Ka Ae

Ask Permission,

E Mahalo Aku

Give Thanks,

E Komo Me ka Hoano

Enter With Reverence,

I Ka hele aku, e hoomaamau i ka wahi!

When you leave, return it as you found it!”

Hawai‘i’s sacred and religious sites that have been desecrated and destroyed in the name of astronomy can never be returned to how they were before the astronomy community took aim at them.

Who owns Haleakala and Mauna Kea? It is well-documented and widely recognized that the lands astronomy facilities in Hawai‘i occupy are not owned by the State of Hawai‘i, who are merely custodians of the land under the belligerent United States occupation of Hawai‘i. As custodians of these lands, the State of Hawai‘i is responsible for insuring that these lands are preserved unmolested for the eventual return to the rightful claimants, descendants of Hawai‘i nationals regardless of race.

Although the State of Hawai‘i and the Federal government of the United States pretend that these lands were ceded by the Republic of Hawai‘i to the United States, who ceded these lands to the State of Hawai‘i, the charade has been exposed as a farce. The self-proclaimed Republic of Hawai‘i had no authority to cede anything to the United States; therefore, the United States had nothing to cede to the State of Hawai‘i .

By this testimony, I hereby charge the State of Hawai‘i, as custodians of these sacred and religious sites, with gross negligence and intentional mismanagement of these sites. By allowing the University of Hawai‘i and their global astronomy partners to desecrate and destroy these sacred and religious sites to build their telescopes and supporting utilities and facilities, the State of Hawai‘i is guilty of the acts of intentional desecration and destruction of sacred and religious sites of Hawai‘i .

Therefore, I demand of the State of Hawai‘i, the University of Hawai‘i, and all nations with astronomy facilities upon Hawai‘i’s sacred Haleakala and Mauna Kea to remove all evidence of your presence from our sacred sites, and to repair to the fullest extent possible the original condition of these sites as they were before “...you found it!”

There is also the matter of restitution to the many concerned who have worked hours, days, weeks, months, years, and in some cases, decades on efforts to prevent the desecration and destruction inflicted on our sacred mauna by astronomy interests. Perhaps the State of Hawai‘i could acquire a few billion dollars from the congressionally approved economic stimulus package to provide

> restitution to these concerned individuals, groups, organizations, and cultural practitioners.
>
> Finally, there is no restitution that can heal the decades of pain felt by thousands of Hawai‘i ‘s people, pain that was caused by the actions of insensitive foreigners. The best remedial action that can be taken is for the offenders to clean up their messes, restore to the fullest extent possible the sites that have been desecrated or destroyed, and pack up and go home to their ancestral lands and do what they will there.

On April 3, 2009, Mr. Harp added the following cultural concerns via email:

> Besides what I have already shared with you, my “cultural concerns” regarding Mauna Kea astronomy development includes fear of unintentional disturbance of kahiko burials on Mauna Kea, some of which are hundreds of years old or older. Many of these are burials of persons from the highest ranks of maoli society whose iwi (bones) were carried to Mauna Kea from all corners of Hawaii for interment on the summit, the realm of Wakea and Papa.
>
> Were excavations for existing astronomy facilities, roads, utilities, etc. overseen by cultural monitors? If not, perhaps iwi, moe pu [*lit*., ‘to put to sleep with’, referring to artifacts placed with the dead], and cultural artifacts have already been disturbed by previous astronomy related development and gone unreported.
>
> I am concerned that the many toxic chemicals used by and the sewage produced by the astronomy industry have the potential of polluting of the sacred healing wai (waters) of Waiau. My concern also extends to the health and safety of the wai from our aquifer that maoli and non-maoli alike depend on for life. Perhaps the wai has already been polluted. Was a baseline study of the wai of Waiau and of the aquifer been conducted prior to astronomy development?
>
> The wekiu is almost gone and further disturbance of their habitat could eliminate them altogether. Who is responsible for this, and what is the plan for wekiu population recovery?
>
> I am concerned that there may be further desecration of this sacred site from continued astronomy development. How does one go about stopping the destruction of one’s place of worship? Would the astronomy industry build facilities on sites of religious importance to their culture?

I am concerned that the astronomy industry is robbing maoli, and non-maoli who respect maoli culture, of their enjoyment of life. In what seems like a never ending cycle, we must put our lives aside to defend and protect our sacred mauna. When will it end...

Section 7 Summaries of Kama‘āina “Talk Story” Interviews

7.1 Talk Story Interviews

Kama‘āina and *kūpuna* with knowledge of the proposed Projects and study area participated in “talk story” sessions for this CIA. The approach of CSH to cultural impact studies affords community contacts an opportunity to review transcriptions and/or interview notes and to make any corrections, deletions or additions to the substance of their testimony. CSH employs snowball sampling, an informed consent process and semi-structured interviews (cf. Bernard 2006). CSH attempted to contact 58 individuals for this CIA (see Table 5, above); 30 responded; and 14 participated in talk story interviews. To assist in discussion of natural and cultural resources and any cultural beliefs and practices associated with the Project areas within the larger context of Maunakea, CSH initiated talk story sessions with questions from the following broad categories: Gathering and Hunting, Ritual and Ceremonial Practices, Freshwater and Marine Resources, Burials, Trails and Cultural and Historic Properties. Presented below are brief backgrounds of participants’ “talk story” sessions and their comments and concerns about the proposed Project area.

7.2 Acknowledgements

The authors and researchers of this CIA extend our deep appreciation to everyone who took time to speak and share their *mana‘o* with CSH in talk story interviews and in brief phone, post or email consultations noted in Table 6; including contacts who opted not to contribute to the current CIA, but nevertheless spent time explaining their position on the proposed Projects. We request that if these interviews are used in future documents, the words of contributors are reproduced accurately and not in any way altered, and that report preparers obtain the express written consent of the interviewees.

7.3 Mr. Arthur Mahi

CSH interviewed Kupuna Arthur Mahi in his Hamanamana home on December 3, 2008. Born July 5, 1933 in Laupāhoehoe, North Hilo, Kupuna Mahi is a pureblood Native Hawaiian who was raised in the traditional Hawaiian way of life. His maternal great-great grandfather was Kuakahela, who was the *konohiki* (headman) of Ka‘ūpūlehu Ahupua‘a when Kuakini was the governor. As a baby, he was given in the *hānai* (adoptive) custom to his maternal grandfather, Keaua Kuakahela, who was born in 1870 and skilled in Hawaiian beliefs and practices. Kupuna Mahi was chosen by his grandfather to carry on the knowledge of Hawaiian culture.

A former *paniolo* (cowboy), he worked for Hu‘ehu‘e Ranch in the 1930s to 1946. In 1947, he was drafted in the army. Kupuna Mahi was stationed in Korea, Lebanon, Philippines and Vietnam, among other places, and was a member of the military police. Married to his wife Theresa for 55 years, Kupuna Mahi has 18 *hānai* children, including his own. He is knowledgeable about traditional fishing, trails, native plants and other Hawaiian cultural resources, beliefs and practices.

When CSH asked about Maunakea’s cultural resources and sites, Kupuna Mahi noted that Lake Waiau is a pristine alpine lake that was reserved for the *ali‘i* and is now being used by people who wrongly believe that it is for healing and cleansing. He stated the lake should be kept free from contamination as it is a source of pure drinking water:

> Cleansing is only for *ali‘i nui*, not for anybody cleansing. No healing the water will bring them. It only dirties the water. We know when people use the lake to clean themselves. It’s not good because it’s people’s water. The water goes down to the ocean, and it is clean water. All the mountains water comes from up there.

Kupuna Mahi stated that it was obvious when visitors use the lake because of what they leave behind:

> People are there because of the green scum bucket they leave there. Lake Waiau is sacred for *ali‘i*…not for any Tom, Dick, and Harry. On top of that, they throw a lot of rubbish in there. People don’t care…they come and do their thing and think it’s theirs. But it belongs to people in Hawai‘i. It isn’t theirs unless the *kūpuna* (grandparents, ancestors) say so.

When CSH asked what he thinks about the proposed TMT Observatory Project, Kupuna Mahi emphasized the sacredness of Maunakea:

> The mountain is sacred, but people like UH is supposed to care for it. But they don’t care for it. The mountain is our *kupuna* (grandparent, ancestor), it is a man mountain. We use the mountain as a guide for us, that’s why we call it our *kupuna*. No do nothing. No add anymore. The hell with scientists…they *nīele* [inquisitive, nosy] somebody. They probe and look…see? We like no more nothing. As a *kupuna* of Kona, no like. I don’t care what people say, put back the mountain like it was. Clean it up. Put [the] mountain like it was…I don’t like observatory on top of the mountain. Leave the mountain alone.

Upon hearing the details of the proposed location of the TMT Observatory Project on the Maunakea Science Reserve area, Kupuna Mahi stated:

> There’s no scientific area. I don’t want to see anything on that mountain. Enough already! Tell scientists go somewhere else; go China, Russia, someplace else. Why here? We like our land free, free from junk. We like our land to be free, and leave our animals alone and stuff.

He suggested that the telescope could be put on the mainland and other countries. Kupuna Mahi also discussed how the *kūpuna* of Hawai‘i did not give their permission for the other telescopes to be built, and whatever financial windfall the telescopes were promised to bring has never materialized:

> Put the dome in the mainland. People of Hawai‘i didn’t give permission. *Kūpuna* did not give permission. The young ones did it, and they didn’t get paid. And now they get mad. They say Hawai‘i gets money, but I stay here all my life and I didn’t see any money. That’s why I don’t believe.

Kupuna Mahi noted the glaring obtrusiveness of the present buildings on Maunakea and again firmly stressed his opposition to the proposed Project and the role of the mountain as a guide for people:

> For me, I don’t want any more telescopes. The ones on top ruin the mountain. Now Sierra Club is eradicating our animals. They are paid by the [former] President Bush. Send them back home. They are killing our sheep, our goats, whatever. They no care where we get our food. The mountain is no place for anybody to put anything on top. Stop making everything worse. We are guided by the mountain, when we are out in the ocean so we know where we are…the mountain is our *kupuna*.

CSH contacted Kupuna Mahi on March 11, 2009 regarding the changes in the Project description. Kupuna Mahi replied:

> No way Jose…the mountain is not their recreation. I pity the mountain. It doesn’t benefit us; it’s just the agony of defeat. Go take it someplace else. Leave mountain alone. Put it [telescope] someplace else or somewhere else, on the mainland, China, or Japan. Hawai‘i is small. We don’t need problems.

Regarding the presence of current telescopes on the mountain, Kupuna Mahi stated:

> When people come to Hawai‘i, they come to see the real Hawai‘i. We used to talk to the mountain. But now, there is a barnacle on the mountain.

7.4 Mr. Kalikokalehua Kanaele

Mr. Kalikokalehua Vernon Kanaele was born and raised in Hilo on July 28, 1949 to Ms. Verna ‘Āina. Mr. Kanaele is a cultural practitioner and activist. Mr. Kanaele has been involved with many of the past issues concerning Maunakea and continues his traditional cultural practices throughout Hawai‘i. CSH conducted an interview with Mr. Kanaele on February 13, 2009 in Pāhoa. When asked what Native Hawaiian Organization he belongs to and their association with Maunakea, Mr. Kanaele stated:

> The organization was called Kaulana Nā Pua, it was between 1977 after they killed George Helm. Aunty Edith Kanaka‘ole changed our name to “Kīhāpai o Lono.” From there we went into the Hale o Lono teaching which was *makahiki* [yearly]. Because of the set up of Kaho‘olawe we decided to use Lono. Every other one if you make mistake, you get cracks. Lono going to give you couple slaps but get back on trail and do this, he is not going really give cracks. We are always approaching our issues that way. I would say we have been taking care the first part of our people like the *keiki* [children] and *kamali‘i* [progeny, children or royal children] because we have eight generations in our whole society, *keiki*, *kamali‘i*, *‘ōpio* [youth], *mākua* [parents, uncles, aunts, etc.], *kūpuna*, *kua* [generations back], *ka ‘elemākua*, and *ka ‘elemākule* [elder generations]. When you talk about the *maka‘āinana* [commoners], it is *mākua* [parents] and *kua* that is the commoners. That is the PTA or Parents Teacher Association. They are

going give you free. What is *mākua*? So you understand that in our society we not talking some feudal nation, we talking *'ohana* [family]. You confuse us by saying, "You feudal with the other guy, Kamehameha…" It is all kinds of separate jurisdictions within our societies. This is our main society which will take care of all that. So when we look at it that way, then we can understand "civilization." Those five things that create "civilized nations"; clothing, shelter, health, food, and education—that's prevailing then.

In our family structure they set up their "*hale mua*" [men's eating house] up to their frozen food section and the teachings of our gods and goddesses and the separation of land to "*nā wao*" [the realms] systems. *Nā wao* hook us in where *ahupua'a* makes borders. *Nā wao* take us through the elevations to the spiral to the very top (referring to Maunakea) and come back down. And they make the wider spiral and finally going around the world. Like how we did in the beginning when you follow the stars and you want to see how everything just comes back to our creation story (Kumulipo).

What our real job in this whole thing is all about and the interruptions that has happened to our people and the other people which is our *'ohana* too. It took us that long, we had to go away from a whole teaching and then go to a Christian story to understand where we are standing right now and what our job is and who everybody is compared to how it was before. It went towards a different kind of creation story, you know, got to watch the movie cause she made us bite the apple and our older brother jealous of us and like kill us, all this kind things. That is not conducive to a paternal kind of teaching to a maternal kind of teaching. The guys only confuse and abuse, so when we look at all of this go back to what they are doing up there on that mountain. To that altar, *ka mole*, we tap one prayer what we are doing up there. Like try do them one by one down here, lean the *heiau*, no can because too much. You would need the whole *'ohana* for do that. Everybody who lives there got to understand what they have to do in their area. If you do the prayer from the top you can clean up from going down and this way come up. You clean them that way. When you do them that way, you do assort. Sometimes you have to use rainbow, I call it combined prayers of the four directions.

'Īo ka lani nui a maomao, *'Īlalo'ole* [those that sit supreme in the heavens] those people up there are going to come and give us this *mana*. The peoples of our *'ohana* are going to come to us. When you come up there when they looked up they going see the rainbow. The culture committee OHA grumble with me taking up *nānā* [observations, attention]…Natives of their…Hawaiians is a political term, *kanaka* is our race. When they make our nationality our race that is where the brain wash is. You can circumvent our whole political system right now defining us as Native Hawaiians. There are no such things, like Native Americans. Americans are a bit fiction with all these rules. What? You have to make us one fiction too in order to have jurisdiction of our minds. How they call

it? Subject matter, jurisdiction. If you believe that to be true then it is, but if you question that you’ll find it’s not true.

Mr. Kanaele shared his *mana‘o* (thoughts, beliefs, theories) about the early issues of Maunakea and how the native activist would react:

In the 60s, but everybody was behind that. Because it was not polluting and all of that kind of stuff. I can’t say everybody was behind it. The mana‘o of the activist at that time was it was a sacred mountain. We participated that time in questioning what everything was. In the 70s it is just building this whole mechanism.

I used to live on the University of Hawai‘i. My father became custodian in 1955 so we moved up there and we stayed at the University from 1955 I think he retired in the 70s, but during that time they had many things happening. Astronomy was just beginning; you know they had their astronomers’ right there by the Gym. They brought down the big telescopes and you set it up there and you look from right there. It was not up Maunakea. During the [19]60s, I think that is when they planned all that [referring to present site of Maunakea]. In those days, most of us were pretty well brainwashed. I could not see and understand what was happening around us. Nobody really questioned *aloha ‘āina* [love of the land] things. Maybe a few people, like the Aunty Peggy and Aunty Emma, they were always watching at that time. I met them through the hula things. I used to dance for my Aunty in the earlier days.

Well, they couldn’t at that time because you have to remember now, Christianity, we were just coming out of the Sunday thing. We could just buy liquor on Sunday. What we are talking about here, they probably talked soft kind inside the kitchen [whispering]. The kids could listen but who understood? And then we would come in and then they would speak Hawaiian.

So you know this movement has been going on a long time. Before we were born and back then what happened was only certain people whole them because we talk to loud, you could lose your business, your house could burn, if you had wooden house, you have to watch your house, until the Hawaiians make their own gangs control their own underground things and then started to nail these people back that they created law against that kind of things. Before you could do because never have law at that time.

Finally the *kūpuna* went to Statehood just because of the clinic things they had no control of the diseases that were brought here. So once we became state then we have this whole structure for watch out for our kids. Before never have nothing. But the deal from that day to now they never understand the price they had to pay for that. That our ocean [is] now from a healing ocean was turned into something that can kill you. Not because it gets rough because of the staph and mutated staph on top of everything that they went put there. By us not paying attention to *aloha*

> *‘āina*, oh we were too busy working for them that we never understand that! This stuff going come up out 20-40 years from now, they say, “I no care that happened 20-40 years ago.” Who is going to be around to say, “Oh that was us.” They never even care if it was their kid was the one who catch the staph and die. They never know it was going to be that way. The only guys who knew were the guys who made something like the EIS, which is why the EIS is good to have it now. They no can pull the wool over your eyes.
>
> They had no means, they had no *mana* until they go over there and make those guys *mālama* [care for] the *kūpuna* bones then they get burial council. All of a sudden they had power. They never had power before. Why you think we had to do that? Because they had no power. Well, we finally blew up! It took us long time. To learn all these things and have our people out there to set up these things to bring us eleven guys over from Big Island for do this stuff. You know how much that cost? Lucky thing we on Kaho‘olawe so we can set up and get all the money and jump on the plane. We no care, main thing we show our people you can win that way. When they flew over Kahana Valley, they had enough *kūpuna* and *‘ōpio* [youth] and the *keiki* [children] over there to stand up and say something. Before they had to fly us around to do that kind of stuff.
>
> But this Maunakea issue is not like that. All our people say, “ENOUGH ALREADY.” I don’t know which part of enough they don’t understand. Enough already! Do good now. Do good with what you get and then maybe later on ask the next generation and then be that good steward you would not have to worry about nothing of this. Questioning your integrity or your honor. We not supposed to do it. UH is supposed to be teaching that stuff. What is going on when it becomes like this? When Ali‘i O Nā Moku said, “Education to desecration isn’t education at all.” That is what we are talking about. Now you are going take them away all the way there to our people, that are not important enough. What is that? This plantation stuff we just finished that, Big Island just finished that going through that whole thing. Some people you going do that to, you going rub them wrong they going smile at you and stab you as soon as they can find one weak spot in you, your dead, and good for you, cause what you got to come see people like us for help heal you.

When asked about his involvement with the Royal Order of Kamehameha, Mr. Kanaele responded:

> I just finished doing Kea‘au and we was living up in Mountain View. Kealoha came over and at that time this *kahu* was living with me from New Zealand, Rotorangi Kaulua Porangi and she came to see him and talk to him about Maunakea and her experiences up there and what she has seen and her visitations and all kind of stuff she has experienced. She was asking us for help on what can we do about it. So finally, they look at me. The buck stops here, once we going do it there is no turning back. Once we start we cannot stop. The first thing we have to do is join the Royal Order of Kamehameha because up there is sacred. That

> belongs in the realms of the gods. The only guys I know that really go up there is you got to be chief, *kahuna* [priest, expert, specialist]. Rank your blood get in there and the only people that can rent is your blood is these people. Because from the Kingdom time if you look back there when number 5 put this in he put that deliberately, he not only made the commitments, he brought all the chiefs. Even the banished ones he brought back in under the order. So all the families now are back in under him, because his great was not through might, his great was through eight generations alive and kept him going until he died, then have the sicknesses. He had control over the sicknesses until he make. As soon as he make, everything just went broke. If you notice in history, the *kapu* was broken. You couldn't control them that way, but you could understand that this one comes from this area, and that one comes from that area. We are all *‘ohana* we the Hawaiian race.

When asked about any ongoing Native Hawaiian traditional cultural practices on Maunakea, Mr. Kanaele mentioned:

> Ceremony and *kahuna* practices and whatever needs to be done now! In this time with whatever is left for us to use. Our ancestors' say, "They so happy to see us." They don't care how we come…just come!!!!! Come home. We your gods!!! It is not scary kind. We no need scare ourselves. This way we all family again, the *kānaka*. Our *kūpuna* had to doom their way in order to save our people from becoming cheating our friends. When we look at this whole thing we look at them as friends who stole from us. When we joined the Order they never know who we were. When I started to explain to them, he goes, "Ah, aaaa…" Then we brought some of the practices back. The Christian all get crazy. I explain no, look at it as a friendship kind of thing.

Mr. Kanaele shares his *mana‘o* on the myths and legends associated with Maunakea:

> To the rest of our *‘ohana* that is the only mountain. Everywhere or any place you go the highest hill is Maunakea. The second highest is Maunaloa and then you go around the world. That is our sacred mountain. It is a male mountain with many females. If you know already that is good teachings, creation and pro-creation. On the female mountain would have male gods on their mountain for the balance. The way I always look at our culture is as ‘ohana. We have to resist when they try to bring that other mana‘o in like the feudal thing. We need to claim our lands and Maunakea all our mountains. Once I went into the Royal Order then I understood the different duties of each office, the *ali‘i okana* [district], he creates the *konohiki* [Headman of an *ahupua‘a* land division under the chief side], my office creates the security part this is because of my genealogy of Ke‘eaumoku guys, I can actually right title.
>
> Who the god up there? Kāne, but coming up there Kū is around then Lono, and of course and out to the deep blue is Kanaloa. Where as you go up the place then going get *kanahelehele* [forests] to the *kini akua* and then on top of that is Kāne. The priesthood of Kāne and then the dog guys and then all these people. Why they call them dog guys? Because they wear dog skin, cause cold up there.

When asked about any concerns he may have on potential impacts to traditional cultural practices that may occur due to the proposed development, Mr. Kanaele stated:

> Before I went up there, it always symbolized everything. When I left here to go to American and came back. That mountain was imprinted up there…*po‘o* [summit, head], when it got lonely or funny, it was there, mean. It brought me home. I could feel myself come home too. That is how heavy that place is. After I went up there then I understood what that experience was all about. Going up there, we went up there like shining nights in white armor we going save the mountain, all we could was go up there and cry and ask talents we never had. So we could understand to do in the correct manner and correct protocol to explain Maunakea. To explain any place we needed to focus on. Then we understood *aloha ‘āina*.
>
> My concerns are in the last EIS, substantial and adverse impacts. You have to falsify some kind of documents in order to kill this. We are dealing with one aquifer and all the waste is going into that aquifer. The mountain itself is a great filtering system; inside of it has a hose that represents rivers underneath and on top. The melted ice and rain, all that seeps right into the aquifers and then down to the rest of the *‘āina*. Maunakea is blue and Maunaloa is red. So you can see where the water goes. They are tampering with the main source of our water.

7.5 Mr. Kimo Keali‘i Pihana

Mr. Kimo Keali‘i Pihana was born in the small town of Wahiawā, central O‘ahu, on October 22, 1942 to Mr. Eddie Fabian Pihana and Mrs. Keali‘i Pihana. Mr. Pihana and his wife Leila Terouru Tarere Taina Pihana moved to Hilo 20 years ago. He is a retired OMKM (Office of Mauna Kea Management) Ranger and has retired from the United States Army. Mr. Pihana is a member of the Royal Order of Kamehameha ‘E kahi, Mamalahoa, Hilo Chapter, a voting member of the Office of Hawaiian Affairs, a member to the Ruling Chiefs of Hawai‘i, Pu‘u Kohola, and a member to the Kingdom of Hawai‘i #10000138. CSH conducted an interview with Mr. Pihana on February 4, 2009.

When asked about his work as a cultural practitioner, Mr. Pihana commented:

> As a cultural practitioner, my title was given to me by the Royal Order of Kamehameha ‘E kahi, Māmalahoa Hilo Chapter, as Kahuna Kuhikuhi Pu‘uoni, caretaker to all of the shrines here in Hawai‘i *nei*, not only on the Big Island but throughout most of the islands here in Hawai‘i *nei*.
>
> I have been able to work with all different Hawaiian Groups here like the Nā Ali‘i O Hawai‘i Nei, the *wahine* group [a local chapter of Hawaiian women associated with the Ali‘i of Hawai‘i] and the Ka‘ahumanu Group [‘Ahahui Ka‘ahumanu Hawaiian Civic Club]. I have participated in a lot of Hawaiian activities throughout the years, like Kamehameha Day, the lei draping ceremony of the new Statue we have here in Pi‘opi‘o, sponsored by the Kamehameha Alumni Association. Other places throughout the island like ‘Ahu ‘Ena in Kona, the residence of Kamehameha and the place of his death is where we do a yearly

retreat and workshops to bring awareness to the general public and to our people. We need to honor our ancestors and be part of a group that is still able to be proud of [who] they are and yet continue my education by going back to College today; learning who I am and my culture by going into areas like Waipi‘o Valley. Doing arts and crafts with our children and general public at Pu‘u Koholā. I practice weaving with *ti* leaf [*Cordyline fruticosa*], *olonā* [*Touchardia latifolia*], and *lauhala* [*Pandanus tectorius*]. I learned different *lā‘au* [plants] at times throughout my life by people like Papa [Henry] ‘Auwai. I still have a lot more to learn and that is one of my reasons for going back to college.

My mentors on this island when I moved here, was ‘Anakē Pua Kanahele, ‘Anakala Ali‘i, Arthur Mahi of Kona, Ali‘i Ernest Akoni of Hilo, Papa Akau of Kawaihae, ‘Anakē Maile Akim Siu, and ‘Anakē Ahuna. Kupuna’s here in the Hilo District. Also I have been working with many other elders, throughout Waimea, Puna, and the Ka‘ū district.

Mr. Pihana shares his thoughts about his work and association with Maunakea:

Back in 1997 I was already a member of the Royal Order of Kamehameha. We were asked to resolve some of the issues that were being brought to our attention and we needed to find out how we can help as far as being able to bring awareness of protocol and respect to our people of Hawai‘i and its culture. We needed someone that would take the initiative to help the University of Hawai‘i understand that part of the problem of Maunakea was the cultural area was sort of put in the back seat. So, my first assignment was to of course to apply for a job and as an interpreter, a cultural interpreter. I applied and was hired in 2000 by RCUH Mānoa after about a year as a Nānā ‘Āina [one who oversees the land], they asked me how we can make it so that…because they didn’t have any job position and stewardship So we came up with the idea of a program today known as their Rangers of Maunakea. It is not federal, it is State [run] by the University of Hawai‘i. We are secondary enforcement for health and safety, which is a program I have built from the ground up. We created many new positions such as employment that would bring interest of our local people that are now in high school and college to look forward at something they might be able to get a job in to work up there—a job to work on the mountain. First of all we had to come up with ideas on how can we generate interest in our people because not everybody was happy with what was going on top of Maunakea.

The kua‘āina are the people of the back land, the original inhabitance living on this island all of a sudden became hurt or you might say angry because they know that there was some restrictions to the mountain and they did not know how to approach the development and the University about the top of Maunakea. My position was to bring awareness to the University of Hawai‘i, meet with the board of regions, Chancellor Rose Tang, and meet with newly created Office of Maunakea Management, Kahu Kū Mauna. They are cultural advisors to the University. We can then voice our concerns, because many time people were sort

of reluctant because of it being a State position and citizenship. For myself, prior to getting a job on the mountain, one of the last questions was asked to me by the person who was interviewing me for the job was if I was an American citizen. The answer to that was and is no, I am Hawaiian citizen first and yes I am American citizen also because of the change from territory to statehood, I am in a position to say so. And we have excepted changes today, but we still need to know that our kuleana [responsibility] is to remember our ancestors, our genealogy, who we are, where we come from and things like this and how can help even the local people understand what responsibility they have when they go beyond the realm of wao kanaka [an inland region where people may live or occasionally frequent]. We need to understand wao Lono and also wao akua [a distant mountain, inland, often forested region, believed inhabited only by spirits or gods]. Many of the scientist[s] and people that I know today have a better understanding of the spiritual connection that everyone has, not only the Hawaiians, but many nations that come to Maunakea have a much deeper respect and learn a better responsibility of leaving their ‘ōpala or rubbish all over the place, a program which keeps an eye on that. That was part of our creating of this new Ranger Program they have today and also help our visitors and local people so they don’t get into trouble when they are up there and most of them understand protocol much better today.

We have created different stages of the mountain so people who cannot get to the top can give their respect to the mountain at Pu‘u Huluhulu at Hale Pōhaku at the 9,000 foot level. I think by this way we have satisfied them at least at some part. The other part of my job and my responsibility was to bring the telescopes back down to the level of the people. In the year 2001 I asked a few of the people who had their own personal telescopes if they don’t mind coming down and do a star gazing program at the yearly Makahiki festival we have here in Hilo. I had good cooperation from observers and astronomers from Gemini, Canada, France, Hawai‘i, University of Hawai‘i, and some people from the visitor’s station and set them up in Keaukaha at Puhi Bay and we had quite a bit of people. That kind of brought about a new program into the University System of creating another position of people that would contribute their times and efforts doing outreach to the schools. It helps create the ‘Imiloa Astronomy Center in Hilo. Today people who are not able to go to the top of Maunakea can enjoy the idea of science and culture right here at this level, here in Hilo at the University Park area, this way people don’t feel being left out. We have been able to satisfy all nations not only the United States, Europe and Asia, Hawai‘i has made its place in astronomy and science world doing work out there in space and the discovery of new planets and stars educating our people so that we can learn how to utilize our idea of science. Science doesn’t really work unless you can apply it especially if you are going out into space and they want to colonize other planets such as Mars and mahina [moon], the moon.

So the future generations are very near of colonizing other areas outside of the planet earth. Preparation and engineering and education play a very important role. Today most of the observatories out there are at the edge of the universe utilizing their entire antenna, mirrors, and their data information on how to discover sounds and asteroids, which there are the possibilities that there may be another impact of an asteroid coming to this plant. If that problem occurs they should be prepared to divert an asteroid utilizing their science, skills, and scientist to divert it so we don’t go through another big impact that would create devastation on this planet.

Humans can continue to survive on planet earth and maybe even colonize other planets. Luckily the Ranger Program was in place we were able secure and bring those people back in safely. Without that Stewardship Program in place a lot of people would have gotten injured—people getting hurt needing medical attention or medivac off the mountain. We had two people die out there. All rangers are required to become First Responders. You must attend several special classes on how to be good international interpreters not only local. Hard work and a lot of studies, a lot of care, keep yourself spiritually connected, mentally awake, and you have to be almost like being “Maui’” because you are protecting not only Papahānaumoku, but Wākea. You are looking at the heavens everyday and every night. You kind of get to know the real meaning of how it is to be up there. It gets lonely; it gets very close to the Gods and goddess that exist out there. It gave me time to reflect back because this is where the Kumulipo starts. Today I am retired, but I have all my Kumulipo intact. I am still doing more research. I carry one of the biggest charts on the genealogy throughout the islands. It help me grow a little bit better with the understanding on why I was asked to go up there and help the people and the University of Hawai‘i understand much better on who we are. I help to create a DVD, “The First Life.” I also help create the new “Mauna Kea Guide to Hawai‘i’s Sacred Mountain.” I was asked to share my *mana‘o* in the forward of the guide. I was able to help create that book and the film by PBS and today it is one of the biggest selling items on the mountain.

I will share my mana‘o with you, the following comes from the forward from the Mauna Kea Guide to Hawai‘i’s Sacred Mountain:

Welcome to Hawai‘i’s sacred mountain, Mauna O Wākea. Visiting Maunakea is an adventure; one that allows us to step back in time in realm of the gods of the Hawaiian people. In the stars astronomers can trace the ancient history of the Universe, but we Hawaiians go to Maunakea in search of our *mana* or divine power in a quest to understand our ancient spiritual connections. On the mountain we can feel the close relationship between heaven and earth. People of many nations say that it is a sacred place for them where they experience awe and reverence as we do. As a Hawaiian cultural practitioner and care taker of the mountain I am often asked on how visitors should conduct themselves on Maunakea. I suggest that they say a silent prayer take a general moment for

> greeting the mountain and then walk with respect on our sacred place of worship. I share how we must *mālama* the *‘āina* or take care of the land, take care of people and preserve the culture. We Hawaiians are fiercely proud of the accomplishments of our ancestors who navigated the vast Pacific Ocean by the stars, a thousand years before Galileo first pointed his telescope towards the heavens. Maunakea was a land mark for ancient navigators and is today a center for that revolving science of astronomy as we scope our place in the universe. As a Ranger on Maunakea I have enjoyed working with many astronomers who are generally people of goodwill and from whom I have learned much about the stars, but despite all of their accomplishments I do feel that much more needs to be done to bring awareness of and respect for Hawaiian culture on the mountain. Science does play an important role in people’s lives, but it is not everything. A spiritual connection is just as important. This is symbolized for the modern Hawaiians by the humble stone and wooden *lele*, the altar at the summit. I welcome you to Maunakea also known as Mauna O Wākea, the mountain of the God Wākea from whom all things Hawaiian are descendant. Here you may experience and enjoy beautiful sunrises, sunsets, and evening star gazing under the northern and part of the southern sky. Here too are preserved many magical wonders of the Hawaiian Nation we all need to continue to perpetuate and protect this land as well as the legends and mythology passed down through the ages for our own and future generations. We must all continue to be good stewards of this sacred mountain.

When asked about the amount of telescopes now on the mountain, Mr. Pihana stated:

> I am not a scientist, but from what I have gathered from all the years of working with all of the top scientist of the world, to include NASA and other exchanging of ideas from other scientist, the bigger the better, but when you look at it from a local Hawaiian perspective living here on this island, again we are going into the womb of what we consider sacred on Maunakea. My idea of no more development is no more development on the mountain period, is my *mana‘o*. I might get out-voted, that I know, but if I do at least I have made my testimony so that we cannot curve this idea of development because, one of the things they are saying is they are creating jobs. Not everyone will be able to work up there. You have to be very healthy and conscious with high education requirements.
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> We have many local people on Maunakea as of now, maintenance, custodians, cooks, security, and at the Visitor’s Center we have many young Hawaiian people, and a mixed group of people, but we also have people in the observatories that are engineers, technicians, plumbers, observers, and controllers of the telescopes themselves; many operators that work at the lower levels in Hilo and Waimea. Some of the astronomers don’t even go to the mountain. They work from their air-conditioned offices in the lower part of the land and also connected fiber optic to Maui. What it does is it keeps us abreast of what is really going on in space and the progress that is going on today as far as new discoveries of stars, planets, and finding out that Pluto is not a planet.

As a young person when I was growing up we always looked up in the heavens and see the twinkle of the stars, today I look at science and they took the twinkle out of the stars. They kind of took the romance away. Just imagine, colonizing the moon.

We have a connection to Wākea the heavens; many cultures have spiritual connections to their highest mountain and Maunakea is one of those places. What are we going to gain or what how is it going to help people that live on this planet—if there is something that we don’t know. If there is that they can come back and bring back from out there that could probably replace oil. We don’t know. Science has taken it many steps further and drawing water out of rocks. That is part of their project that they are working on right now.

Other programs are utilizing the use of minerals that could replace fossil fuel here on this planet. We don’t have all the answers yet, but then imagine colonizing another planet. It will not be an easy chore. Many people won’t be able to make that journey and some will fail and of course some will come back. We have already seen that happen in our time where we have lost quite a few of our astronauts.

Onizuka was a local born astronaut is one example. He dared to go out there and ready to lead and of course he did open up a lot of doors bringing awareness to the people of Hawai‘i. From a young boy growing up in Hawai‘i become one of the first astronauts to go out into space many times until that accident.

Mr. Pihana spoke about his cultural associations with Maunakea:

My cultural association with Maunakea is when I first put together the Royal Order of Kamehameha to greet Princess Saiaku of Japan and their emperor to Maunakea. I had to go through the Japanese Embassy in Honolulu to assist her and to recognize her because of her diplomatic and very high position of government with Japan and Hawai‘i relationship. We put a group of people together especially the ruling chiefs and chiefs of Hawai‘i to be present when she arrived at the Visitor Center, at the nine thousand foot level. We were able to greet her and let the University of Hawai‘i witness that the people of Hawai‘i were interested on what is taking place on the mountain. There was a slight indifference on how we were going to do the right thing in protocol and respect to foreign visitors such as the Princess. We have also had visitors from the United Kingdom who visited. There were other dignitaries such as Prince Phillip and other countries that needed to make a presence on the mountain. The people and the chiefs of Hawai‘i are ready and willing to protect this mountain and to help our *kūpuna* understand that we have not forgotten about them [and] to teach our future generations as far as being able to understand. After all the development was already in place and now we needed to get to work and understand on how we work together much better than against each because it is very important that we be diplomatic and be the ambassadors to the people of Hawai‘i and for those

who cannot go up there. I have had a lot of *kūpuna* that were afraid to go up there because they believe in the old system. That the mountain is under some kind of *kapu* or restriction and they did not want to break that *kapu*. So, it took a lot of meetings, conferences, and work to finally get the word out to the people of Hawai‘i that if you take certain ideas and learn the proper protocol to approach this high mountain not only of science, but of sacredness and the spiritual connection to our Kumulipo and to learn more about the significance of why it is important for us to help in the preservation of this area and leave it in tact and not build another city of some type on top of our sacred mountain. There have been many different articles in the newspaper that say, “There is too much on the mountain, too much rubbish, too much tourist on the mountain, and the foreigners are to blame for all the *pilikia* [trouble] out there.” We are all involved in this; astronomy is nothing new to the Hawaiian people. We are navigators of Polynesia; we are on the ocean and on these islands prior to western contact and Captain Cook. So navigation on the ocean, the Polynesian navigators is still one of the best in the world today. This is another giant step if we become involved and become partners then we become of the work that is now available so that our children will become educated. We tell them to go to school get educated; after you get educated you are standing in the un-employment line. We want to make it available so it can reach out and touch many different people even those with disabilities.

I fortunate that I was able to finish up my time on Maunakea with honor. I have been there eight years and have retired from the University of Hawai‘i Mānoa system. I received my retirement gathering by all my bosses and I collected all the different ideas of how we were able to come this close. Some of the comments I was given by Ed Stevens. When he first set eyes on me on Maunakea, he was scared. Others said I was very intimidating. That is the role I had to play to bring to the University some kind of awareness, that—hey, we are still alive, we are still here, we demand respect, and we need for you people to understand that we need a plan and better program to bring not only awareness and education, but bringing people from foreign lands to come and visit that the mountain is considered very sacred like all high mountains!

The development that is what there already, we need to understand whatever data collection and information they are getting from all the work being done up there happened a long time ago. Astronomy was introduced into the islands during the time of King David Kalākaua. He had one of the first observatories and telescopes set up for him in Honolulu by Dr. Forbes of the United Kingdom. So here we had another government at the early time, United Kingdom, Great Britain, today that is why our flag has part of the UK emblem on top of our flag. We were subjects to the United Kingdom at one time. Today of course there is a different government in place and we still respect the United Kingdom as part of our government in existence until today, but our citizenship today of course has been changed to the United States of America.

> I myself did my testimony for the thirty meter [telescope] development and I have also been accused many of times of being a traitor to the culture and I think I have proved many people wrong, because I lasted all the way to my retirement. I help to create many good jobs and brought awareness throughout the world. Not only in Hawai‘i by working with and along side, not agreeing to everything they want to have done on the mountain, but how to better take care of our *‘āina* and respect the culture so that we have people just trampling out there and removing some of the *pōhaku* [rocks] that you are not supposed to take off, but then we still do have people and work alongside archaeologist from Bishop Museum, Pat McCoy, and the State Archaeologist who have been working out there for about twenty or thirty years and have collected a lot of good information. We have protected the burial sites much better, we know where they are at and of course we don’t want to see any more development up there. That is my *mana‘o*. It must go through a process of muster.

When asked about his knowledge of burials and burial practices on Maunakea, Mr. Pihana mentioned:

> The burial grounds are much further out than that area, 13 North they call it, but even then it is too close to our *kūpuna* and early caretakers of the mountain have been put up there, some of our ali‘i are buried up there. It would really be another hurt or you are going to put more salt on the wound so to speak and I don’t think our people are going to accept that development. You are going to have a bigger protest than ever because of that, other things, because of conflict of interest out there. When it comes to who we are and employees to the employer that if we were to disagree it would be a conflict of interest, and many of local people of course, even like myself, were threatened with termination if we don’t agree. For example, the removal of the *kuahu lele* that sits on Pu‘u Wēkiu was a destroyed that didn’t like to see that shrine up there at one point. I was responsible for helping and placing that shrine up there. The other part is that once found out, they were probably angry that were wasn’t going to be accepting some of the changes out there, the only comment I had when I first comment when I first started working for the University that if they are going to renovate or they are going to improve that they stay within the imprint and footprint they have now and not go any further outside of that. I believe other project failed to come about and that was the Keck [Observatory] who wanted to put outriggers out there, which did not happen.
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> Early development where one of the observatories was on top of Pu‘u Poli‘ahu, prior to me working at the university that observatory was removed brought down and taken off Pu‘u Poli‘ahu I had brought the new established Office of Maunakea Management, Office of Hawaiian Affairs, Civic Clubs, and many other community leader, and other local community leaders to close the road to Poli‘ahu. Today there is only a trail and the only way to get up there is by walking. No vehicles allowed on top of that mountain. No vehicles allowed at the Lake. No vehicles allowed into the area where we consider where our burial

grounds are. Pu‘u Māhoe and Pu‘u Mākanaka, those areas are off limits even to hikers.

Yes, ashes are still being taken up there. I have a lot of people, non-Hawaiians also that have somehow got up there and distributed their family’s ashes which is, at some time for me, it was hard that have left ashes. People bring all kinds; they even bring their ashes of their pets and animals up there. We can tell by doing the research and looking at the bone and teeth with some of the archaeologist and scientist out there. The biggest one I have seen brought up there by the Visitor’s Center was a horse. It is on one of the Visitor’s Centers, not the University area, the area that is under the control of Department of Land and Natural Resources. So there are some areas that DLNR has appreciates the fact that we are there and that the caretakers are on board and Stewardship Program is on and the Rangers suggesting they might take it someplace else. I had family members and people bring falling warriors from Iraq, Iran and Vietnam and even going back to Korea.

Hawaiians bring their ashes up and distributing it in areas and holding their vigil. These are some of the things that are hard to control and stop. We don’t want to see full body kind of ceremony and ashes goes back to dust. Once it is mixed in with the cinder, soil, the *lepo* up there we don’t see. People today are also doing at point spreading of ashes in the ocean in different areas. So, as myself as a Hawaiian practitioner I kind of look at this that is not being desecration at all it is something that we cannot avoid sometimes and other times we can discourage, but other times we try to bring awareness that the soldier should have been taken to Punchbowl and place where they know, because they are not familiar with Maunakea or maybe a family plot. We have been able to see some of these ceremonies take place and once they are going on it is kind of rude to stop it. We also many nations and leave their prayers or their prayer sticks, their flags and other things and I feel for them.

I had a group come in from Tibet and talked with them. They were a group called a climb for Tibet. So other leaders from around the world have sent some of their people to distribute some of their ashes of their family on Maunakea. Sometimes it is after the fact, they tell us later on, because they don’t want to let us know, they know we are going to stop them, but we warn them and caution them.

Mr. Pihana shared his concern about safety on Maunakea:

We have had few people to go out there and get hurt and sick. Luckily the Ranger Program was in place we were able secure and bring those people back in safely. Without that Stewardship Program in place a lot of people would have gotten injured, people getting hurt needing medical attention or medivac off the mountain. We had two people die out there. All rangers are required to become First Responders. You must attend several special classes on how to be good international interpreters not only local. Hard work and a lot of studies, a lot of care, keep yourself spiritually connected, mentally awake, and you have to be

> almost like being “Maui,” because you are protecting not only Papahānaumoku, but Wākea. You are looking at the heavens everyday and every night, you kind of get to know the real meaning of how it is to be up there. It gets lonely; it gets very close to the Gods and goddess that exist out there.

When asked about his knowledge of any ongoing Native Hawaiian traditional cultural practices on Maunakea, Mr. Pihana mentioned:

> Going back to the times of ‘Umi who had set up his shrines all over this island in celebration. By then the priest were concerned with studying the stars and navigation. Also the time of the year to celebrate the solstice and also the equinox. We were able to bring that practice up to the summit of Pu‘u Wēkiu today. So that we can seek reverence towards the idea of our ancestors leaving behind information that we could go to higher places and do the same type of work they do below.
>
> Umi was navigating the stars. The star chart, the moon phase and also the directional between from here to Hawai‘i. Today teachers, cultural practitioners visit the Lake Waiau, the place where Poli‘ahu would go into her sacred lake and be protected by her *mo‘o*. I was always thought he was a white *mo‘o*, but he is red. I have been able to see that. The placing of the human *piko* or umbilical cord, an ancient and still a practice of today—the beginning point of our people. I was able to put my son’s *piko* in Lake Waiau after I started working there and my son participated with me, he was turning seventeen at that time. I was just moved by being able by going out there and see the place clean not being desecrated, very serene. We consider this a tradition to the Hawaiians. It keeps it as a safe place for our future longevity of our family. There are many other families, generations that have done the same. Larry Kimura has his family up there; the Lindsey Family is up there. So those places need to be more and more protected and still witness in today in their life time that the practices of old still go on, do their hula, practices, and walk in the footsteps of their ancestors without getting overwhelmed by the development on the mountain.
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> We need to protect the environment up there, the animals, insects and all natural resources. We are conscious about that. The idea of being able to look up into the heaven and still be able to learn the old names of stars and constellations such as those we use in navigation. People like to go and practice at the night time too. They also need to learn to respect it more.
>
> Practices we have established in the year 2000 until today is a yearly gathering of people to go up and pay tribute to the mountain first, by going through the proper protocol from the Naha Stone in Hilo from there we stop at the Kaūmana Caves and then we go to Pu‘u Huluhulu area where we conducted the practices of setting up a *kuahu*, the center part to the island to rest and acclimate. They can leave *ho‘okupu* [tribute, gift or gratification], they can do practice there hula, and then we *kāhea* [call, greet, name, summon] from there and after that we mount up in

vehicles today and drive up to the Hale Pōhaku where we set up another *kuahu lele* where the silversword plants are located, so people again have another place to offer *ho‘okupu* and give prayer and reconnect themselves. They are going through the different realms as they come up to the summit.

People come to do their practices in the Pu‘u Līlīnoe area and other places. I have been able to work with other people who set up areas where they can go and pay their respects to Līlīnoe. In Pu‘u Līlīnoe there is no shrine, but we have seen others come and make shrine for today. Ed Steven, which is his favorite area to sit down and make himself ready to continue his way up the mountain.

Then we head up to the top and from there they can see the rest of the pu‘u as they go up, Pu‘u Haukea, Pu‘u Kea, Pu‘u Hauoki, Pu‘u Pōhaku, Pu‘u Poli‘ahu, Pu‘u Wēkiu, Pu‘u Kūkahau‘ula. From there they prepare themselves to take their journey out to the top of the summit known as Pu‘u Wēkiu. They have protocol to approach the shrine; they have protocol to ask permission to be in reverence to the area. As they gradually climb to the top of the summit they are in full reverence in respect to the elders and the idea of being able to accomplish their quest. To go up there to see what our ancestors seen and the only obstruction is the people don’t like to look at the observatories so they look towards Maunaloa, Hilo, and Hualalai. They have to come back off, when we come off the summit area, we close with prayer, *mahalo*, forgiveness, and all the other things so that we don’t get overwhelmed and many do once they make that connection. It can be exhausting and at times we need to get oxygen to them. At one point, being overwhelmed and gathered we are just glad that some of the *kūpuna* that I met, Leinala‘ala was one that called herself Līlīnoe in some places and Poli‘ahu, the snow goddess and before she passed we had a short gathering together and she said, “You know if I pass, I would like to be on Maunakea, which is where Kealoha comes in and she put Aunty up there.

Mr. Pihana speaks on his knowledge of the reverence to the *pu‘u* and *akua* associated with Maunakea:

I think it is idea to give reverence to all the *pu‘u* that is place names up there in recognition of their existence and their connection to the Kumulipo, because in the Kumulipo all of these areas on Maunakea are mentioned.

As far as we can see today, most of it looking at Poli‘ahu, the snow goddess, she comes along almost daily even though you don’t see the snow, she is there, because of *hau*, the cold, the winds, *makani*. The senior of the male side are very powerful ones, other gods and goddess that reflect thunder and lighting, Kāne. Those ideas of recognition of acknowledgement. I have done many ceremony where out of the clear sky while doing our prayers and giving our thanks to Maunakea and all of the gods and goddess that reside in this area, that are the guardians of this mountain actually appear by snowing, hail, thunder which is to me an acknowledgement from a higher stratum.

> We assemble the gods. The god of lightening, Kahekili, Ku, the stratum is straight up, Kāne, Lono all the gods. They all come to an essential point of the mountain.
>
> Their idea of marriage and birth it is also being recognized because without marriage there wouldn’t be any birth so have to continue understand that a little bit better on the creation part of man and the creation of the birth of the islands. Things like this is why cultural practitioners that go up there acknowledge all of this that was put forth before them, passed down from generation to generation, by the their ancestors. People even come from faraway places such as Borabora, Tahiti, Nuku Hiwa, Aotearoa, around the world, the Pacific Region center on the top of Maunakea. We have had other Polynesian Nations come and do their testimony, from Samoa, Tonga, and Fiji. Today we get out there coming up other Polynesians that have never been to the islands and they go up and give reverence and respect by hearing that some of these practitioners have brought down that it is okay to go up there and acknowledge your ancestors and share the mountain because of the highest temple today in the world. I am just glad that I was part of helping to create that program and bring it forward again. We are having visitors and astronomers to the mountain acknowledging what we have set up as proper protocol to come to this mountain.

When asked about what concerns he may have on potential impacts to ongoing traditional cultural practices on Maunakea, Mr. Pihana stated:

> I been in 13 North, this is the area that they have set up to put a portable station to collect data. I was one of the first practitioners to have that power to remove and close the road to the 13 North. The only reason I had closed the road was to make sure that public scrutiny and public quorums be held so that everybody’s *mana‘o* can get on the table that if we allow it we really have to think before we say, “Yes,” to this development. We look across the island to Maui from the area and Maui and Kaho’olawe is looking back of what the people of Hawai‘i is going to do and if they allow it to happen, the only thing I could say is, “Good luck and have the best of my respect and hope that you do a good job and that it would benefit the world.” And you have show proof that you can do well by your words, “One up, two down.” You cannot have it all. I think in the beginning of the Master Plan even though the 30 meter was already on the table that they had promised to remove some of their other telescopes because this is joint venture and I think the first one that would be removed is Canada, France, Hawai‘i and the people there are going to lose their job. The other part is that you cannot replace what you already removed in that area. Another one that was said to be removed is property of University of Hawai‘i 88, but then we got other plan that comes forward by the Air Force and probably even NASA, so the Government place a big role in decision making, “Put them up, money talks,” everything else walks. Having the TMT up there will bring a bigger impact, the more visitors, and a major impact.

> My main concern is that it is going to hurt the Hawaiian people again. It will hurt their eyes and spirit. It hurts the eyes already. I have not been up there since I have retired. I need time, after giving my testimony at the 30 meter; I made a promise to myself that I really don’t want to see the 30 meter developed up there. I told them in Canada, France, and Hawai‘i, because it was like saying, “I re-nig I went back on my word as a Hawaiian.” Not only the practitioners, and if it does develop, like I said before sometimes we can come to agreement and sometimes we cannot satisfy everybody. I received a word from of my old uncles that live on Kaua‘i, one of the high Chiefs, “It is okay to discipline.” I took that statement seriously, but there are always disagreements in everything we do. I have been told many times and called many different names when I went up there and try to bring awareness, to all sides. It didn’t stop them to overdevelop O‘ahu or this island also. Population growth, jobs are very scarce and very demanding. Education is very demanding. What are we going to do with our people? If it is going to create good work for the majority of the people, as a whole, then you might say it is a good to build up here. There are other areas in the world that can use the jobs and the moneys, not necessarily Chile, countries like Mexico who need the jobs, but here we already have enough telescopes.

Mr. Pihana shares some knowledge of the myths and legends associated with Maunakea:

> Then the myths and legends will become very scarce; it will all focus on the observatories. They myths and legends I know about is the night marchers, and they are constantly at work. I had many visitors and employees that have had many spiritual experiences out there and unexplained happenings and have recorded it on film, because these guardians that are still on duty are showing themselves that they are asking, “Who are you? What are you doing up here? Where are you from? Go home, you don’t belong here.” I had a Japanese film crew and I was escorting them form 8 o’clock in the evening to 3 o’clock in the morning just to get a shot of the moon and the camera man and soundman noticed giants walking across the valley between Subaru and Cal-Tech. They stopped work and came down to ask me to escort them back down to Hale Pōhaku which I did. Their question was, “Are their giants on the mountain?” Yes, these are guardians to the mountain and area, they are known as the night Marchers, not only walking below lands, but up here too. They show themselves because they don’t really want to be exposed. They want everything up there now to be left alone.
>
> The myth of Poli‘ahu lives and when she comes home everybody stops working because she closes the road.

7.6 Mr. and Mrs. Burt and Sheila Okin

CSH interviewed Mr. Okin via telephone on Jan. 23, 2009. He and his wife are residents of Waimea. Mrs. Okin is Native Hawaiian. She is a retired teacher. Mr. Okin is a retired air pollution meteorologist. Both are active volunteers in several community projects. When

informed about the proposed Project changes involving a staging area and electrical transformer, Mr. and Mrs. Okin did not have any additional comments. When CSH asked if they wanted to share their *mana‘o* regarding cultural sites, resources and practices in the proposed Project area, Mr. Okin stated that they did not feel they had anything to add.

Regarding the proposed TMT Observatory Project itself, Mr. Okin noted the following:

> I am neutral about it. There is a cultural imperative that has to be acknowledged and respected. There is also scientific information that we need to gather in the long run that may aid us in how we look at the universe. We eventually may need to know what goes in our universe, because in the long run, who knows what information we need to understand the expanse of the universe, our place in it, and how it will affect our long-term survival.

Mr. Okin stressed that respect has to come from the two parties involved, those who are against and those who are for the Project. He stated that it is his hope that there will be some kind of process that can be put in place so that worthy projects can be done while respecting the Hawaiian cultural imperative.

> It has to be done with both sides. Nothing can be done with disrespect. We have to find some way before projects go forward, and we need to explore the culture with those who know it best.

In a follow up email to CSH on Feb. 2, 2009, Mrs. Okin wrote the following:

> I have learned that several of the companies who have placed telescopes on Maunakea have not lived up to their agreements re: caring for the area on the mountain that they use. I don’t think that there should be any further development until those issues are rectified to the satisfaction of Native Hawaiian groups who also care for the mountain. Every group using Maunakea needs to come together and take responsibility because you cannot act as an individual entity when it comes to caring for a sacred place or any place. Everyone is affected by what one group does.

7.7 Ms. Kealoha Pisciotta

Ms. Kealoha Pisciotta was born on the island of O‘ahu. Her *mo‘okū‘auhau* or genealogical line comes from the island of Kaua‘i. Her ancestral lineage is of the Oniha ‘Ohana originally, but they were *lawe hānai* (traditional adoption practice) to the families of Ka‘anape‘a and Kamahukilani, Kaua‘i lines. Ms. Pisciotta is the founder of the Native Hawaiian organization Anaina Hou, a group of Native Hawaiians and supporters who advocate for the protection of Maunakea. On March 14, 2009, Ms. Pisciotta provided written testimony for the proposed TMT Observatory Project on Maunakea. Her written testimony is included in Appendix D. CSH conducted an interview with Ms. Pisciotta on January 19, 2009:

> CSH: Let me start by asking you to share your past history and association with Maunakea?

KP: I worked for the British government for 12 years and I lived and worked on Maunakea for 12 years. My job title was telescope systems specialists, which is a name for the people who run the instrumentation and the observing for the visiting astronomers. The telescope I specifically worked for was James Clark Maxwell Sub millimeter Radio Telescope. It is jointly owned by the British Dutch and Canadian government, actually British Canadian, Dutch in that order and ran by the Royal Observatory of Edenborough. I also work for a little while for the Cal-Tech Sub-millimeter Observatory as a Technician. I have familiar genealogical ties to the mountain and some of the *iwi* there, actually ancient and modern. I feel it is important to mention modern because that is still in ongoing cultural practice continuing today. Famous people of today have their ‘*ohana* there.

CSH: Okay, what about burials up there? How will they be impacted?

KP: Burials are in the *pu‘u* and along important astronomical alignments. Burials are hard to talk about, on the one hand you need to speak to it to have them protected on the other hand culturally the different levels of *kapu* on speaking to it. One of our greatest concerns is that there has been no actual burial treatment plan. The one plan that the Hawai‘i Island Burial Council basically said is the best treatment is no development, because the burials include not only important national figures, but also important spiritual figures. So, the question is what is the burial treatment for Līlīnoe? The problem has been is that there have been reports. Mr. Patrick McCoy and Holly McEldowney have done extensive work on the burials, but they never got to finish their work. Also Pu‘u Mākanaka, of course it is listed only as a burial, but really it is a burial complex, hence the name Mākanaka. The problem is to not list it as one when it has many. The *kūpuna* have testified extensively in the past as eyewitness that on Pu‘u Mākanaka that there is so many *iwi* that you can see them through the cinder. So they immediately know better not go over there.

So destruction of the cinder cones and the landscape itself is the danger to *iwi*. They, University of Hawai‘i, also mistakenly put a whole bunch of burial information on the web, which they realized was bad after the burial council complained about it, so I think one of the big concerns is the generalized disrespect for that fact that we have burial complexes that Maunakea is a burial ground and no one seems concerned about that. A good example on how it still continued is when the families brought the personal artifacts of their sons who were killed in the Iraq war. One of the father’s is Hawaiian. Kupuna Clarence Ching helped to facilitate the bringing of them up there. Through protocol he placed all of these personal artifacts inside the *lele* on the summit. And now there was *ahu* that formed underneath it from years of people placing the *pōhaku*, and the burial artifacts were placed inside of it so their personal items were put inside. When that was desecrated the second time someone had used a hatched to hack down the legs of the *lele* and then just threw all of those *pōhaku* around and these

boys artifacts came out and tourist found them. The state is supposed to protect these things.

At my own *ahu* site, it is hard for me to say is my own, it is where I go from time ago. Many people go there. The reason why I tell them to go there is because it is a place where they can go and [not] disturb historic sites. My Aunty Kamakahukilani, she asked to be placed in certain places and that was one of them. When the University personnel (tour guides and rangers) destroyed it, they destroyed her remains (ashes). That is more than desecration. It never ends. And you know how? We just went up to collect medicine in the big snow for water and it was gone again. That one was put up by Paul Neves of the Royal Order of Kamehameha, me and Keomailani. If we do it again we are going to file because initially when it was first taken by the University tour guide, Hugh Grossman in 1998, when it was discovered that he had taken the *‘aumākua* stone of my family. He had taken it to the dump. Then I recovered it and I put it back. I tried to file a claim when he had taken it, but DOCARE [Division of Conservation and Resources Enforcement] actually investigated me instead of him. My family worship sight has been desecrated and destroyed seven times now this year is the eighth time.

CSH: What does the acronym stand for?

KP: Department of Conservation and Natural Resource Enforcement, I think. We have actually a good relationship and we would like to see them supported because they are the actual lawful enforcement arm of the state that is legally able to cite people for violations on historic properties. The DOCARE investigated me because they were told by someone at the University that I should be cited for having my *‘aumākua* stone in the natural area reserve. So I went to find out if they had investigated the desecration and they said, “We found you innocent.” Who actually helped me was Holly McEldowney as the SHPD at that point. She had Mark Smith write a letter on my behalf confirming that I had not destroyed or desecrated or impacted any historic sites within that area and kind of to affirm that I have a right to continue my practice. Nobody got cited in the end, but the University did force Mr. Hugh Grossman to apologize and the head of the Institute for Art wrote a letter saying, “It would never happen again.” The problem is it has happened seven times. The fifth time the stone that was given to me to replace my *‘aumākua* stone which was originally taken; I don’t know where the original or the second *pōhaku* is they have never been found. Aunty Leina‘ala Apiki McCcord gave me one of her family stone from her family of Aunty ‘Iolani Luahine. She said, “You bring this until you can find another one from your family.” So that was placed there and it is no longer there too. Both stones have been taken.

My controversy with that is two-fold. As a matter of fact, when I called the police to report it, I said, “This is probably going to sound really strange, but there is a man who has taken my family *pōhaku* and it is in his car and I need you to help to

get it back.” Because he was outright caught with it in his car, the brother, a Hawaiian police officer, said, “What! They take your *pōhaku*?” He then said, “Sister, you go and ask him first, politely, for it to be returned to you and if he does not return it, you call us back and we will come and assist you.” I had to explain to him it is my *pōhaku*, but it is dedicated. I gave it as a gift because I am giving myself as a gift as part of my contribution to help *mālama* the mountain. So, yes it is of my family, but yes it is that I needed a place to go every day when I went to work. That is why it is there and nobody touched it for 12 years. Holly McEldowney also wrote on this—that our practice is a continuance of a traditional and cultural practice. I gave my *ho‘okupu* because I work there and to ask permission.

The other thing is, when I spoke to the University about it they said, “Well it is modern and it doesn’t belong on the mountain.” I said, “Well, what is modern, how old is the *pōhaku*?” So I said, “Well, how are you determining what is modern and what is ancient? Who do you have that is qualified to determine that? Are you going to measure the age of the stone, well that won’t help you? Are you going to measure the size, does the size matter here? What metric do you use to determine what is old and what is new?” Our *pōhaku* is old. How am I to know that they are not touching the ancient sites, because you believe they are modern? Who? The University is not the judges and jury of our practices. Neither are they politically appointed. They need to follow the law which is to protect our rights to continue our practice. It is not the UH’s right to tell us what to do on our own *‘āina* [land]. Sometimes the archaeologist would call me and ask me to look at a site because I have seen it [a] long time. So, they think that something was different with it and they would ask me, “Do you think was this a half circle or a complete circle site, Kealoha?” I would say, “I will go look.” The other thing too is that sometimes there is clear evidence that a *pōhaku* is missing because of the rain shadow. Like if you look at many of the adz flakes, many of them have that shadow. So you can tell it is like a finger print left. I want to know who at made the University the authority to determine who is *pono* [proper, correct, moral] and who is not, who has a right to do something and who doesn’t. It is not that I don’t recognize we want to be careful; we don’t want to interfere with the ancient sites in which we need to preserve them in their natural form.

CSH: What about the possibility of sites within the Project area?

KP: Yes, let us look. Oh, sure, that is part of the problem.

CSH: Are these sites, still cared after by our Native Hawaiian organizations, like yours?

KP: Yes, and many others too. Like Uncle Clarence Ching, individuals as well and families linked to Poli‘ahu’s Family.

CSH: Of the many issues on Maunakea, what about the past and present land use on Maunakea and that relationship to what is proposed for this Project?

KP: The State Land Division which is now the DLNR, it was called something different in 1968, but when they issued a lease for what is now known as the Science Reserve. I think it is everything above eleven thousand feet except for the pie shape of the Natural Area Reserve. The UH has no jurisdiction over the Natural Area Reserve. I don’t know why there is no Cultural Reserve only a Science Reserve, because the mountains significance even way back then it is eligible. It is a national landmark the lake, then it is eligible for National Historic Register as a historic district, but all of those things were because of the geology, the archaeology, the cultural traditional properties and the fact that it is watershed a principal watershed for Hawai‘i Island. So, we have this big area designated conservation, the natural area reserve is that big pie shape. The University was given the lease to build an observatory and so that what was the original lease was for.

CSH: Was that 1968?

KP: Yes, 1968.

CSH: For one observatory?

KP: Yes, and support structure, that is when they put in a diesel generator and stuff like that.

CSH: What observatory was that?

KP: I think it was the Air Force. That one is now down replaced by the Gemini Telescope which is substantially bigger than the little Air Force one. This [is a] breach of the lease, by the way.

CSH: So they have taken down and used those areas for new ones?

KP: Yes, the difference though the Air Force one is very small. The Air Force shared it with UH. So, they did take it down and then they erected the giant Gemini. So the footprint is still bigger. That is one of our problems is that the size keeps getting bigger. You can conceivably see that happening depending on the project.

After being given the lease to build this observatory people were already upset because they really didn’t want to see the mountain changed. Many people, they are always saying, “Well, Hawaiians weren’t objecting then.” Well, Hawaiians didn’t actually identify themselves as Hawaiian act then we couldn’t speak our own language then, but the hunters were Hawaiian, along with other ethnicities. They were also environmental people and groups who supported like Mae Mall;

she was a major player in that; fearful of the *‘ua‘o* bird [an endangered seabird, *Pterodroma phaeopygia*, considered to by some as *‘aumakua*]—she was a bird person. The other species those are unique, so unique that they are not found in anywhere else on the planet. In the 70s, they [built] several, let me say a number of telescopes, I think it is three or five, without permits which just aggravated the initial public concern. So, public outrage broke out and in the 70s people think we are the only ones who were upset, no. In the 70s they marched on the capitol and they carried signs that said, “Maunakea belongs to the people” principally because they were concerned that the astronomy community was taking over the mountain. Was not their concern real? So, what happened was this fact was brought forth that UH had built without permits illegally. The University had just been saying, “Yes, we can do what you want.” So, the State had to intervene and it was actually Governor Ariyoshi at that time who ordered the BLNR to do a plan that would quell public concerns and protect Maunakea and its resources.

CSH: BLNR or DLNR

KP: Well, I think it was DLNR it became a board a little bit later (BLNR). It is the Land and Natural Resource Division. He ordered them because they are in charge of the conservation district and only those to do a plan that would help accommodate the multiple uses on the mountain. In that plan they established a legal limit on the number of telescopes that are allowed to be on Maunakea. That limit was thirteen including those six initial telescopes that had already been put up, so they didn’t ask them to tear them down. They said, “You can’t do that anymore.” And now there is a limit. Now what is an agreeable reasonable number that the science community can live with and the people can live with? The people obviously didn’t want to live with anymore. The science community said, “Okay, we will agree to 13.” They actually integrated the science at the time, the biological science, and the cultural ethnographic studies. In the 1983-85 Plan they said, “Look, the caring capacity is thirteen,” because that is a huge resource. Now the Smithsonian can build up to twenty four? So we are way beyond thirteen which means the UH continues to violate their lease. Not only was it in number, but it was a limited size and height. It is mostly the Institute for Astronomy; they are the arm of the University that is doing it. So, we now are beyond thirteen, not only is the number, but they size and height, only 125 feet max, height and diameter. That 13 limit is actually eleven major telescopes and two minor. So they included the Air Force and the NASA. So they removed the Air Force and put in the Gemini, which is significantly bigger. They put in Array, the Smithsonian Array [reference to the Submillimeter Array, funded by the Smithsonian Institution and the Academia Sinica] and that has as many as 24 pads covering I think an area of ½ mile in diameter. So that footprint is huge. They have all underground cable with no studies. They have this giant telescope mover that lifts the telescopes up off those pads and moves them around. It is a huge complex, a huge infrastructure going on there. So, then when NASA wanted to build the 4 to 6 more outriggers in a five acre area where the Keck I and Keck II are which

would really increase that density it was too much. So the latest set of people came forward and argued, Native Hawaiians, Royal Order of Kamehameha, our group, Hank Fergerstrom, Ka Lāhui and many organizations came forward, KAHEA and Sierra Club, Life of the land. They said, “Wait a minute….” because they remember the legal limit was set to 13. There is no legal justification for building more. Here is the thing the University is not accepting as a reality for them, they are claiming, “Well, that plan only went to the year 2000. So that limit is over. We can exceed the limit now.” And that is why they did that second plan, the 2000 plan we all had to testify for over and over again. We missed an important feature back then and that feature was the University is not the one who can do the plan. So the 2000 University Plan is not a legal document and that has been confirmed now in the courts. The Court said, “The UH 2000 MP has not been approved by BLNR and is not a legal plan.” The Court said, “That is not a document that is legal.” So we must fall back on the last legal plan. The last legal plan said, “13 only.” It is still legal because it just said, “At least the 2000.” It didn’t say only to 2000. It is open, because the deal is what they were trying to say was, “In 2000 we should probably reassess the condition of the environment to see how much impact we can sustain?” All the data we have today came from 1982. Hydrology, bug studies, cultural studies, there is a couple new ones for the *wēkiu* [summit, peak] because they made it worse for the University, 99.7 percent reduction in population.

When the University was doing this next plan, we looked at and realized it wasn’t a Conservation Plan it was a Development Plan because they just want to build more. It is not a plan for conservation it is a plan for development. And we knew that, but we did submit to them, “If you must do this plan, you need to implement this structure, because it is not just that a plan needs to be done, but who does it?” We continuously told them, “You are not the agency, DLNR are the ones who controls conservation.” The way we tried to explain it is to say, “If I am a police officer, then I am empowered by the State to be armed and use deadly force.” I cannot take that gun and give to a civilian and say, “Shoot that criminal.” Only I am empowered by the State to shoot the criminal as Police Officer. So we kept saying, “What is happening here is you are shifting the legal authority to the University claiming that you can do it. You may not do it because you are not BLNR. BLNR is the only ones that can do it.” So eventually we had to challenge that in court. The problem with the Maunakea Management Board is that most were appointed by Senator Inouye and now they are just appointed by the University itself. That is not okay they are all political appointed that serve the community and not the people. That is one problem, the second problem is that they are not a legal body, well they are not a body who can tell people what to do that is for sure, because they were created in that 2000 Plan. It is not a plan contemplated by the rules of DLNR, so he threw it out. He also said, “The 1995 Plan that was approved by BLNR did not mention anymore development.” So there is a limit.

CSH: Can we talk about your knowledge of cultural sites within the Project area and the mountain?

KP: Yes. [Looking at maps] Trails…there are *ahu* all over the mountain.

CSH: How has your past work helped you in your efforts to both understand the need of astronomy and the need to keep the mountain sacred?

KP: I think it is unfortunate and I have been coming out a little bit more on this now because I am tired of it. I feel that the astronomers are there to do astronomy and we don’t object to astronomy. The astronomers are not there to hurt anybody; they are not there to offend the host culture, maybe there are a few who don’t care, but most are good. They are not there to hurt the environment. Most astronomers want to be environmentally conscious. The problem is and this is what I am telling the astronomy community is, if you continue to listen to the University lawyers and only the University’s side of the argument you are going to get in trouble, because you are going to come out and say things that already have been decided in a court of law. The difference between the political arguments and legal arguments is that in court you have to prove what you claim. In politics people say all kinds of things but they don’t have to provide actual evidence, the University making arguments that they lost in court. That means that they cannot introduce evidence to contravene our evidence. Our evidence is 10 thousand documents of hazardous materials used on the mountain and no record of UH removing them. Our evidence is that hazardous waste can go directly in the ground because they have no proper waste containment. If the community’s water becomes toxic, where do we go? On the other hand they can fix that. It is completely fixable problem, but the University continues to manipulate everyone involved. So we have come out to say, “Look, we are not going to let you keep saying that Hawaiians or the environmentalists are against astronomy.” Because we have stated publicly and in written form that astronomy is a noble endeavor that should be support, however, not at the expense of everything else and good science should include environmental science, the geology, hydrology, the ethnographic studies, archaeology: all of it is science and our cultural tradition is science.

The lake is a significant site because it is like a *wai ea* [*Lit.,* aerated water, water used for purification], which was significant for marking time, seasons, even a mirror to the stars above. Many of the *ahu* around the lake are markers for directionals. So there are directionals not only of the primary four pillars, north, south, east, and west, but also the solstice, so you have the eight, the *he‘e* [octopus], *nanana* [spider], the *pe‘a* [bat].

The Ahu-a-Umi is in between the three great *pu‘u*. I have spoken with Aunty Kawena Rubillite Johnson because she has done significant work on the trigonometry of our *heiau*. I grew up with her youngest daughter Līlīnoe and so I have known her for years. Years ago she asked me to look for Ahu-a-Umi

because I called her to say, “Aunty….” So I said, “Aunty I am working on Maunakea.” The first thing she asked me if I could see Ahu-a-Umi. I said, “No….I am in the telescope.” So she said, “Go outside and see if you can see it.” And she directed me to look for it and what it looked like and everything. So I had never gotten to go until Uncle Clarence [Ching] made a *huaka‘i* [trip, voyage] and we went then. It took us two days to get in there. Amazing! So I called Aunty Kawena and I said, “What would you like me to do?” She said, “Go measure the alignments from Ahu- a-Umi to Maunakea. Especially look for the one relating to Venus.” So I said, “Okay.” Because I had measured the alignments from Maunakea and they just went to Ahu-a-Umi. So we have the alignments both ways on Maunakea. The *kupuna* told me to find the solstice equinox alignment because those are kind of critical for things. So I struggled with that. I couldn’t make the initial alignments because I didn’t know where they were standing. I struggled and struggled. The story I was being told was you need to know them because the alignments established on Maunakea become the baseline alignments at the other places and you’ll see them if you can establish that. I had a dream and the dream kind of shook me up because it was an *iwi kupuna* . I was looking at the *kupuna*(’s) back and he was pointing in this direction and he had this beautiful *hulu* [feather] cape on the bottom of it had a big black iridescent feather star. Where he was pointing I had no idea what that was meant for. Is there something going on I started to look around. I asked Aunty Kawena and went to see her about this dream. I had two significant dreams in a row. One the *iwi* grabbed my ankle when I was standing on a *pu‘u* and it was a *pu‘u* that Subaru and that is Pu‘u Koholā the back of the *koholā* [whale] which is the alignment with Pu‘u Koholā that was leveled in order accommodate Subaru. Aunty asked me, “So, you have this vision, where were you in the dream? Where you in the dream? Where outside of the dream looking in? And where was the *kupuna* in relation to you?” I said, “I was standing behind and he was pointing in this direction.” And then I told her about the star pattern and she said, “How many points did the star have?” I said, “I cannot remember, Aunty.” So she went from there and then she said, “Maybe you need to ask for clarification.” So, I forgot about it for awhile about a month later it came. I saw it all clear. I called her up and said, “There is eight points. He’s pointing north because he is standing on a ridge and I can tell is because I can feel the wind.” I know the direction. She said, “That is very significant.” Then she gave me that the number 8 is a magical number to the Hawaiian. So, I took the directional and I made the alignments based upon where the *kupuna* in my dream was standing, where I was. Then I drew the lines just for our summit area first. Then I said, “Okay, if this is correct, if this is establishing where I am supposed to look from.” If this is correct then exactly on the solstice of December 21/22 I should see the sunlight and the crack of dawn hit this *pu‘u.* So that is how I made my vision become scientific. And if that was true then these were correct because you cannot mess up after you get the first data point. So I waited that morning for sunrise it happened. Then I drew all eight lines out all the way to Poli‘ahu Heiau on Kaua‘i. So that is a view plane. These solstices and equinoxes are of one view plane that must be protected.

I went to Kaua‘i to test my theory too. If in fact I was at Poli‘ahu Heiau and I measured the alignments and they are completely aligned to the Maunakea alignments. When the navigators for our recent canoes came up to the mountain, some wanted to go to the lake, some wanted to go up to the summit to the *lele*, because the *lele* is aligned. We gave them snow water to take with them, but they needed to go to the lake to see the sky reflected in the lake. They are codifying the alignments in their mind’s eye. That is how the *kūpuna* could see the pathway, see in the lake hold it in their minds and follow it on the sea. Some people say, “The navigation is all about the ocean.” But it is really all about the sky. That is where the difficulty is on finding the *mo‘olelo* on Maunakea. It isn’t just under Maunakea it is under all the navigational lore. I remember Kepā Maly talking with me years ago, and I kept saying, “You know what you see on the ground Kepā is only the reflection of the heavens? This is our connection. When you are looking you have to look for those things over head.” Mrs. Johnson told me that too.

Our *kūpuna* could tell and some say that this is a modern myth that modern science taught us the idea of the procession the 26,000 year cycle. It is not true, the ancient Magi, the Egyptian Priest and the navigator chiefs of Polynesian all knew those things, and they made the alignments in accordance with that. Twenty six thousand years, we are basically being able to plot the motion of the heavens over a 26,000 year cycle. So that means that motion is really small, so small that in one humans life it would take them 70 years or so to detect it. They set up the *pōhaku* and they are watching the same star and that same star is moving slowly over time and they caught that the nautical sign. Then they knew that is found they found their seasons and that is how they led their lives. Again I called Aunty, I said, “We found this chant and this chant is saying that Canopus and Vega are the pole stars.” But that was 12 thousand years ago. So I am saying, “How can that be, 12, 000 years ago we aren’t recorded as being here.” She said, “There is any easy answer, perhaps it is proto-Polynesia.” That is a really exact measurement because we know when Canopus and Vega were there. Because of that movement of the 26,000 and where it comes in is in our *Kumulipo* because the number of wā [epoch, era, period of time] are broken down into the epoch periods. So, it is not just like everything just happened in days, it was here is and as we progressed in time. So, that our cultural things are antiquated and not science. [That] is not acceptable. Because our ancient knowledge is repeatable and it is measurable and that is what is required in science. Nainoa Thompson, before Papa Mau, they demonstrated that our ancient knowledge has relevance today, that by using the same ancient knowledge we can still go and find all of Polynesia. We populated 10 million square miles of islands, I mean if you are off by only a degree you are off by hundreds of miles on the earth. It was an acute observation. So our ancient *kahuna* had the same skills. I am not saying that we are better than the scientist today, I am saying give credit where it is due, and that we were able to circumnavigate the globe millennia before western science. So

science would do well to recognize our star knowledge as science and stop calling it myth.

CSH: What are the cultural practices you have witnessed and participated in on Maunakea?

KP: Burials, contemporary and historic. Contemporary burials though I am not going to say that it is only limited to, but it tends to be more of the ashes, not all because people are still fighting the health department on the Hawaiian burial of bone. I have personally participated in a number of them. Other families have called me to help them and I have. This has involved their personal affects and belongings or things people would otherwise bury with their *iwi*. It is still done today. Sometimes people bury it or sometimes they leave it at the *ahu* or *lele*. In doing that they are placing it in the hands of the ancestors and for the benefit of those who have past and now to come.

CSH: You were talking about collection or gathering of ice, water, and snow?

KP: Yes, it is an old practice. There are reports of the *ali‘i*(’s) travels to the mountain and bringing the ice down in big blocks on horseback, even contemporary times. They would use it for medicinal purposes, temple ceremonies, and other kind of cultural protocol. The water that is collected from Maunakea is water that is used for bringing life back or taking it. I only work on the side of bringing back life. We were blocked before at one point from gathering. For example sometimes we want to collect it while snow is falling and we were blocked, the road was blocked. Not because it was a safety hazard, I mean after working twelve years on the mountain I can tell the difference if it is a burial stone or not. Anyways the practice wouldn’t live very long if all the practitioners died doing it. We were collecting it for Uncle Genesis for example, he had the lung cancer and then he drank all the water and it went into remission. For five years. So we still go and collect it for many people. A few years ago, Papa Auwai said, to his *haumāna* [students] who communicated it to me, because I often get for them and Aunty Margaret, they don’t want to use the lake water anymore. So, that is what has caused us a lot of concern, we want to know is the lake clean? Is anything going in there? So why don’t the authorities want to know if the sewage is hazardous material has contaminated the water or not?

Ceremony at the lake…there is a lot of that. All different kinds, Queen Emma went there to *hi‘u wai* [bathe for water purification] before her election and to demonstrate her worthiness and *mo‘okū‘auhau* or genealogy. We found her *ahu* site. We have the GPS of it because we knew where it was. But they got the actual meets and bounds from *mo‘olelo* that was found on the east coast and then Kepā brought it back and then him and Uncle Clarence guys did a *huaka‘i*. There [are] *pūnā wai* [springs] that you can collect from. There is the lake *pu‘u*, Waiau, but there is another one, *pōhaku* I think. Uncle Clay is the one who knew all the names of all the *pu‘u* from *paniolo* days. Pōhaku and Māhoe…they collect water.

Perhaps it is because of the cinder cone it has ice plug. The other things is the fossil ice and the ice from the last ice age which still exist on the mountain maybe just 4 feet if you go below 2 to 4 feet you can hit that in certain spots. So, there is the collection of fossil snow and ice. The underground ice is important for some *lā‘au* [reference to lā‘au lapa‘au, or medical practitioners] people. There is actually water from Maunakea that is collected in the ocean.

CSH: What about the summer and winter solstices?

KP: Well you have the winter and summer solstice and then you have the equinoxes. They are conducted by the Royal Order of Kamehameha specifically can handle the temple kind. I know other people who go up at different times for doing different kind of ceremony. Then there is the navigational uses of lakes and other *pu‘u*, because of the *pu‘u* being markers. That is important because the landscape is the environment of our belief, so changes to the landscape alter the belief, they can take away or they can enhance it. Obviously placing the *lele*, Kaliko Kanaele was so clear about it. We need to re-center the focus. After I had done the alignments, we re-done some of those and then watched to verify that what I had seen was true. Once I re-did the alignments for the ceremony that I realized the *kua*, the backbone has been leveled. So if that would be the central place directly looking north where you would start it, but we cannot do it because there is the University telescope so we did it over here. So it has been changed. There is perfect demonstration of this. It is a beautiful picture taken by Richard Wainscot; it is a picture of facing the Southern Cross, which is significant for navigation because it is used for keeping time. The Southern Cross is used for keeping time at night on the sea. You can perfectly keep time of the 24 hour clock just using the southern cross at night time, so the rising and the setting of the southern cross. Before obviously you can see the view plain was clear, but when they built the Gemini they took that view plain out and that view plain, so when you are standing in the traditional setting you can no longer see the Southern Cross. The picture we have has the glow of the volcano on one side, and Gemini in the forefront, but Gemini did not put the whole dome on, so the southern cross is right in the middle of dome structure, so now with the dome on it the view of the Southern Cross is obstructed. Then you have the other type of ceremony which is for deity.

CSH: Who are the gods associated with Maunakea?

KP: There all the male pantheon gods, then the eight females. The story throughout Polynesia is the story of the god Kāne. For example in Aotearoa they speak about him bringing the three baskets of knowledge down. There are our own stories where they talk about Kāne not wanting to do it, told to me by my Aunty Kamaka. He was told that you have now go up to Maunakea and take care of your responsibility after the floods mentioned in the Kumulipo. He did not want to go, but the kupuna who used to go before could not go anymore. So the moral of the story is that Kāne had to go because of the kupuna told him too. It

was his love for the kupuna is what made him willing to break through the limits of not wanting to do something or feeling that is not my kuleana. The main stories of Kāne are about the creation and also of him asking Poli‘ahu to care for the kupua children. The other story identifies Mo‘oinanea [legendary serpent goddess] as the one to do it, those stories are actually in the book called Moku‘ula on Maui. Maunakea is featured in this book through the Mo‘oinanea story. Because Mo‘oinanea has three principle places that she is always at; one is Pu‘uloa, Kaimanahila, and the lake. The other stories of Kāne and Kanaloa, they say Maunakea is where they meet. That is where the fresh water and salt water meet, that is also where the pō [darkness] meets. The deepest pō is the pō of the sea and the pō of the heavens, right there is the lake.

Papa and Wākea, Wākea as Orion is super significant for navigation because Orion’s belt rises due east and sets due west, so you must know Orion and of course Orion comes winter and there was a time that I really got it because some say the sword is the ‘*ule* [penis], so at certain angles you can see right over the summit how they are touching is loving embrace. Papa is clear when there is no snow and then is Poli‘ahu when there is snow. And those alignments are significant and major. There are different levels of each story as there are the levels of heavens. Papa and Wākea come to meet here in the *Kumulipo*. Bringing it all through their names will tell it all.

There is Līlīnoe, the sister of Poli‘ahu, her *iwi* are recorded to be there. Fornander also have some of those Kāne stories. I read this one that describes Poli‘ahu being able to see Poli‘ahu from Paliuli. Is it a state of mind that they are referring to or it is a place? and then one day I walked out and the snow had been perfect and there was a cloud bank, a typical cloud bank that always is on the mountain, and right there you could see her whole body, her face, her hair, her shoulder, and her arm, her *nene* [nipples of a woman’s breast] and then of course the telescopes are right there by her ‘*ōpū* [belly, stomach] and her *nene* and then you go down and then two *pu‘u* on the mountain that if you look from Hilo side, like looking from Moku‘ula is a good way to see, and then you can see her two feet. Then what happens is that she floats like a cloud of the tree line. So when I saw that it is a state of mind too because you have to be open to it. Because when I went out I was thinking about her and then all of a sudden I saw here, and once I saw, I could not see her anymore, so her *kino lau* [different forms taken by a supernatural body] is codified and to be seen especially during solstice, her *kino lau* manifested herself so that you can see her in the snow time. The legends tell of her adorning her *kīhei* [shawl, cape], or mantle. Yes, and the telescope levels the *pu‘u*, her image and *kino lau* on the top of Maunakea.

Let me just say something about the later stories of Pele and her sister Poli‘ahu. You hear it usually framed in a conflicting way, but this is what I think. That there were probably some battles between the *malihini akua* [foreign or non-native god, often referred to as Pele who traveled to Hawai‘i from Kahiki] and the older one,

possible water and fire, *mo‘o*, fire, but in truth I think it is also a story that is telling us that you have to have both, because without them we cannot have those elements or the *wai*, which is Kāne *ka wai ola* [the life giving waters of Kāne]. The fires and ice make the water. In one of the things we submitted to the court also as to demonstrate the traditional use and the cultural *mo‘olelo* is as our *kūpuna* told. We had a satellite photograph from NASA in infrared and you can see Maunakea with no snow now is blue in color and Maunaloa is really a brilliant red. What it is showing because it is an infrared is that Maunaloa is hot even underground it can penetrate and you can see the heat coming through Maunaloa, but Maunakea doesn’t have any heat. It is all brilliant blue and what that is showing is the fossil ice underneath. That fossil ice is perpetually re-circulated with the freeze and frost cycle of the mist, which is the deity Līlīnoe. Everyone always talks about exactly watching the lunar arise and she shows herself in the evening and morning, those are the primary times to see her. She comes right over it looks like a waterfall made of mist because the changes in the temperature cause the mist to drop really fast, and I have watched her come around the telescopes of the summit. Where I worked was in the valley so I could watch it drop down like a big waterfall of mist coming down. Then Namakaokaha‘i comes on Pele’s journey’s here. Then she has to advocate for her sister who gotten herself in trouble and was frozen. I think it tells us the story that even the *malihini akua* have to abide by the *kānāwai* or ‘law’ of every *‘āina* that may precede them. Every *‘āina* has *kānāwai*. The significance of Maunakea is because the higher you go the farther back you go to the point of creation to ascend into. Below is the land root and heaven above, so it is principle spot that touches the two that brings the *lewa* [levels of heaven explained in next sentence] together. The *lewa* are the levels of the heavens. The Papa and Wākea come together there, they are significant in relationship to the mountain, for here is the *mo‘olelo* of their relationship to or navigation. Our navigation is hinged upon our ability to understand what we now in modern terms as celestial equator. All that is means that our equator is expanded out so that we have an understanding of a dome of the sky.

The story of the connection between Papa and Wākea through the *aka* [shadow] that holds them together [the *piko*], when they separated when the gods and Kāne lifted up the pillars, the four directions of the heavens, they propped them up to give them space to live and flourish and for man to come into being. That is the *wao akua* and they were given the *wao kanaka* [realm of men]. When they separated they were connected by the by the *aka*, which is the *piko* and when they come together we see that. That also was the demonstration on how we drew our celestial equator, because once you have one direction if it is north, south or east or west, we have the southern cross in the south, so we got that one and then we Hokupa‘a [North Star or immovable star] in the north we need an east and west, and then that east and west is set by Wākea. Orion transverse east and west you always know where you are especially the three stars in the best is due east and west and never changes. So it records that as well so Maunakea sits in the middle

and that is what the early kilo to see and assess. From that then they can set all along the whole archipelago the base line. Different heiau for different reasons but obviously the ones that have any kind of relationship to the deities related to Maunakea also their alignment.

CSH: What are the resources that may be impacted?

KP: Water. Let us talk about the lake in the context of cultural practices. As home of Mo‘oinanea, the Royal Order of Kamehameha feels they have specific duty here is because Mo‘oinanea, when you go back into the genealogies. It is pretty much a mystical realm, Mo‘oinanea comes through and her first descendant is Kihawahine is the one who gives birth to the entire *mo‘o* clans in Hawai‘i. Their birth place being at Waikīkī and Pu‘uloa and that is why her *kino lau* is the mother of pearl shell. The story in the 1800s Pu‘uloa is raided along with the northwest Hawaiian Islands. Pearl and Hermes reef were pretty much fished out of all of our pearl shells, but about the same time a *mo‘olelo* came out where it is said that she was angry because a chief severely punished one of the *kama‘āina* for taking the pearl shell when it was *kapu*, but the *kama‘āina* was starving so Mo‘oinanea became angry and took the pearl shell to Tahiti, so if you see a pearl shell, right at the time that *mo‘olelo* is gone, and the pearl shell has gone to Tahiti and what today the pearl shell is flourishing there; which is beautiful so it connects of *kua mo‘o* [the back of the *mo‘o*] and it is all through Mo‘oinanea too. The navigator has her with the pearl shell I on their *wa‘a* [canoe]. She is significant because she is also is the caregiver of the *kupua* [demigod or supernatural being] and other *ali‘i* children. When the sacred chief Keopuolani is the bearer of the Kiha [supernatural lizard] and because of that Kamehameha had to marry her. Her lover was Wahilani. Kiha was her *kino lau*. I know that there are some people that go up to give ceremony for Mo‘oinanea, that is their primary deity. The ones I know that are of the *mo‘o* clan.

The resources up there are one of the earliest ones is the *‘ua‘u*, the dark rump petrel, a bird. It is a high altitude bird that flies hundreds of miles out to sea to feed and then comes back to Maunakea to nest. They are always in the high altitude. One of them was making a noise one time and went out to look for it, but I could not find it, but I could hear it. I was looking and looking that is when I found one of the water caves with the water shooting down. So there is a lot of water flow up there. The *‘ua‘u* was there before because during the times of the *ali‘i* there were a lot of remains, it is interesting question, what does that mean or lead, they must have been eating them. The *‘ua‘u* were reserved for the *ali‘i* to eat and there are many remains found of the *‘ua‘u*.

The *wēkiu* bug was not the first concern, because there is eleven other species of plants and animals that are also threatened. Some of them are lichen species, grass species, bugs, and tree species. Palila [native honey creeper *Loxioides bailleui*] is another. I have personally seen *‘io* [the endemic Hawaiian hawk, *Buteo solitarius*], and *pueo* [Hawaiian owl, *Asio flammeus*] too. Why we saw them that

high up is a question. I can understand the ‘*io*, but not the *pueo*. During the dedication of the Smithsonian there was an ‘*io* flying higher than normal. The tree line is very important because it is the home of our native bird species and realms, no more mosquitoes.

CSH: Let us close with what are your concerns about the potential impact to traditional cultural practices?

KP: First I think there has been enough built. This telescope is going to be so huge; the size of modern sports stadium, there is just no way won’t it impact some kind of resource or traditional cultural practice. We have compromised so much already. Our traditional ways, our customs and beliefs, customs never change tradition may evolve. We have to adapt, for example we have to put the *lele* over there because we cannot put it on the *kua*, because it is gone and a telescope is in the way. Don’t forget the Kūkahau‘ula riding the sunbeam to court Poli‘ahu every morning—significant telling of the story. Ahu-a-Umi and the alignment with Venus. These are impacted with more construction and destruction of the landscape.

Our traditions are not antiquated, they are ancient, but that does not mean they are useless in the world today and their science. They are not just religious belief they have practical use to us every day. Many of the scientist learn about certain things because of the *mo‘olelo* not because of the science. They would not have learned to look for unless someone communicated to them, “Well, did you look for this? Because this happens.” We did not have any NASA satellite pictures of the two *mauna* but yet we know all the elements about them. We have a continuous base of knowledge that spans millennium and indigenous people is critical to the world because of the fact that it is continuous. It is unbroken knowledge and observation from generations, therefore modern science should actually learn to utilize it in a better way. Modern science is young compared to the ancient science. We don’t want to eliminate native knowledge. The idea that astronomy is somehow superior to this knowledge because what astronomy does is good in which we support that, but it is not fulfilled. You cannot look one way and not the other. The fact is astronomy is flourishing on Maunakea and what is not flourishing is the practices being repeated because of the destruction of the landscape our ceremonies are impacted.

In the end good science is science that learns from the past and protects knowledge as well as collects new knowledge.

Mahalo no.

7.8 Mr. Leningrad Elarionoff

CSH interviewed Mr. Leningrad Elarionoff in Waimea, Hawai‘i, on January 31, 2009 (Figure 23 and Figure 24). Mr. Elarionoff comes from a Hawaiian-Russian background. His father,

Gregorio, left Russia with his family in 1910 when he was 10 years old. Mr. Elarionoff’s grandfather had worked for Czar Nicholas II who was later assassinated along with his entire family in 1917. When his grandfather, Evan Elarionoff, realized that his allegiance to the Czar would probably get him sent to Siberia under the new administration, he fled the country with his family.

In San Francisco, the grandfather of Mr. Elarionoff learned that Parker Ranch was searching for employees to farm the lands of Waiki‘i, Hawai‘i. A.W. Carter was the ranch manager at that time and he controlled the ranch with an iron fist. The grandfather settled in Waiki‘i with his son Gregorio and other Russian immigrants. At a young age, Gregorio was put in charge of the Parker Ranch farming operation at Waiki‘i. Eventually, he met and married Ms. Nancy Awaa‘a, a Hawaiian with a little bit of Irish and Chinese who was born in Kawaihae *uka* (uplands).

During this period of time, Parker Ranch maintained a huge population of sheep and regularly harvested the wool. Then with the introduction of synthetics in the 1930s, the market for wool diminished. Gregorio Elarionoff was assigned to reduce the sizable sheep population by getting rid of the sheep by the thousands. The method employed required channeling the sheep into a narrow, single file, with a chute on the edge of a ravine. As the sheep ran through the chute, men on each side would then stab the sheep with long bladed knives. As the knife was withdrawn, the sheep would run down the embankment and eventually die far away from the area without blocking the chute. Gregorio Elarionoff complained to the authorities about this project in that it was cruel and they were prohibited from recovering some of the meat for home use. He was subsequently fired and relocated his family to Honu‘apo (*lit.*, “turtle back”), at the southeast side of Hawai‘i, in Ka‘u. Gregorio was hired to work on the Honu‘apo Landing operating the crane that loaded sugar pallets onto boats called launches which ferried it out to large sugar ships which transported the raw sugar to refineries. Between sugar ships, Gregorio was assigned to the fishing detail that supplied fish for the community. It was during this time that Leningrad was born and raised along with his four brothers on property that they had bought in Kioloka‘a, Ka‘u.

After attending Pahala High School (now Ka‘u High School), Mr. Elarionoff worked for the Hutchinson Sugar Plantation in Ka‘u, and the Satellite Tracking Station at South Point before attending college in California. Upon his return to Hawai‘i, Mr. Elarionoff joined the Hawaii Police Department and retired as a Police Captain, District Commander in 1994 while residing in Waimea. At retirement, he became an active politician and was elected as a county council member. For the past four years, Mr. Elarionoff has been a Hawai‘i Island Burial Council member. He currently is a volunteer on the Waimea Trails and Greenways committee working to establish a trail through the town and he also does volunteer work to maintain and enlarge the Waimea Nature Park. In his spare time, he grows *‘ōhi‘a* trees with a variety of *lehua* (flowers of the *‘ōhi‘a* tree) colors. He asked that this interview be considered his *mana‘o* as a private citizen, and not as an official burial council member.



Figure 23. Leningrad Elarionoff shows the *lehua* from one of the *‘ōhi‘a* trees he has grown (source: CSH Researcher Margaret Magat)

While giving CSH a tour around the nature park, Mr. Elarionoff told a *mo‘olelo* about the meaning of the place name “Waikoloa.” Pointing to the dry Waikoloa Stream bed that flows through the town of Waimea, he related that because the stream bed is covered with rocks of every shape and size; when the stream flows, it causes the rocks to tumble. The sound of the tumbling rocks is referred to as “koloa” (Hawaiian duck, *Anas wyvilliana*) in the Hawaiian language, and is similar to the sound a duck makes while filtering underwater in search for food. Mr. Elarionoff points out that the word for water in Hawaiian is “wai,” and when combined with the word describing the sound of the tumbling rocks, the complete word would be “Waikoloa” which has been incorrectly interpreted by some to mean “duck water.”



Figure 24. Salmon-colored *lehua* on an *‘ōhi‘a* tree tended by Mr. Elarionoff in Waimea Nature Park (source: CSH Researcher Margaret Magat)

When CSH asked what he thinks about the proposed TMT Observatory Project, Mr. Elarionoff began with a story about his mother’s family. He noted that his mother’s maiden name was Awa‘a (*wa‘a* means “canoe or boat”). According to Mr. Elarionoff, family history hints that his grandfather on his mother’s side was related to skilled canoe travelers who came to Hawai‘i from some distant land.

> Imagine traveling by canoe on an open ocean with no pre-knowledge of a destination. The only drive being the need to explore and the belief in a land destined to be called home, guided by fate for three thousand miles over uncharted waters with limited supplies of food and water. Their motivation is beyond understanding, their determination unwavering and their success a testimony to what a true explorer is capable of accomplishing. Their explorations were limited by their abilities but today, technology has expanded explorations to beyond our physical world. Given the opportunity, I believe that our ancestors would have explored outer space. Maunakea is a gift preserved for eons for just such a purpose.

The proposed TMT Observatory Project has his support, in part because of the history of Hawaiians as avid explorers of the world around them and beyond. Mr. Elarionoff stated:

> For me, Maunakea is the logical place to continue the explorations my ancestors began many years ago. Now that we have basically conquered the world,

> everything that is above the water anyway, where else is there to go? My cultural upbringing is full of respect for our ancestors who conquered the earth, understood and managed the resources available to them. They treated the island as a gift, not as a god. I feel that if my mother’s side of the family had the opportunity to shoot off into space, they would jump at the chance. They would view Maunakea as a launching pad, a monument preserved for explorations beyond imagination. Until a few years ago, the mountain was uninhabitable, a very harsh environment. That harshness has preserved it for us today. It provides an opportunity so we, like our ancestors, can still explore. I think that our mountain is a fantastic gift. Whether it is God-given, nature-given, or whatever, it is still a gift. So let’s make the best use of it. If we need to worship, let us worship the Giver, not the gift.

According to Mr. Elarionoff, the worshipping of the mountain is something that he likens to the Old Testament story where the Israelites were wandering in the desert and venomous snakes bit them. To heal them, God instructed Moses to make a bronze serpent and place it on a pole so whoever looked at it would be healed. As time passed, the bronze snake became the object of worship when in reality; it was just a piece of bronze.

> I take issue with the guys who talk about worshipping the mountain and wonder how they are able to associate worshiping of the mountain with the Hawaiian culture. I have never heard any old-timer or family member ever speak about stuff like that. They treated the mountain with great respect and honor and believed that it had *mana* but not to the point of being worthy of worship. It was always looked upon as something majestic, a Ku Pa‘a [immoveable foundation], something that we could depend on. We may not know what is in it, we may not understand why it is there, but it is there.
>
> In my Christian upbringing…I’m thinking of my mother’s side…we were taught that God is all powerful, you don’t have to go up the mountain top to meet him. He comes down to you, and he meets you in your heart. So when I hear people talking about worshipping the mountain, it’s really hard for me to comprehend why…
>
> To me it’s going backwards. It’s what God has given us to enhance island living, to provide direction as in *mauka*, the opposite of *makai*, but some chose to worship it instead…

As far as he is concerned, Maunakea is meant to be put to greater use.

> Maunakea is the anchor that secures our island to the ocean floor. It is a product of time during the formation of our islands. It didn’t appear by some miracle---floating down through the mist and landing on the ocean. No, it came up from the middle of the ocean. It took eons and eons for the mountain to build up to what it is today. So as far as I’m concerned, the best use of the mountain would be for us to explore it and explore from it. I don’t see it as being sacrilegious or anything close to that.

When CSH asked if he knew of cultural resources, sites and practices in Maunakea, Mr. Elarionoff described his first visit to the top of the mountain where he saw the famous large basalt adze quarries. The rock piles were up to 15 feet high, he estimated.

> It was many years ago, I don't remember who the first person is that took me up there...We explored the adze factories. It was fascinating, fascinating. You go up there, and you see these rocks. The rock piles are taller than these trees. There were five [of those piles] with hundreds of adzes in various stages of completion just lying around. It was obvious that to chip the rocks into rough finish implements, the craftsmen used other rocks, [as] they didn't have metal. The chips that were broken off fell to the ground and just piled up and piled up until it covered the side of the hill in a slope 30 to 50 feet long and who knows how deep. The amount of rock chips was amazing. If they brought the rocks down here to the warm area to work on it, it wouldn't chip. It couldn't. Basalt is hard and in the cold, it gets really brittle. So that's the most productive place to chip and rough shape it...when you get to the halfway finished product, you bring it down to the warm, comfortable climate and you finish it, sand it down then polish it on another rock to make it smooth and sharp.

Mr. Elarionoff finds the dedication and hardiness of ancient Hawaiians to be admirable and intriguing.

> To me it is fascinating...we sit here today and it is cold. Can you imagine what Maunakea was like? What did they wear to keep from freezing?—*ti* (*kī*, *Cordyline terminalis*) leaf? They couldn't walk from the warm area to the top of the mountain in one day's time and go back home after dark. They had to have slept up there and worked up there. In that harsh environment, some of them may have died and remain buried.

It is feasible that some of the burials that are present in Maunakea may be related to the adze makers, said Mr. Elarionoff.

> Because of their dedication to adze making and their craftsmanship, it is fitting that they be buried up there. The same honor afforded fisherman. A fisherman is buried in his canoe in a cave down by the ocean. The principle is the same. To have burials on the mountain is not a mystical thing like some strange god came down and got buried there. It's a normal thing. People die, and when they die, they rot. So what do you do? You bury them to hide the stench and protect the deceased from scavengers. The craftsman's life dedication to the culture was to make adze which earned him the right to be buried where he labored.

Another notable cultural feature that Mr. Elarionoff remembers about his trip to Maunakea is the presence of a rock slide where the millions of chips allow for a safe slide down to the bottom. "We used to go down there and slide down the chips…it's like a water slide only comprised of rock chips." He also discussed the ways Hawaiians in the past must have broken down big boulders into manageable-sized rocks, asking "How do you suppose they managed to break the rocks into manageable pieces for chipping?"

A family member explained to the young Elarionoff that Hawaiians probably found cracks in the boulder and used water to widen the cracks until it split. The tricky part was to keep the water within the crack until it froze and expanded. He noted that once thawed, the process would be repeated. “The process sounds very slow and time consuming but there is no other explanation and they had no means of cutting the rock,” Mr. Elarionoff admitted. “Fortunately, water was available.”

Mr. Elarionoff also described seeing Lake Waiau and its pristine, glacial waters. “It’s clear water, but [is] cold, cold, cold. It’s fresh water.” He stated that he drank from it at the time, but doesn’t know if it would be possible to drink from it now. As a young child, he grew up knowing that it was forbidden to step into the lake or swim in it. “We were prohibited...and found it prohibitive for two reasons; one, the water was too cold to be comfortable and two, out of respect for the lake and future explorers who utilize the lake as a resource for drinking water.”

Although he supports the proposed Project, Mr. Elarionoff emphasized that the dignity of the mountain should be respected and maintained.

> The thing that I wanted them to do, the thing that I’m not happy about, is that they have detracted from the majestic-ness of the mountain. By that I mean the road itself is a big scar caused created when the bulldozer came in and cut the road. They pushed the rocks off the side and left them there. They could have cut the road and then removed the excess material. It’s extra work and extra expense, but it would have allowed the mountain to maintain some of its dignity…If you just had a road without all of the extra rock-calling attention to the scar lying around, I think the mountain would look so much nicer. That is something that can and should have been done; it’s not impossible.

He also stressed that old telescope sites should be recycled, rather than constructing new ones on unsullied ground.

> I think we should recycle the sites. If an outdated structure is identified and there is a need to build another telescope on the mountain, tear down the old structure and build the new one on the same footprint. The Mountain is valuable and respected by us. Do not sacrifice our cultural monuments for expedience or budget concerns. Another structure can be another unnecessary intrusion that detracts from the beauty and majesty of Maunakea.

When CSH later contacted Mr. Elarionoff regarding the addition of a construction staging area and electrical transformer, he did not have any further comments to add.

7.9 Ms. Ku‘ulei Keakealani

CSH interviewed Ms. Ku‘ulei Keakealani on February 19, 2009 at the Ka‘upulehu Interpretive Center located in Kalaemano, where she is the curator. Ms. Keakealani has been a cultural activist and Hawaiian traditional practitioner for years, and has worked with cultural historian Kepā Maly on several projects including one regarding the *ahupua‘a* of Pu‘uwa‘awa‘a.

When asked about her thoughts on the proposed TMT Observatory Project, Ms. Keakealani stated the following:

> I think my first and foremost thoughts would be that it doesn’t need to be done. Not because more research isn’t needed or anything along those lines. The latest technology and research helps educate all of us, but at the same time, it’s about the location…My question is when is enough, enough? I pose that question on many levels to many individuals. Looking at archaeology, when is enough data recovery enough? Do you have to, as an archaeologist, take everything that exists in a particular site to make the most accurate assumption, or prediction about what that particular site was? When is enough, enough?
>
> And so for me, for the summit of Mauna a Wākea, looking at what exists right now, that I do being a resident of Waimea see on a daily basis—open my eyes and it’s there, close my eyes and it’s still there—when is enough, enough? That would be my initial comment.

Ms. Keakealani emphasized that the stories of a place such as Mauna a Wākea are critical to understanding the place itself. Knowing the *mo‘olelo wahi pana* of a certain area can often change the way one views the place:

> If we went to another layer…or dimension, for me, the stories of a place are something that I almost don’t even have words to describe. Sometimes, all I need to know, all you need to know, is the story of a place that’s hundreds and thousands of years old that can change my perspective or your perspective of a place.

As an example of how a *mo‘olelo wahi pana* of a place can change one’s perspective, Ms. Keakealani gave the story of a pond she once frequented as a teenager in Waimea. At that time, she knew the pond as “Anna’s Pond” where teenage parties were held:

> Now years later, hearing this story about that place tells me there is a *mo‘o wahine* who lives in this pond. This is her name, and here is the story that talks about this stream, this pond, this woman. It changes my perspective about that place. Had I known that—when I was 12, 13 and 16, if my friends and I, at that time the youth of Waimea—had we known and been told those stories, I know that we would have had a level of respect. Whether different ones of us deemed that a true story or not a true story, that wouldn’t have been what was important. It would have been, we know this about this place, there is a *mo‘o wahine* who lives here, her name is Manaua. I don’t know that we would have carried coolers back there, and drank, and had all of this…raging teenage parties that are probably no way close to the raging teenage parties of today. But that changed my perspective. I now knew the name of the pond…it’s actually called Kohākōhau. It’s not Anna’s Pond; Anna’s Pond is just a nickname. A common name maybe, that everybody calls it. But its name is Kohākōhau. There is a *mo‘o wahine* who guards this water, and her name is Manaua and she does come down into Waimea town; this is the rock that she loves to come and sunbathe and warm her body.

> And when she is done, she retreats back up to her home at Kohākōhau. So in that lake, and in sharing that story, a wonderful individual Kepā Maly and prior to Kepā, my grandfather, open this whole new world of stories for me. With Kepā, we find native accounts and native traditions of Maunakea, or Mauna a Wākea.

Ms. Keakealani shared her favorite Native Hawaiian traditional account, concerning Poli‘ahu, the snow goddess. Whenever she tells it to children or adults, she stresses that it is her favorite *mo‘olelo*:

> And so it says that Poli‘ahu is going to be taken, reared and raised, in our language we say “ho‘okama”...raised by Kāne as if she was his own child. And he loves her so much. And it is because Poli‘ahu was so beautiful that her father Kāne places a *kapu* on her. This *kapu* that Kāne places on Poli‘ahu is this: she must live and dwell on the summit of Mauna a Wākea. Kāne knows that if any man were to see Poli‘ahu, they would just be enraptured by her beauty. They would be so taken by her beauty that perhaps they would take Poli‘ahu away as their wife. And Kāne, being the protective, loving father as he was, said, “I can’t have that. So I placed this *kapu* on you, Poli‘ahu, and this is where you will live.”
>
> Kāne knows that Poli‘ahu is going to need attendants, people who are going to care for her, and be with her, and be companions and attendants to her. So in this account, he is first and foremost giving her a nurse…Līhau will be Poli‘ahu’s nurse. Līhau will never ever leave Poli‘ahu’s side. Wherever Poli‘ahu goes, Līhau will go. When we look at translating, or the elemental form of the word Līhau, she is the dew or the frost, first thing in the morning when it’s still cold. So when you see that dew or that frost, that is what Līhau is. So a second attendant that is going to be given to Poli‘ahu is going to bear the name of Līlīnoe. Līlīnoe…when you look at what her elemental form is, she is this fine misty rain, almost kind of like a fog form. That is Līlīnoe. So she is the second attendant that is given to Poli‘ahu to live out her days on the summit of Mauna a Wākea. There’s going to be a third attendant that is going to bear the name “Waiau.”
>
> Kāne is going to dig for, and create for Poli‘ahu her own swimming pool, her own bathing pool. Because yes in fact, Poli‘ahu loves to swim in these cool and very chilling waters. So Kāne is going to dig for her, her own bathing pool which will bear the same name as her third attendant…Lake Waiau on top of Mauna a Wākea. So with her attendants in place, with her bathing pool, that’s all Poli‘ahu would need. Kāne as her father sees to it that she has all these things, the necessities…
>
> At this point, the *mo‘olelo* is going to pull our story to a faraway place, never named. But there’s going to be a man. And this man is going to dream and dream and dream; every night he dreams. He is going to see this area, this place, mountains. And it is what’s called, *kupaianaha* [surprising, strange, extraordinary]…it has a weird notion to it, but it’s also kind of intriguing. Because what in fact is this white stuff on these mountains. And so the man is

going to dream it and always sees the place…he sees various, a few mountains that are white-capped. And again it intrigues him…

So not only does he see these particular mountain ranges, he also sees a woman. The story will tell us that with this dream, his desires will grow. And it is going to propel him to come and search. And it says his *wa‘a* is prepared and he is going to come. And lo and behold, yes, once his *wa‘a* reaches the horizon, what his eyes will behold, he will have confirmation. So he sees potentially Haleakalā, Mauna a Wākea, Maunaloa, Hualālai—all snow-capped. He has confirmation. “This is the place that I have seen in my dreams.” He knows that if he is to proceed forward, what else will he find but the woman? He will find her too.

One place name is given in the *mo‘olelo*. It says Kawaihae. His canoe is landed. He is going to come to the second place named in the story which is Waimea. So he is going to be at Waimea and he will look to the expanse of Mauna a Wākea with just excitement. You could almost feel it. The excitement is going to overwhelm him because he knows he is going to find the woman, the woman of his dream. And so he will ascend. He climbs to the summit and what an incredible sight does he come across. There is Poli‘ahu and she is bathing at Lake Waiau. He is just beside himself.

Well, her three attendants will rush out. They approach the stranger and they tell him, “What are you doing? Do you not know where you are at? What has overcome you to come here? You are at the sacred, the *hālau ali‘i o Poli‘ahu*.” And he is trying to tell them, “I have come from so far away, and I have seen this in my dream.” And they are telling him, “You must leave.”

The translation of the story actually says that they drive him away. He is going to descend. But it says he is not going to give up. He will return. A second attempt is going to be made. So this man from a faraway land is going to climb again, once again to the summit of Mauna a Wākea. And comes upon virtually the same scene. Poli‘ahu engaged in her favorite past time, which is to lie at the waters of Lake Waiau. The three attendants rush out and they tell him, “You must leave.” He again tries to plead his case. They tell him, “Listen, Kāne her father, has placed this *kapu* on Poli‘ahu. We upkeep and we uphold this *kapu*. Listen, you must leave.” And so it says he does.

Like we see very common in our culture, there are water guardians, half-women, half-lizard, if that’s what your mind believes they are; they are called *mo‘o wahine*. Well, Lake Waiau is no exception. There is a *mo‘o wahine* and she is named in this story. It says Mo‘oinanea has watched all of this happen and she is actually going to call to Kāne. She says to Kāne, “Come, we must talk.” So Mo‘oinanea will sit with Kāne and she is going to tell Kāne, “It is in the interest of your daughter, Poli‘ahu, if you let her and this man love.” Kāne is a little bit *pū‘iwa* [startled, surprised]. He is taken by the words of Mo‘oinananea. And he’s going to tell her, “Are you telling me that I should lift this *kapu* from my

daughter?” And Mo‘oinanea said, “No, no, no, no. I’m not asking you to lift the *kapu*. What I’m asking you to do is to allow them to love. Because Kāne, I have discerned the nature of this man, and you will not, cannot, find any man who is going to love your daughter like this man can.”

Kāne will then call his daughter and call this man before him and he’s going to say to them, “Mo‘oinanea has spoken. And what she says is that I should allow you two to love. And you, this man, this stranger, that only you can love my daughter like no other man can, well, what do you think about this?” So the man is actually going to tell Kāne, “Well, she was right. There is no other man who could love your daughter like me.” And Kāne says, “Is that right?” He says, “Yes, I tell you the truth.” So Kāne says, “Well, this is what I will allow: As Poli‘ahu's father, I will allow love to happen two times, everyday, from *no na kau a kau*, forever and ever. You can love my daughter at sunrise when the sun first comes up. And the second time you love my daughter everyday is at sunset, when the sun goes down. This is what I allow. Let it be known.”

So for us, we bear witness to them, to this loving. Sunrise and sunset, Mauna a Wākea is going to turn colors. You’ll watch certain time for a distinct amount of time, it’s going to turn hues of pink and purple; some say red. But when you see Mauna a Wākea turn these colors, that is what we are watching. We are watching Kūkahau‘ula, who is this man who has traveled afar and seen this dream and comes in search of this woman. So Kūkahau‘ula is embracing and placing his love like no other man could, as he loves Poli‘ahu two times, everyday, *no na kau a kau*, forever and ever.

Referring to the *mo‘olelo* she narrated, Ms. Keakealani listed the reasons why she is opposed to the proposed Project:

These are the sorts of things in all the identity molecules I have in my body, that identify me and my people. If we still have these stories but no longer have the places, I would definitely say that a large part of that *mana* is gone. But how much more wonderful for us, for all people—it doesn’t just have to be the Hawaiian people—that not only do we have these stories, but we have the places too, they still can remain in existence. The story says *no na kau a kau*, when you translate that, that means, forever and ever.

And I just think that, that Thirty Meter Telescope and all of those observatories up there have just overstepped the bounds of going into what is a sacred realm. I don’t know how many people can go to the summit of Mauna a Wākea and not acknowledge that you are in a different realm. That truly is the realm of the goddess Poli‘ahu and of all these other incredibly stronger forces above and beyond us as humans. And you know, in one way or another, you are so aware that you are in a different realm up there.

> At the same time, I honor science. My grandfather, my mom’s dad…he was a guided missile creator. My grandfather actually made and created…he was one of the top engineers for the Johns Hopkins Space Center, and on contract with NASA and all of the top, leading people in missile making. He made guided missiles, I cannot even imagine that. So I totally honor…I honor that learning and that teaching and all of that information that we can get from there, from that study and that discipline. But to me, the summit of Mauna a Wākea is almost off limits, it is. I don’t even know a better word, because I think the word “sacred” is kind of used, overused nowadays. But you go there, and you know, you just know.
>
> And for me, sometimes, I don’t know if you have interviewed Uncle Ed Stevens, but he does have an extreme love for Mauna a Wākea, and he is a person who is really linked to the other side as well. For me, it jolts my heart when he says stuff like, “Poli‘ahu is so sad because she feels everybody has forgotten her. And Līlīnoe is sad and Kūkahau‘ula is sad.” If you look at any map, these are all the names of those top *pu‘u* up there, the summit of Mauna a Wākea. You have Pu‘u Līlīnoe, Pu‘u Kukahau‘ula, Pu‘u Poli‘ahu. To have an elder be telling us these things, and I know he has a direct communication line—for me. I go back and I say, “Uncle, I haven’t forgotten. And I will tell these stories as long as I can, and let their stories be heard and known.” Hopefully, at least some of the people that hear their stories will become the storytellers and they will speak it and carry it when I am gone. And that is something I hope will never stop. A hundred fifty years from now, those stories are still heard, and said, and told, and felt and known.

Ultimately, Ms. Keakealani urged for the TMT Observatory Project to be located in Chile instead of Hawai‘i.

> My bottom line recommendation is to not have it [TMT telescope]. At the same time, there is a harsh reality for some reason that’s on my heart that says, if this already has been stamped with a seal of approval that this is going through…if we are there at that point and that is the game we are in—again that is just a reference because I know by no means is this a game—then what are ways…It’s beyond having the Hawaiian people recognized or heard or they sit on the board, that’s all wonderful and we need all these things, but then how true have the people, how much have they listened to us? If the majority of the testimony is “No, don’t put that TMT there,” and it still goes in anyway, did it just not matter that we all said “no, no?” What about the other site, is it Chile, that there was another potential site for the TMT to go? As far as I know, the people wanted it there. And the people are okay with having it there. If I am wrong, I so stand to be corrected. But as far as I know, it was all good to go on that other site. I would like to revisit that. If there is another option on the table, try to look at Chile than here, than our mountain.

7.10 Mr. George Van Gieson

CSH interviewed Mr. George Van Gieson by telephone on February 11, 2009. Mr. Van Gieson’s father is a community activist Hobie Van Gieson and as a young boy, he became active along with his father in helping preserve Hawaiian culture. He is half-Hawaiian and currently works as the Fire Captain of the Volcano Fire Station as well as being the coach for Kamehameha Schools’ air rifle girls’ team. In 1976, he was one of the members of the non-profit Hōlua Project Information whose mission was to record and safeguard *hōlua* throughout Hawai‘i.

Mr. Van Gieson is quite familiar with Maunakea. At 5 years old, he accompanied his uncle, an avid bird hunter, and his aunt to spend all day on top of the mountain. He still regularly visits the mountain to direct firefighters in containing bush fires set to eradicate the invasive gorsebush:

> As a kid, I spent a lot of time on the mountain. There were no four-wheel drive cars up there, just military jeeps. My uncle lived on O‘ahu but came over the winter months for the bird season. We caught ring-necked pheasants [*Phasianus colchicus*], chukars [*Alectoris chukar*], and Japanese [*Coturnix japonica*] and Chinese painted quail [button quail*, Coturnix Chinensis*]. It was beautiful; a whole different world with snow and frost…peaceful and quiet.

When Mr. Van Gieson grew older, he became a bird hunter as well and he would take his own sons, Jonathan, 27, and Jonah, 23, up the mountain along with their friends:

> These were real special outings; the kids loved it away from traffic and buildings, a very special place on the island. A lot of times you were above the clouds and you could look at Maunakea, and sometimes Haleakalā. When you go hunting, you go before sunrise. So you have a view of the sunrise, absolutely outstanding.

He is aware of the cultural resources, beliefs and practices regarding Maunakea and its environs, including the practice of putting the *piko* of infants into Lake Waiau:

> When I was researching the hōlua sledding, we went to the adze quarry to see where it was made and what materials it was from. We also went to the lake, which was smaller than I thought. People said it had healing powers, so they went and got water from the lake. And people put the piko of babies into the lake…
>
> It was very sacred. People spoke of the lake with great reverence and the mountain in its entirety. It was a religious site for a lot of old people.

Mr. Van Gieson also discussed the Kumulipo, the creation chant of Hawaiians. “The mountain was the birthplace of the Hawaiian people. That was my understanding.” He feels strongly that the TMT Observatory Project should not be put on the mountain, as it would definitely be an act akin to desecrating the Egyptian pyramids:

> I think it would be like putting an escalator on the pyramids. It would take away from it [Maunakea]. I hope they take the…[other telescopes] down when they are done with it.

Regarding the lease agreement University of Hawai‘i has with the Board of Land and Natural Resources (BNLR), Mr. Van Gieson said:

> This whole thing where the university leases the land for $1, I don’t see the benefits of what they are accomplishing. It just destroys the mountain. If this telescope is as powerful as they say it is, they could put it anywhere. If it’s 10,000 feet, they could put it in California for that matter.

He questions the foundation that is responsible for constructing the telescope, stating:

> Something is not right. They are funded by a non-profit foundation, but that foundation expects to profit from their investment. What are the objectives of this TMT group? They are saying they are a non-profit, working with a couple of universities, funded by a school and this foundation.
>
> Do they expect to profit from their investment? If they generate income, why is it not going to the state? Why is the university leasing for a dollar? It’s not up to the university anyway, it’s up to DNLR. I don’t like them; I don’t trust these people; I don’t believe that what they’re doing offsets the damage they are doing to the mountain.

Mr. Van Gieson believes that such projects as the TMT Observatory Project will benefit only a few, and not the majority of the population. He thinks that the proposed Project will lead to further commercialization and to larger and larger telescopes, with no end in sight:

> I believe these astronomical projects are largely projects of the wealthy and they do not benefit the general public. At this point in time, there are countries selling tours into space. And that bothers me. Is this where this is going to go? What’s going to be next? Germany has a 100-meter telescope. The TMT telescope is 30 meters and will they want to move to a 100-meter and get bigger and bigger?
>
> I know some people say it’s good for university kids, good for the economy. I don’t think we should sell our mountains for a couple of jobs.

CSH again phoned Mr. Van Gieson on March 20 to inquire if he had additional comments on the changes and the proposed TMT Observatory Project. Mr. Van Gieson began by emphasizing that before any project is done, there must be a study of the cause and effect. Stating that he was a paramedic for 18 years in the fire department, he noted that the training taught him and fellow paramedics not to administer a medication that would require another medication to counteract it:

> You have to think things out, look at the cause and effect at what you’re doing before you do them. A lot of people have pet projects that they would like to see personally done, and they haven’t looked at the cause and effect…I wish I knew more about what’s going on, and what the benefits are of having all these telescopes and continually putting more and more. You would think at this age that they could share their information and not need to each have their own telescopes. I’m just wondering what the motives [are] behind having to have their

> own separate telescopes…It bothers me they are saying that it is so much more powerful [the TMT telescope], so if it is that much more powerful, why do they have to put it on the mountaintop? Why couldn’t they put it in the middle of a desert somewhere? The Mojave Desert is over there on the mainland.

Acknowledging that he has heard that Chile is the other potential site for the proposed TMT Observatory Project, Mr. Van Gieson further explained his opposition to the telescope being in Hawai‘i:

> I guess it’s cleaner air, but it’s almost like they are looking at Hawai‘i as a place where they can build it, use the place…and leave a mess behind. Historically, they have done that. The sugar plantations have done that. They’ve come in, they’ve had their sugar business and when they left, they left a whole bunch of trash and junk behind. The exit strategy has got to be in there too, and it has to be set on a timeline that if they put the thing [telescope] up, it’s going to have to be dismantled and everything put back the way it was. The major funding behind it is a private foundation. Even though they say which funds are from a university in Canada, and I think University of Southern California is the other university but there’s $200 million that’s been put in as seed money by a private foundation in San Francisco.

Mr. Van Gieson noted that it would be better if the proponents of the TMT Observatory Project would make an effort to disclose and reach out to the community about the findings of the telescope, something that astronomer Carl Sagan did. Stated Mr. Van Gieson: “He [Sagan] did a bunch of shows and expos…showing everybody what he was doing, the pictures he was taking and what he was finding. I thought that was great.”

When CSH asked if this meant he would be supportive of the proposed TMT Observatory Project if it would do something similar, Mr. Van Gieson said the following:

> It seems like they came in and they did the Canada one and the Keck. Nobody knew exactly what was going on. The next thing you know NASA has a telescope up there. All of a sudden there was a bunch of telescopes and nobody knew exactly what they were doing.

He challenged CSH to ask any three people on the street what is happening on top of Maunakea and if they could explain the benefits of the telescope:

> Most people don’t know, they don’t understand…That’s where the first telescopes were lacking. They weren’t giving information as to what they were doing up there. The military has a whole bunch of stuff in, and nobody really knew what they were doing. The sugar plantations put out a whole bunch of pesticides and chemicals that they were using, which transferred to the ocean. People weren’t sure unless they were working hands on what was going on. Then the telescopes came in and they were doing things and for years, nobody really knew what they were exactly doing and how it benefited people here. UH received a dollar a year from these telescopes. How does it benefit anybody?

As for the proposed changes in the Project description which involves the installation of an electrical transformer and the construction of a staging area to house both equipment and materials needed for the construction of the TMT Observatory Project, Mr. Van Gieson said:

> I’ve got to see more benefit for the people than a dollar a year, and I’ve got to see an exit plan where they take everything with them. And a limited time for them to be there. I drive home every morning and I see six telescopes up there from my road. And I’m thinking why do they have to be there? What’s going on and how is it benefiting us? How many of our kids are going into astronomy? What is the intent there?

Mr. Van Gieson compared the installation of the TMT Observatory Project on the mountain to other ventures, such as volcano monitoring, to underscore what he believes is the not-so-clear picture as to why such things are needed:

> A lot of the science thing now is very political. There’s a $140 million in Obama’s plan for volcano monitoring. What I hear from volcanologists is “there hasn’t been a large eruption recently and we can’t tell you when and we can’t tell you where but there will be large eruption.” For me, that’s a real stupid thing to do, we all know that. You can apply that to hurricanes, tsunamis, and asteroids striking the earth. In terms of volcanologists, they’re all crawling around on the field and taking extreme risks, and if and when they get into trouble, guess who has to get out and get them? Our fire dept. has to go and get them. I don’t know what benefit they are getting from walking around active lava flows. A lot of college kids come in because they’re all into volcanology and stuff and it’s hard for me to see what they are learning out there. We know it’s hot, we know it smells bad and they shouldn’t be allowed near it. We can’t tell when the next eruption is coming and we can’t tell where it is going to come. So don’t put our firefighters in danger by putting yourself out there where you may get into trouble and we have to go and get you…

According to Mr. Van Gieson, in the end, it is not clear how or what benefits the general public is receiving from such projects as the TMT Observatory Project. “The amount of effort and money invested…it seems to benefit the scientific community, but what do they do with all that?”

7.11 Mr. Kelly Greenwell

CSH interviewed Mr. Kelly Greenwell on December 10, 2008. He belongs to the fourth generation of the Greenwell family who has been involved in agriculture and ranching since the 1840s. His great-grandfather was William Henry Greenwell, who was the father of Frank Greenwell, the founder and owner of Palani Ranch. Frank Greenwell’s son Robert was also a well-known *paniolo* and the father of Kelly Greenwell.

Recently elected as a member of Hawai‘i County Council, Mr. Greenwell has been active in the community for the last 30 years. Along with Louie Kahanamoku, Herb Kane, Stan Zurin, and Mary Jane Kahanamoku, Mr. Greenwell helped established the Keauhou Canoe club. He also co-

founded several other parks, including the Old Airport Park with Mrs. Kunitake. He is a member of the Kona Young Farmers, a well-respected organization whose members are long-time residents and farmers of Kailua-Kona.

Mr. Greenwell considers the TMT Observatory Project as an important project that would bring back the cultural importance of consulting the heavens. He stated:

> If you were to look back 500 years, and if you were to look at the …lifestyle and beliefs of people who lived here then, and realize that it was tied in to what we call science today, tied to how you ran your life and how you ran your society, the most important element in their belief system is the heavens…They are able to find direction in something that is constant. Something constant is all important and the heavens are a constant. So they used it as a tool of discovery. It’s not only [Hawaiians] that did this, almost all ancient people did it. If you were then able to have a tool that allowed you to see the heavens in a much more advantaged way, a telescope for instance, that can actually look at what you’re looking at, see what you’re looking at, it would be hugely embraced. It wouldn’t be thought of as a bad thing; it would be thought of as a miracle almost…
>
> If you move forward today, what’s happened to that whole cultural process is that it’s been lost in the day-to-day way people ran their lives; it’s no longer significant what the heavens are doing because we have other means of predicting the future. So the heavens have lost their import, so they’re fading from the cultural processes. There’s not the same degree of respect, there’s not the same degree of wonder.

He noted that Hawaiians in the past would have supported a project such as a telescope which could provide a window to peer into the heavens.

> I think [Hawaiians] were a much more fluid people…Consequently; we have the same similarities in language all over the Pacific because they interacted with each other to a much greater degree. Therefore, from a navigational standpoint, the heavens were so important to them. They had to know what it was. If they had a tool that would make that more doable, it would be celebrated, rather than rejected.

Pointing to the flexible nature of Hawaiian culture, Mr. Greenwell cited the history of Hawai‘i when Captain Vancouver showed up with guns and cannons that were integrated into Hawaiian culture, the same as when Christianity was introduced. He stressed that it is the fluid Hawaiian cultural process that needs to be preserved, not just the artifacts.

> If you go back and say we want to be culturally responsible at what we’re doing in Maunakea, what you really want to revere, respect, preserve is the process, not the artifact. The artifact may give an indication of what went on, but it’s not what went on. It’s a tool, a guide.

In the example of Hōkūli‘a, a private residential development in Kona, stones that have been moved are being given undue attention, according to Mr. Greenwell. The focus must instead return to the Hawaiian cultural process, and what the culture can offer the world.

> Somebody picked up those stones and moved them. Yes, it is an artifact because it can demonstrate somebody was there and picked up the stuff. But is it meaningful and worth saving? Or is it an insult to the people that you’re saying these people aspired to piling three stones on top of each other? What you want to do is to focus on who were these people and what it is they had that we need today to save the world. Hawaiian culture is so vitally important because it’s different. It’s different because of the fact that it’s accepting, it’s innovative, it’s imaginative, and it accepts other things from other cultures and other happenstance. They take advantage of [it]…You couldn’t survive if they didn’t include into what they were doing, opportunity. And this telescope thing is an opportunity. It’s an opportunity to see the heavens more clearly, more succinctly in a way so they can understand why the moon goes around one speed and why the stars go around another. You don’t say, “Over here, we only use spears, we only use that kind of stuff.” That’s where we’re going right now. That’s very European, that’s very American. “We have our way of doing this and we don’t want to be disturbed.” That’s totally and completely opposite from what the Polynesian culture, Hawaiian culture was all about.

Mindful of the past issues and projects that have led some in the community to object against the treatment that Maunakea has been subjected to, Mr. Greenwell emphasized that the right attitude of respect needs to be present. There has to be a willingness to listen from both sides.

> If they went in there with a degree of respect and understanding for those issues…it’s like building any temple, you have to bless the land that’s its built on. You cannot violate the land that the temple is built on. These stargazers, if you will, are akin to a series of temples. And they have to be appreciated as such, and all that’s involved in creating them has to be appreciated. But it’s not an issue of “no, we’re not going to do this.” It’s an issue of who we’re doing it for, and why we are doing it. Who we’re doing it for is very important…When it comes to actually sitting down, and deciding how we are going to build these structures on this mountain, the attitude has to be “we want to listen.” And that is said from both parts. It’s not just the people who are speaking who have a future up there…we’re going to have to think for everybody. It’s a big responsibility.

Mr. Greenwell believes that the Project’s importance is not limited to the here and now, but it is eventually tied to the future of the planet.

> Why is it important to look at the stars? What are the opportunities that this presents to the future? What’s the responsibility of the Hawaiian culture? Is it just going to become a list of artifacts, which is where it is headed right now? Artifacts are fine for museums, but the future is where the next generation of humanity is going to reside. And it’s not just our kids and the Hawaiian kids, it’s everybody’s kids. What’s the role of Hawaiiana going to be? What’s its future?

> What’s the future of this planet? I’m extremely strong believer that if the concepts of the Hawaiian culture are not re-activated, then this place is going to fall apart. I just don’t mean Hawai‘i, but the whole planet. There’s too much antiquated religious thought that is dictating what is going on in the world today…

For Mr. Greenwell, what is needed is a process that will respect what the community wants but at the same time, enable the continuance of projects that are needed. He pointed to a current highway project as an example.

> We’re having a problem now with the highway. We can’t move a couple of graves so the highway has to go around it. And I don’t know whose graves those are. I don’t know if the circumstances of them being buried there are for, and I don’t know if anybody does. But I do know that there is a distinct need that we have a highway system for the future. And there’s also a distinct need to have a responsible process put in place for when this occurs, that’s in compliance with everybody who is involved. Can this be done? And the answer is yes, it has to be. Otherwise, everything just stops. And that’s where we are right now. We’re at the place where everything is stopped.

As a young man who was born and raised in Kailua-Kona, Mr. Greenwell could remember the changes that occurred after World War II, and how life had to change.

> Hawai‘i has to be part of the future rather than defending its position in the past. Things will change…I can remember going places and having to pack the mules. And then you got a hold of an old jeep and that was revolutionary. You can go up the mountain with a load of whatever, and you couldn’t do that in the past. You’d have to go on horseback. You’d figure in Thomas Jefferson’s time, the fastest thing at the time as 3½ miles per hour. That was a horse. Compare that with going to the moon, in a relatively short amount of time…We’re thinking about building all of those new highways. I would venture to say that in 50 years, we won’t be using any cars. The technology would have evolved, so that you could either get your body from place-to-place or at least get your message from place-to-place without having to go there. It’s like we are going to spend $150 million dollars right now to build this West Hawai‘i Civic government office. There isn’t a thing that goes on in government that can’t be done with a fax machine…and a computer.

Mr. Greenwell considers the government office building project as an unnecessary, expensive one because nothing physical is taking place except the distribution of license plates. His mission as a county council member is to look for sources of funding for community projects that are worthy of being funded.

> I’m right now looking at how we can get two to three billion dollars from the Federal fund monies. There’s three hundred billion dollars allocated for things happening in the farm industry. Three hundred billion! That’s a lot of money. But [it] is a lot of tools, a lot of enabling. You have to view money in a different way. Money is not a sign of wealth. It’s a process of getting to wealth.

The building of the TMT Observatory Project is a worthy project than the building of a civic center, Mr. Greenwell stated. Instead of a civic center, it would make better sense to build a hospital.

> It's just a matter of priorities. Is the telescope center a matter of priority? I believe it's more than a priority; it's an essential element to establishing a cultural tie to who Hawaiians were 500 years ago. In a very real way, it's a living artifact.

He called for a process of constructing the telescope that would respect the aesthetics of the mountain. One way that could be done is to not paint it white and to bring it down to a lower level. Respect needs to be woven all throughout the process of building the telescope.

> I want to see it built…to see some respect for what is [being] built. I don't think it needs to impact the aesthetics of the mountain itself…To me…respect for nature is not to deface it. You can enhance it, but not deface it…When it comes to the bottom line, the only thing that really counts is that it is done in an appropriate manner, the alternative of that is inappropriate and this is not religious or any other than mechanical. What I have against windmills, they're ugly and I don't like them whirling about. It's the same as solar panels, if we can come up with a way that's not obtrusive, then I might warm up for it.

To get a clear understanding of how the community will respond to the TMT Observatory Project, Mr. Greenwell recommended that CSH speak to everyday, ordinary people. Also, he stressed the importance of making decisions with the future in mind.

> We're making decisions based on a very limited vision and it's most important to know what that vision is. We don't spend enough time researching answers for the future. I think that's our biggest problem.
>
> I like to think in terms of 1,000 to 10,000 years from now. We may not be physically here anymore, but there will be a planet here. It's so hard to let go of a little fingernail hold of what we think of as forever…Something like the telescope to broaden our view of the future rather than remembrance of the past cannot be set aside. We have to know as best as we can what's in the future. In the same way, why it's important to know what's in the past.

The grievances that people have about past projects and events on Maunakea do not have to be repeated with this new project, said Mr. Greenwell. He understands, however, why some people are against it.

> One of the things that we have to remember is that the mountain belonged to the old ancient Hawaiian culture. But now it belongs to the living, it belongs to the future. The mountain itself does not care who it belongs to. The concept is almost foreign to those claiming ownership. If the mountain does not belong to anybody, the mountain has a future just as much as it has a past. There's a way to build a relationship and it's going to come out of the culture of this place but has to be respected by people coming here. And that's what it boils down to. You are moving into an environment that's been fortified by a lot of grief, a grief that has

> come from theft. And this is an opportunity to show it doesn’t have to be that way.

CSH sent revised Project changes on February 2, 2009. On March 25, Mr. Greenwell called CSH and stated the following regarding the Project changes:

> Frankly, I don’t know if there is anything that we can do. We’re going to have to have support facilities. I don’t see a problem there, other than to say I’m hoping that whatever is envisioned is what we have already discussed.

7.12 Mr. Daniel Akaka, Jr.

CSH met with Mr. Akaka Jr. on Feb. 24, 2009. Mr. Akaka Jr. is the Director of Cultural Affairs at Mauna Lani (Figure 25). A *kahu* (minister, guardian) and historian, Mr. Akaka Jr. is also a Hawaiian cultural practitioner and active in the community. Born and raised in Nu‘uanu and Pauoa Valleys, Mr. Akaka Jr. is the son of U.S. Sen. Daniel Akaka. In 1995, he participated in Hōkūle‘a’s voyage to the Pacific Northwest and in 1999; he traveled to Mangareva (French Polynesia) as the voyaging canoe’s protocol officer. Last year, Mr. Akaka Jr. also traveled to Japan on the Hōkūle‘a. He and his wife, Anna, have five children. They are Kaleihikina, Kahikina, Kapihenui, Kalā, and Keānuenueola‘akea.

Familiar with the cultural history of Maunakea, he related one of the most well-known *mo‘olelo* which pits Poli‘ahu, goddess of the snow, against Pele, goddess of fire:

> You know Maunakea is known for its snow. And the goddess of the snow is Poli‘ahu. And the most well-known of the stories of Poli‘ahu is a battle between two physical forces, fire and ice: Pele representing the fire, Poli‘ahu representing the ice and snow. In this *mo‘olelo*, this story, there was a chief from the island of Kaua‘i, ‘Aiwohikupua, who was betrothed to the legendary Lā‘ieikawai of this island. So he prepared his voyage, his journey to meet his fiancée on this island on Hawai‘i. But on this journey, he went to the island of Maui and he was enchanted by this very beautiful woman riding the surf. Because of this mutual interest, they both consented to having an affair while on Maui. Following this brief interlude, he left Maui to seek out Lā‘ieikawai here on the island of Hawai‘i.
>
> But as he approached the island of Hawai‘i and gazed at the beauty of Maunakea, he saw the beauty of Poli‘ahu in the mantle of white snow. And he fell in love with Poli‘ahu. They immediately connected with each other. And ‘Aiwohikupua took Poli‘ahu back to the island of Kaua‘i where he was from. He prepared for marriage and little did the chief ‘Aiwohikupua know that the surfer girl he had the affair with on Maui was none other than Pele in the guise of a beautiful woman. And so Pele, jealous [of] the relationship of ‘Aiwohikupua and Poli‘ahu, intervened and broke up their ceremony of betrothal on the island of Kaua‘i. The two forces of nature, Pele and Poli‘ahu, returned to the island of Hawai‘i to battle on the great mountain of Maunakea.

> It was a great battle. Pele would cause Maunakea to erupt, Poli‘ahu would release her snows and at one point in time, Pele seemed to be winning the battle as the snows would be melted by the fires. But then, Poli‘ahu with renewed strength caused a great snowfall that covered the mountain and covered the lava and solidified it. So Poli‘ahu won that battle. Pele took leave of Maunakea and the relationship that she had with the fickle young chief ‘Aiwohikupua, who left empty-handed. And because of that Poli‘ahu reigns over Maunakea. Maunakea’s never erupted since that battle, not until Pele tries to take over the mountain again. Pele moved over to Mauna Loa and Kilauea where she activates the mountains on occasion. That’s the story of these two eternal opposites of nature, Pele and Poli‘ahu.

When asked about his *mana‘o* regarding the proposed TMT Observatory Project on Maunakea, he stated the following:

> I’d like to first of all say that education is primary to the future of not only Hawai‘i and the Hawaiian people and the rest of the community, but to the nation and the world. Education comes in many forms. So we have to constantly educate ourselves, always knowing that we’re not always educators, but many times…students. We get our education passed from what we’ve learned at home and at school. Things that were passed on from our *kūpuna* as a foundation of the things that we need to carry with us into the 21st century and beyond that even with the new technology knowing that modern technology can be very beneficial.
>
> We also need to be aware of the cultural foundation as well and to find a sense of balance and harmony in that. For our ancestors were very innovative, creative and resourceful, and if they had things like this, they would’ve used it. They were scientists in their own right. They looked at the night sky to use that knowledge to create star paths so they could travel to places where their ancestors came from. So they understood the world that surrounded them through their vast knowledge of the night sky, the many different stars, the moon and the sun. These things are all part of a great creation that was created by God, the Great Spirit who is known as ‘I or ‘Io. And then everything that surrounds man, all things of nature come through this Creator.
>
> So with that understanding, I always like to try to look through the eyes of the ancients to see what is best, what is best for our community, for our children, and the children of the future. Whatever we teach them, whatever we pass on to them will affect their decisions, which may affect the whole world and the universe.

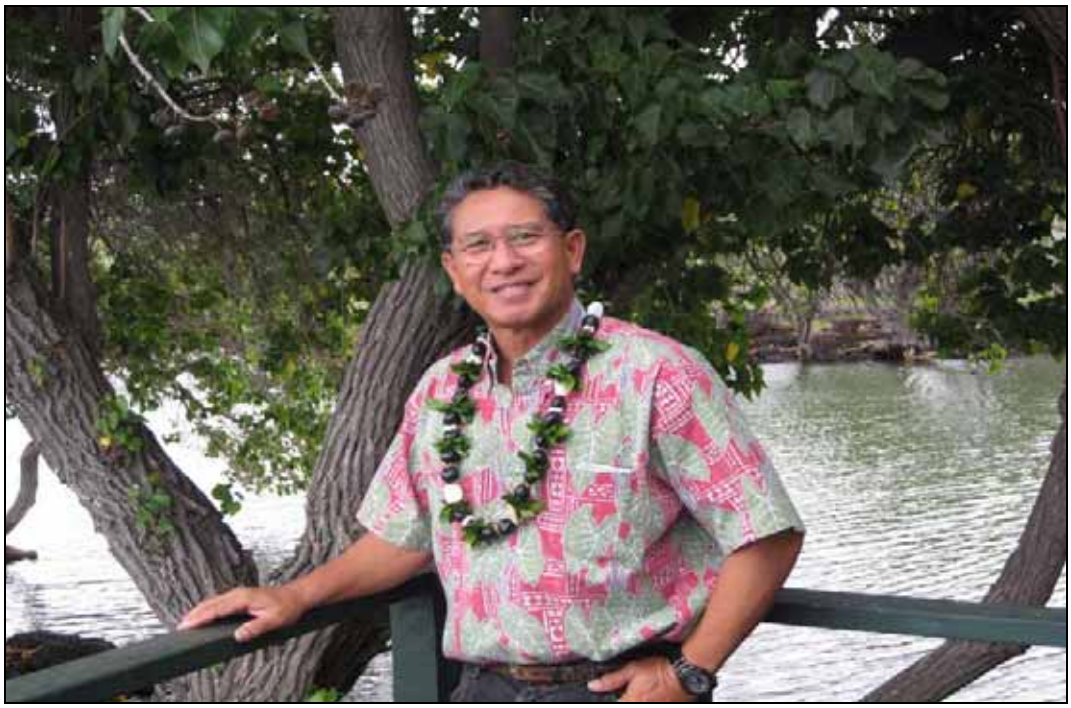

Figure 25. Mr. Danny Akaka Jr. stands in front of one of Mauna Lani’s fishponds (source: CSH Researcher Margaret Magat)

In response to the question whether he has any concerns about cultural practices that may be affected by the proposed Project, Mr. Akaka Jr. said:

> It has to work in harmony with practitioners. That’s the way it will work best. It is through the knowledge of the practitioner that can help the astronomers as far as how to do things up there, how to take care of the place, their understanding and connection with nature and that you have to become a part of the place. You can’t just come up and feel that this is a place you can desecrate or trash out. It’s a very sacred place. The mountain top is the highest physical point that a man can achieve. Maunakea is the highest mountain on earth. So, the Hawaiian at the summit of Maunakea reached his highest physical achievement for man. Beyond that is the spiritual aspect, the heavens.
>
> We need to instill that understanding to people who are going to be up there and who are going to work there. They need to have respect for this very sacred place. It’s kind of like working on the grounds of a church, you don’t want to be *kāpulu* [careless, slipshod, untidy, disgusting], you don’t want to desecrate it. Maunakea is also a resting place for many of the ancients. So it’s a very hallowed, very sacred place. So anything that is constructed up there not only has to fit into the nature of the mountain, but it has to be something that can also compliment Maunakea. One needs to understand that it’s a place that at one time, not all

> Hawaiians were privileged to go to because it was the abode of the gods and a place that was greatly respected.
>
> The future of Maunakea is that yes, it can serve as an educational center and a place for man to view the stars and the universe but it has to remain a sacred and holy place. It’s like stepping into a sanctuary, a very sacred place of peace, a place that one can learn the things beyond what man knows now. There are many secrets, some of which the ancients knew but was never all passed down. So it needs to be a blend of the ancient knowledge and modern knowledge and it needs to be treated as a church would be treated, as a sanctuary.

As for other concerns, Mr. Akaka Jr. stated:

> When you look at the mountain now, you see all these different observatories which kind of detract from the sacredness of the mountain. And if we truly feel this knowledge that we gain from learning about the universe, from the heavens will be one that’s beneficial to the world, then all the nations need to work together, need to unite to have one observatory that will represent the world and one that everyone can use. And all of the other observatories should be removed. But it should be a united effort between all the nations. All nations should work together, not in separate facilities, but all in One [Mr. Akaka emphasized that the word “One” should be capitalized]. And maybe this is the theme that all nations should work together in harmony and unite as one.

7.13 Mr. Clarence Kukauakahi “Ku” Ching

CSH conducted an interview with Mr. Clarence Kukauakahi (Ku) Ching on February 27, 2009 in Hilo. Follow up interviews were conducted on May 6 and August 20, 2009. He is a former trustee for the Office of Hawaiian Affairs and is currently a subsistence farmer and cultural activist and practitioner on the island of Hawai‘i in Waimea. He provided the following concerns regarding the proposed TMT project on Maunakea:

> I am very concerned with the TMT being built on the Northern Plateau on the summit of Maunakea. That area is relatively undisturbed with the exception of a few unpaved dirt roads. If the TMT is built there, it may potentially open the door for future telescopes being built there, and on the far parts of the mountain, as well. So this concerns me. It will set precedence. Once one telescope goes there [on the Northern Plateau], all the unused space on the plateau, and the remainder of the mountain, will now be potential sites for future telescopes.
>
> To have the TMT built near the *pu‘u* on the northern side of the mountain (away from the summit), where there are traditionally lots of burials to be threatened by telescope development is unthinkable. These *pu‘u* are where burials of those of non-paramount standing and status were allowed.

Mr. Ching mentioned his concern about the size of the proposed TMT:

> Another thing that concerns me is that the TMT is gigantic when compared to every other telescope site on the mountain that it makes a mockery of the idea that development on the mountain—and their impacts—should be classified by numbers of telescopes. This particular telescope [TMT] is very big and will cover a land area that may rival all of the other telescopes put together. So when I hear all this talk about the 13 existing telescopes and that by allowing another telescope, it may appear to people that “Oh, it’s only one more telescope, it can’t be that bad,” but really, this site will dwarf all of the other sites. The parcel that the TMT will sit on will be the biggest by far on the summit compared to all the other observatories in total. It seems that the observatories should be compared by the diameters of their mirrors—or the land area their sites encompass—but not by numbers. This makes it additionally confusing when the terms “telescopes” and “observatories” are mentioned as some of the observatories contain multi numbers of telescopes. For instance, while Keck is made up of two major telescopes, is it one observatory or two? It may depend on whether they are in operation as one unit or not.

Because of the size of the telescope, Mr. Ching has expressed his concern that TMT’s electrical consumption may adversely affect the power supply on an island with limited electricity resources:

> Do they know how much electricity is required to operate the TMT? I mean our island has limited electricity as it is now. How much electricity are they [TMT] going to consume to keep all their equipment at the right temperature and functioning properly? Not only will the TMT require additional electrical transformers, but there will also be the requirement to dig up new and undisturbed ground on the Northern Plateau for electrical infrastructure? I believe these things need to be addressed. Since there are no existing underground conduits that I’m aware of on the Northern Plateau, my assumption is that there will be trenching done to get the power to the TMT. If this is the case, then how much and where will this desecration be and how deep?
>
> In any case, using up any part of the power capacity of Hawai‘i island creates a problem for present and future consumers of electricity on the island.

Mr. Ching was asked about his thoughts on the proposed TMT development on Maunakea:

> Well there are a couple things I’d like to point out. Although I am very much opposed to the TMT being constructed on Maunakea, it is possible that it will either survive or subvert the processes that protect the environmental and cultural integrities of the mountain. However, I am appalled at the 20 tricks (strategies if you please) that the universities (Mānoa and UH Hilo) and the TMT folks are forcing on, specifically, cultural practitioners and, generally, the public.
>
> It is interesting to see how “carrots” are put out to influence public attitudes that are then used to influence public opinion and thus the workings of government or to suppress the truth in order to choose the “right” forum. For instance, TMT has

> lied that it hasn’t used (or has any plans for future use) any federal moneys so it can avoid the “federal” requirements of the National Environmental Protection Act (NEPA). The fact is that TMT has been granted more than $8 Million of National Science Foundation (federal) funds for design and planning and TMT has put out requests for future federal funds for operations and administration.

From a mitigation standpoint regarding the proposed TMT project, Mr. Ching offered the following:

> Like I said earlier, if it has to be, if the TMT project is eventually approved to be built on Maunakea, I would not want it on the summit—except that the summit has already been already severely culturally desecrated. I also have severe feelings about building it on the virgin lands of the Northern Plateau. If I were forced to, I would consider building it around the 13,000 foot level, near the VLBA [Very Long Baseline Array Telescope System located below the summit of Maunakea, approximately a three mile drive from the summit] that is a distance away from and not visible from the summit. By being sited there, it would be away from the areas of paramount cultural sacredness and not interfere with the major view planes of the summit area or be so visibly intrusive from lower levels on the island.

7.14 Additional Statements

7.14.1 Mrs. Cynthia Nazara

Mrs. Nazara was born on O‘ahu in 1947, and moved to Hawai‘i at age 13. Her great-great grandfather, William Keanaaina, was the caretaker of Kaloko Fishpond. She is a member of the Hawai‘i Island Burial Council and is actively involved with the Kona Hawaiian Civic Club. She replied to CSH via email on December 9, 2009 with the following statement:

> My mana‘o for this particular project for the TMT is as an individual. As you know, I am a freelance Cultural Resource Consultant. I read the project in question. The only concern was that we never go and disturb the “iwi” area and or historical sites. There are sites and burials that have been already identified, but sometimes we come upon others. So, when we do, I would like these concerns to protect them just as we have done in the past. This has to be taken up not only with the HIBC, but with the kūpuna of this ‘āina, more specifically, this ahupua‘a. The mountain holds so much history that we cannot crowd it with more technology in the future.

When CSH contacted Mrs. Nazara for clarification later on December 9, 2009, Mrs.Nazara stated the following: “However, it is all right now what we are trying to do with the TMT.”

7.14.2 Mrs. Ululani Sherlock

A member of the Hawai‘i Island Burial Council, Mrs. Sherlock has been involved in issues related to Mauna Kea for a number of years. She recently fulfilled two years of service with the

Office of Mauna Kea Management and was a member of the Kahu Ku Mauna advisory board. CSH contacted Mrs. Sherlock on October 20, 2009. Mrs. Sherlock replied via email on October 26, 2009 with her personal *mana‘o* as an individual, raising issues about waste and/or water run-off, the light pollution that may be generated by the temporary dormitory at night, and the presence of hunters and tourists visiting Maunakea. Mrs. Sherlock stated the following:

> An important concern I would have and share with you is that the entire Pu‘u is considered sacred from the ocean to the very top of Mauna Kea and just the mere digging, which I know will need to occur in order to construct this facility, is considered by most a desecration of Mauna Kea in itself. I know it may seem a little unusual, but the very thought of digging and removing the soil to install a base for the “trailer” is a sensitive issue to a Halau, members of the Royal Orders, Ali‘i Societies and other traditional practitioners, who often go to the Summit to perform their rituals, respects and present Ho‘okupu. There are also burial caves known only to the ‘ohana where remains of iwi kūpuna, wrapped in kapa were stored by their ‘ohana.
>
> To begin with, you mentioned “a temporary dormitory complete with restroom facilities, a cafeteria, and parking area, as well as staging areas, located both in and adjacent to the Hale Pohaku site.” I’m assuming you are saying this is where their equipment will be stored temporarily. Will this restroom facility be a “portable unit” trailer and assuming here will be a “septic tank,” who will be responsible for collecting the waste and/or water run-off and how often will it be transported off of Mauna Kea?
>
> Another item that there may be a concern is the lights utilized by the temporary dormitory at night; I’m not completely sure why this was raised during one of meetings, but that might be food for thought. I know there will be other concerns and issues raised during your presentation at a Council meeting such as the fact that often times we’ve noticed hunters just below the Summit during the day and last but not least, there’s the tourist. Whenever the boat docks at the Hilo Harbor Pier, a short walking distance from home on Hawaiian Homelands here in Keaukaha, there will [be] tour buses plus ten, 12, and 14 passenger van loads of people transported to Mauna Kea at least two, three, sometimes four times a week including Sundays, which includes tourists who fly in for the day and then return to Honolulu or wherever they began their trip to see our Pu‘u.

7.15 Additional Interviews

7.15.1 Mr. Ed Stevens

CSH met and interviewed Mr. Stevens on October 12, 2009 at his home in Kailua-Kona, Hawai‘i. At the time of the interview he was 79 years old. Mr. Stevens was born on O‘ahu, but has lived on the island of Hawai‘i since 1968. Since 1961, he has regularly hunted and hiked on Mauna Kea. In the process he has gained knowledge about the mountain, as well as deep appreciation and concern for it. He is a member of the cultural advisory group, Kahu Ku Mauna,

since 2000. He is also involved with ‘Oiwi Lokahi O Ka Mokupuni O Keawe, a non-profit organization assisting the Department of Hawaiian Home Lands with land-use plans for areas on the southeastern slopes of Mauna Kea.

Mr. Stevens began the interview by emphasizing that he was speaking as an individual, not as a member of Kahu Ku Mauna.

> I want it to be clear that I am speaking for myself and that I do not speak for the University of Hawai‘i, or the cultural advisory group, Kahu Ku Mauna, who are working with the University. I don’t represent them in this interview, because I am talking about my own *mana‘o*, my own feeling about how Mauna Kea is being used for astronomy. I will be focusing on the cultural impact the TMT will have on Mauna Kea, specifically, at its proposed location at 13˚ N.

When asked about the history of the group Kahu Ku Mauna, Mr. Stevens explained that his involvement first began in August 1999. He noted at that time, Senator Inouye was searching for a Hawaiian cultural group that could work with the University of Hawai‘i on issues related to the Mauna Kea Science Reserve Master Plan. Along with eight other members of the Hawaiian community, Mr. Stevens was invited to participate in a discussion group. Soon after, the nine individuals of Hawaiian ancestry formed a cultural group and they named themselves, Ahahui Ku Mauna, which Mr. Stevens translated to mean “the group for the mountain.” He described the challenges the group had to face.

> We worked in that capacity with nine members of astronomy who were either directors or managers of their respective telescopes. It wasn’t working too good, as we couldn’t get commitments from them, because they could not speak for their institutions. We were getting frustrated because we couldn’t get yes or no answers from them, so we decided to move ahead without them.
>
> We disengaged ourselves from this astronomy group, and in striking out on our own, got the University’s Board of Regents’ attention, who eventually assigned their own subcommittee to meet with us and resolve issues impeding the progress. We got along well…the net result was the Board of Regents had a public meeting in June 2000 and approved and adopted the Mauna Kea Science Reserve Master Plan.

According to Mr. Stevens, the master plan called for three bodies to be formed: Office of Mauna Kea Management (OMKM), Mauna Kea Management Board (MKMB) and a Hawaiian cultural group. “Once the master plan was approved and the three bodies were formed, we took the name Kahu Ku Mauna, which means “Guardians of the Mountain,” noted Mr. Stevens. “Our mission was to take care of Mauna Kea. We worked closely with OMKM, which worked with MKMB on requests concerning the mountain.”

Mr. Stevens stated that the MKMB was the point of review and approval for whatever action needed to be taken and forwarded to the Chancellor of University of Hawai‘i at Hilo for approval. If the project was a major undertaking, it would then be forwarded to the UH Board of Regents for their approval or disapproval.

When asked how he got involved with the cultural group, Mr. Stevens stated:

> I was invited because of the knowledge I had of Mauna Kea. As a younger man starting in 1961, I did a lot of hunting on the mountain. Thus, as a hunter, I had an intimate association with the mountain. I just loved being up there. It went from wanting to hunt to just wanting to be there. The hunting became secondary and it was more hiking and being up on the mountain. And the result is I got to know the mountain very well. All parts of it, not just specific areas such as the science reserve. Being in hunting and hiking, I covered the whole mountain. As a result, I knew places, I knew place names and I knew the significance of each of the areas. I therefore had good background on Mauna Kea so that when I joined with Ahahui Ku Mauna and then with Kahu Ku Mauna, I had an extensive background and knowledge of the land forms and the place names, etc. That was very valuable for a member, an advisory member, to have that background. In that capacity, I took a leadership role for the group.

When CSH asked Mr. Stevens to share his *mana'o* about the TMT proposed project being erected on the northern plateau within the Astronomy Precinct, he expressed the following:

> There are two parts to this answer. Culturally, there's no more room for new telescopes on Mauna Kea. From a cultural viewpoint, the mountain top, the most sacred part of Mauna Kea, the summit, is already overbuilt, overcrowded with telescopes. So when you ask that question, that is the reply that you will get from most Hawaiians, is that we don't want to see any more new construction. There's already 13 facilities up there, and it's overcrowded. They don't leave much space for us up there. So back to your question, if any proposal is made for a new telescope, and if that telescope went through the process of being approved and it passes all of the requirements, and approval is obtained to build the telescope on Mauna Kea, then that site that is now picked for the TMT at 13˚ N would be my preference to see it built there…below the summit in the north plateau.

Because there are relatively fewer cultural artifacts in the northern plateau, it would be an appropriate area if a telescope needed to be installed, stressed Mr. Stevens.

> What I am saying is that if we have no other choice, and that a telescope is going to be put up there after all the approval[s], then my preference is to put it in the north plateau which is essentially where TMT is being proposed. I see that area as more benign and [it] has less cultural artifacts that can be disturbed.

Mr. Stevens further elaborated on why the northern plateau for the proposed TMT would impose less impact on cultural resources.

> The site that was chosen for the TMT has been surveyed for the cultural impact and there are no cultural historic objects within a 200-ft. radius of the site. In other words, the site that they picked is free of bonafide, historical treasures. Now there are some historic sites but they are not within the immediate area that is proposed for the TMT. That makes it simpler in that there is no danger of harming any of the historic sites. Mostly, the historic sites I am talking about are shrines

> that were built by early Hawaiians to represent their gods and goddesses on the mountain. Unaltered select slabs of stone, the *pōhaku* of a certain size and shape, were stood upright to represent a god or a goddess. So when we say a shrine in this sense, we are talking about slabs of basalt material that were stood upright. Currently, there are at least 222 shrines around the circumference of the summit area, between the 11,000 and 13,000 ft. elevation.

If he was able to choose, Mr. Stevens emphasized that his ultimate choice would be no telescopes on the summit of Maunakea.

> What my choice would be, and this is to me important, my choice would be to remove the telescopes from the summit and put them down there. Take them off the summit. I'm talking through attrition; as a telescope gets older, it nears obsolescence, then take it out. And if a replacement is needed, then put it down in the lower area. Following that concept, the vision that we would hold in the Hawaiian community is that eventually, the summit would be cleared whether it be 20 years or 50 years, whatever time it took…we can foresee in the future that the summit would then be returned to us in time so that there would be no remaining telescope facilities on the summit. That they would be, if at all, down in the north-northeast plateau where they will be out of harm's way in our view and they can function there. They've already had several testing done for observation, and maybe not 100 percent as good as the summit, but good enough for them to do their astronomy work. So that's my *mana'o*. As far as eventually, and this is our view of others in the council…in their view, that would be the ultimate goal to see the top cleared and…not so visible. Right now all you see on the summit are telescopes, and that bothers us. So that is the cultural viewpoint, and I speak for myself actually, and I am sure others feel the same way; many others.

Thus, if new telescopes have to be built, Mr. Stevens emphasized that the telescopes should be worthy of being built up there, such as the TMT which he called an "outstanding piece of equipment." He stated:

> …If you are going to put telescopes on the mountain, put only the best that is available. Because Mauna Kea is so special there needs to be a limit as to how many telescopes could go up there. Selecting the best to me is important because we don't want to see helter-skelter kind of decisions on what to put up there. The TMT telescope, in my view, is an outstanding piece of equipment that is high technology and that is current state-of-the-art. It has amazing potential. Seeing that, I see benefits for the telescope being there. There are two parts also: one is the technical aspect, the other is the benefits of what can be derived by them being up there.
>
> …From the non-Hawaiian viewpoint, looking at it from a scientific view, the TMT has a lot to offer and it is exciting to think about the potential of the telescope. How can you not be excited by something that tremendous? Looking at it from a very practical point-of-view, which is what I am saying, that I think the

> TMT is a wonderful facility to have. Aside from the scientific viewpoint, the wonders of that telescope, I'm looking at the other benefits that will come from it.

However, Mr. Stevens called for changes to be done to the lease if the TMT telescope will be installed on Mauna Kea. He expressed the following:

> When the decision is made for the TMT telescope, it's approval to go ahead, some major changes will need to be made in the lease. The current lease is a 65-year lease that terminates in year 2033. It was granted to the UH for a dollar a year, and they in turn sub-leased to the other facilities for a dollar a year. So the revenues therein for the 13 facilities, counting the university, is $13 a year---it's a sin to have that kind of an arrangement for the value of Mauna Kea as an astronomy site.
>
> The way things are set up, we cannot let TMT get a site up there for a dollar a year. That would be absolutely ludicrous. So right now, they realize that and they understand that and they don't fight it. They acknowledge that the land that's reserved for TMT…is valuable land; it is priceless because of the ability of astronomy; it is priceless for them. They are not against paying a fee, but currently they can't deviate from the present policy of a dollar a year. Everybody has it for a dollar a year. So why should TMT not have it for a dollar a year? Well, for one thing, it would be totally objectionable from the Hawaiian community. They need to revise and modify that master lease so that it would be fair and equitable to all; all the telescopes up there. I know that TMT is taking the first step in trying to mitigate that problem, and they are proposing in a way to begin to correct that problem by committing to donating a large amount of money per year into some sort of trust, some sort of endowment which would be used for education for students. It is a large sum of money which they are talking about, which makes appropriate compensation for the land they will use.

For Mr. Stevens, the draft Environmental Impact Statement (EIS) is a useful document. Indicating a copy of the draft EIS on the table, Mr. Stevens stated:

> They are looking at proposing ways to mitigate impact. They recognize what we have been saying---that everything done on the mountain adds to the cumulative impact on the mountain. What does this cumulative impact mean? It means the accumulated impact on the sacredness of our mountain. It diminishes rather than improves. So the draft EIS speaks of those things, acknowledges the negative impact on certain things...it has the good and the bad, and you want to look at both, the plus and the minus. How else can you make a fair assessment if you don't have both sides of the story? …It does have a negative cumulative impact but it is not enough to defer the project. It is minor. Essentially, what I am saying is that I see in the Environmental Impact Statement that they are recognizing the negatives as well as the positives. And that is what we need to have them do. So that those who read that EIS can understand both sides of the issue and not be biased…

In response to the question whether he had any recommendations that would help lessen impacts, Mr. Stevens shared the following:

> One of the concerns, and they understood that, is to be as far away as you can from any historic sites, any shrine, or *ahu*. That is the main drive, to not disturb the cultural properties. The site that they have right now for the TMT was selected on that basis that it didn’t have major impact on artifacts. In that northeast plateau, there are large areas of potential, for future, if need be, if it would be allowable to put them there. But again, my thinking being only if they took them off the top, then put them down there.

As for the supporting facilities proposed to be constructed on Hale Pōhaku, including dormitories, restroom facilities, a parking area and a cafeteria, Mr. Stevens noted:

> As far as the facility, it would be warranted to have that because the facilities that are there now are heavily used. So to add staff and allow for staging areas, living quarters, eating quarters, all of those amenities, then it is logical to build facilities to handle their own traffic because the existing facilities are already booked pretty heavily. So yeah, it is necessary to have it there. As far as cultural impact, the area has been thoroughly surveyed for cultural artifacts. There’s a few in that area but they are already defined and they know where these sites are and they can readily be avoided. The proposed facilities for TMT dormitories, eating places etc. have been selected on the basis that there is no cultural impact, or at least, a low level of impact at Hale Pōhaku.

In addition to discussing the proposed project and the implications of putting the TMT on Mauna Kea, Mr. Stevens also shared some cultural beliefs regarding the mountain. He pointed out that in his more than 40 years hunting and hiking on the mountain, he has become aware of what he calls “three levels of transition.”

> One of the things that I pay particular attention to, again, this is my view and there are others that may feel the same, and there are those that may not; when I go to Mauna Kea, there are three levels of transition… As you are progressing upslope, the 11,000 ft. level would be the first transition into “*wao akua*.” *Wao akua* is the place where gods dwell. The first level of transition into *wao akua* is from 11,000 to 12,000 ft. This entry is allowable to all. I am talking about early Hawaiian history where it was open to anyone for access. The next transition was at 12,000 to 13,000 ft. elevation. This was the beginning of the sacred area, more sacred than the first. It is here that you will find in the circumference around the mountain, the area where most of the shrines are found. All these shrines represent gods and goddesses. So you could see it’s like being in a church where all the walls are lined with statues of saints. Catholics I know do that. Those statues are the saints that you pray to, to ask God for something. That’s what those shrines are up there for. In that same church, the 12,000 ft. elevation, the early Hawaiians along the coastline, they know their shrines are there, and they can pray to akua. Now some may dispute that but that is their choice. But I take it as how I get it. The third and final level is at the 13,000 ft. level to the summit.

> From there on, it is *kapu* only the priesthood and the *ali‘i* could go beyond 13,000 elevation.

Historically, Mr. Stevens described the level above the 13, 000 ft. to be free of any kind of manmade structure.

> …It was too sacred for the workings of man. When I say that, I mean anything manmade was not appropriate to leave in the summit areas above 13,000 ft. elevation. When the priesthood entered, they entered with reverence and respect. And when they left the mountain after they made their thanksgiving and offerings…they didn’t leave anything back. It was always you leave it the way you found it. That philosophy, I would like to see it enforced today. People in the astronomy community have asked, “If Mauna Kea is so sacred, how come there is no *heiau* up there?” I had to tell them the story about too sacred for the workings of man. You don’t build stuff up there. You leave it as you found it because it is too sacred to do otherwise. And some acknowledged that, and some denied it, but it’s okay; it’s their choice. But I offer it anyway. Now there’s been a lot of manmade things afterwards. In more recent times, additions and alterations. This has to be stopped because it diminishes the mana that adds to the sacredness of Mauna Kea.

Mr. Stevens ended the interview by summarizing his position on the proposed TMT and what he thinks about the EIS.

> I’d like to summarize by saying that the draft EIS thus far, soon to be presented in final copy, is not as perfect as some would like. But I support the EIS because it gives the truths, both good and bad. It gives possible mitigation methods to alleviate some of the wrongs that are up there. Seeing the genuine effort made by the TMT Corporation to do the right thing: if they are going to put their telescope up there, they want to do it right, to do it correctly and avoid the mistakes that were made with the other 13 telescopes. Personally, I support the TMT because of what it stands for and what it can do for us. It gives us an opportunity to look into the deepest space, into the realm of God. Now we can see almost to the edge of the universe. We can see, now, the realm of God through the TMT. It would take us closer to that so we can see the miracles of the universe. So I favor it from a spiritual level, I favor it from a practical level, and I support it, that’s just from me. Thank you.

7.15.2 Mr. Patrick Kahawaiola‘a

CSH interviewed Mr. Kahawaiola‘a over the telephone on November 12 and 23, 2009. Mr. Kahawaiola‘a is the president of the Keaukaha Community Association, a Native Hawaiian organization grounded in Hawaiian culture. Keaukaha was the second Hawaiian Homestead Lands created by the Hawaiian Home Commission Act that was spearheaded by Prince Jonah Kuhio Kalaniana‘ole. Born in 1945 in the homestead, Mr. Kahawaiola‘a remains active in the community and has three children.

Describing the community association’s activities, Mr. Kahawaiola‘a stated:

> I will say this about Keaukaha Community Association in relationship with Mauna Kea. The Association has gone on record since 1999 with the issue. The Association is opposed to any new development, without some of it [telescopes] being taken down. We haven’t had a dialogue after that. If there is an opportunity to comment, I will. This is an opportunity to comment.

Mr. Kahawaiola‘a noted that two of the four plans that have been approved and are part of the Mauna Kea Comprehensive Management Plan (CMP) have resolved some issues of access. Based on what he knows about the proposed location of the TMT, Mr. Kahawaiola‘a stated that there are no *iwi* there. He noted many of the *kūpuna* who knew much of Mauna Kea have since passed away. Some of their *mana‘o* he has gotten from their children. He asserted:

> Hawaiians are very specific on sites. If they did something, it would be recorded through the *mo‘olelo*. Those that I know, families who take care of their *iwi* there, say there is none over there [where the TMT is being proposed to be located]. There are no *heiaus* there that have been identified. The problem that I see may be a conflict is regarding the proximity to several *pu‘us* there. Although people will say the *pu‘us* there could be burial places, but no one has evidence, that’s what I see.

Explaining that Hawaiians perceive Mauna Kea as sacred, Mr. Kahawaiola‘a noted:

> Hawaiians are attached to the land. The Hawaiian culture believes the land, the mountain, the highest part of the land, comes to us with an “alloidal title” argued many times in courts of law, in many places. That being said, regarding the temporary staging area, it’s going to be like what they do in other places. If they find *iwi*, they would have to stop.

Noting the general discussion in the media regarding the re-internment of *iwi*, Mr. Kahawaiola‘a gave several examples of past maltreatment of *iwi kūpuna*, including the disinterment of burials by the construction of a new Walmart in Keeaumoku Street in O‘ahu in 2004 where the *iwi* was stored in a container. Such examples are precisely what he does not want to happen if *iwi* is unearthed during the proposed TMT project. “In my opinion, it would not be satisfying [to see that] on Mauna Kea,” he stated.

Referring to the information provided by CSH about the proposed TMT project, Mr. Kahawaiola‘a stated:

> Looking at it from the perspective you gave, if they are going to put something temporary, take it down. Based on the info given to me by you, when they are building this thing, I don’t see an impact culturally. They have given Kahu Ku Mauna a lot more latitude. If they need to, they’ve been given a broad brush, what is the culturally accepted brush in the protocol to go up the mountain. I’m a little more interested in the next two plans, which involves de-commissioning of some of the telescopes. Therein lies good faith. It’s been there now for 30-40 years;

> when you de-commission and use the area again, I don’t think they will find anything culturally.
>
> I have asked, looked, pondered the question. Gone to the community where I have asked those who I believe have knowledge of the area and knowledge of the protocol. Several of them have said that they have yet to identify a *heiau* up in Mauna Kea… Every Hawaiian would be upset if there was *heiau* that would be flattened. You won’t know about *iwi* unless they begin construction. I have read the summation [about the TMT] and noted that there will be a buffer. Historically, when you hit a *pu‘u*, you will find bones.

As for cultural practices on Mauna Kea, Mr. Kahawaiola‘a discusses the bringing of *piko* for burial up the mountain.

> People will tell you that they bring the *piko* of their young ones. My family, my dad and my mom, believe in putting it in the ocean. Are we to say if they are in the ocean that one can no longer do anything in the water?

Section 8 Cultural Landscape of Maunakea

8.1 Overview

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the Project area are presented below. This section examines cultural resources and practices identified within or in proximity to the subject Project area in the broader context of the encompassing Ka‘ohe Ahupua‘a landscape and the summit of Maunakea. It also provides a sense of the cultural attachment that Native Hawaiians have for Maunakea. As defined above by Maly, “Cultural attachment is demonstrated in the intimate relationship (developed over generations of experiences) that people of a particular culture share with their landscape – for example, the geographic features, natural phenomena and resources, and traditional sites etc., that make up their surroundings. This attachment to environment bears direct relationship to beliefs, practices, cultural evolution, and identity of a people” (Maly 1999:27). Excerpts from “talk story” sessions from past cultural studies and the subject CIA are incorporated throughout this section where applicable.

8.1.1 Gathering and Hunting Practices

Maunakea’s unique geographic features and relative isolation have combined to make it a place of special resources that has long attracted Native Hawaiians and other *kama‘āina* seeking to partake of its abundance. For example, both traditional and archaeological evidence illustrates that there are numerous *ana* and *lua kā ko‘i* (caves and quarries from which stone was harvested for making tools) (see Maly 2005) where Kānaka Maoli have gathered stone for their tools. Perhaps the most renowned of these *wahi pana* is the Mauna Kea Adze Quarry, also known as Ke-ana-kāko‘i, “the adze-making cave” (Pukui et al. 1974:103). Recognized on both the State and National Registers of Historic Places, the basalt found between approximately 11,000 and 12,400 feet elevation on Maunakea is among the highest quality in the Hawaiian Islands. Measuring some 4,800 acres, the quarry itself is one of the largest of its kind in the world, certainly in Polynesia (also see Kirch 1985: 179-180; Langlas et al. 1999; McEldowney 1982: A8-A9).

Speaking about the adze quarry, community contact Mr. Leningrad Elarionoff noted:

> The rock piles are taller than these trees. There were five [of those piles] with hundreds of adzes in various stages of completion just lying around…The amount of rock chips was amazing. If they brought the rocks down here to the warm area to work on it, it wouldn’t chip. It couldn’t. Basalt is hard and in the cold, it gets really brittle. So that’s the most productive place to chip and rough shape it...

Some rock shelters, including one at Hopukani Spring (10,400 foot elevation), the Hopukani Rockshelter (10,160 foot elevation), and an open camp site at Liloe Spring (8,921 foot elevation) bear witness to the traditional use of such camps for procuring water, food (primarily birds) and fuel, besides being used for acclimatization (see McCoy 1986). Bird walls or bird hunting blinds have been documented by Maly and Maly (2005) as existing “in the form of single, double or tri-sided stone walls” which are meant to keep the hunter hidden from the birds (also see McEldowney 1982 and Langlas et al. 1999, for more accounts of bird hunting).

CIA participants Mr. Ed Stevens and Mr. George Van Gieson hunted on Maunakea. Mr. Van Gieson confirmed the cultural practice of hunting birds on Maunakea. At five years of age, he accompanied his uncle, an avid bird hunter, and his aunt to spend all day on top of the mountain. He still regularly visits the mountain to hunt for birds as well as to direct firefighters in containing bush fires set to eradicate the invasive gorsebush:

> As a kid, I spent a lot of time on the mountain. There were no four-wheel drive cars up there; just military jeeps. My uncle lived on O‘ahu but came over the winter months for the bird season. We caught ring-necked pheasants [*Phasianus colchicus*], chukars [*Alectoris chukar*], and Japanese [*Coturnix japonica*] and Chinese painted quail [or button quail*, Coturnix chinensis*]. It was beautiful; a whole different world with snow and frost…peaceful and quiet (see Section 7 for full interview).

Another participant, Ms. Kealoha Pisciotta, mentioned the ‘*ua‘u*, “the dark rump petrel, a bird. It is a high altitude bird that flies hundreds of miles out to sea to feed and then comes back to Maunakea to nest…The ‘*ua‘u* were reserved for the *ali‘i* to eat and there are many remains found of the ‘*ua‘u*” (see Section 7 for full interview). Birds were also caught for their feathers, in particular, the *‘ō‘ō*, whose feathers were valuable (Foster 1893:456). Historically, some cattle hunting and sheep hunting was also conducted, but at lower elevations such as 5,000 feet (Langlas et al. 1999).

Because the vegetation at the summit of Maunakea is almost non-existent with the exception of small lichens and moss, gathering of plants was not as prevalent as bird-hunting or the use of basalt for tools. The Alpine Scrub Zone, which ends at about 11,300 feet elevation, is the highest major vegetation zone, with the tree line occurring at around 9,000 feet. Plant life is more abundant around the Hale Pōhaku Project area including endemic *māmane* (*Sophora chrysophylla*), *pūkiawe* (*Styphelia tameiameiae*) and the endangered endemic *‘āhinahina*, also known as Maunakea silversword (*Argyroxiphium sandwicense*). The gathering of fuel on Maunakea (e.g., *māmane*) was noted (McCoy 1986) as was the acquisition of hardwoods and sandalwood in the region (McEldowney 1982: A-8, A-9).

Ms. Pisciotta stressed that the tree line is critical as it is home to native bird species, including the *pueo* or Hawaiian owl (*Asio flammeus sandvicensis*), the *palila* (native honey creeper, *Loxioides bailleui*) and the *‘io* (endemic Hawiian hawk, *Buteo solitarius*)

8.1.2 Freshwater and Marine Resources

Maunakea is a major aquifer for Hawai‘i Island (Figure 26). It represents the integrated system of Hawaiian culture where the surrounding environment is connected to people, as evidenced by the mountain’s role in providing the life-giving waters known as “Kanekawaiola” due to its ability to stop the rainclouds (see OHA statement in Section 6.2). Kāne and Kanaloa are said to meet in Maunakea, with water from Maunakea being collected in the ocean (see Kealoha Pisciotta interview in Section 7 above).

Stated participant Mr. Kalikokalehua Vernon Kanaele: “The mountain is a great filtering system; inside of it has a hose that represents rivers underneath and on top. The melted ice and rain, all that seeps right into the aquifers and then down to the rest of the *‘āina*” (see Section 7

for interview). Other community participants such as Mr. Isaac Harp and Ms. Kealoha Pisciotta also emphasized Maunakea's role as an aquifer.

The mountain is home to the highest permanent lake in the Hawaiian Islands, Lake Waiau, which contains melted glacial water. Community contact Arthur Mahi noted that Lake Waiau is a pristine alpine lake that was reserved for the *ali‘i* and is now being used by people who wrongly believe that it is for healing and cleansing. He stated the lake should be kept free from contamination as it is a source of pure drinking water:

> Cleansing is only for *ali‘i nui*, not for anybody cleansing. No healing the water will bring them. It only dirties the water. We know when people use the lake to clean themselves. It's not good because it's people's water. The water goes down to the ocean, and it is clean water. All the mountains water comes from up there (see Section 7 for full interview).

The use of Lake Waiau for drinking water was discussed by CIA participant Mr. Leningrad Elarionoff, who recalled drinking its clear but "cold, cold, cold" fresh water as a young child (see Section 7). He stressed that it was forbidden to step into the lake or swim in it, due to its cold temperature and "out of respect for the lake and future explorers who utilize the lake as a resource for drinking water."

Considered sacred by Hawaiians, Lake Waiau is reputed to hold special healing properties according to community contact Mr. Isaac Harp. Water from the lake is collected by visitors and hunters who bring it to their families to "drink for good health" (Nā Maka o ka ‘Āina 2008) as the water is believed to be the sacred water of Kāne or "*ka wai kapu o Kāne*" (Maly and Maly 2005: A-3). Ms. Pisciotta noted that Queen Emma bathed in the lake to purify herself (*hi‘u wai*) "before her election and to demonstrate her worthiness and *mo‘okū‘auhau* or genealogy" (see Section 7, Kealoha Pisciotta interview; also see Nā Maka o ka ‘Āina 2008).

For Ms. Pisciotta, Lake Waiau also marks time, seasons and the constellations which are reflected in its waters:

> The lake is a significant site because it is like a *wai ea* [*Lit.,* aerated water, water used for purification], which was significant for marking time, seasons, even a mirror to the stars above.

The water of the lake also was also used as a receptacle for the *piko* of newborns, as it assured "long life and safety" (Maly and Maly 2005: A-3). Cultural contacts Mr. Van Gieson and Mr. Kimo Keali‘i Pihana discussed the practice (also see Nā Maka o ka ‘Āina 2008). Said Mr. Pihana:

> The placing of the human *piko* or umbilical cord, an ancient and still a practice of today—the beginning point of our people. I was able to put my son's *piko* in Lake Waiau after I started working there and my son participated with me…We consider this a tradition to the Hawaiians. It keeps it as a safe place for our future longevity of our family. There are many other families, generations that have done the same.

Fresh water could also be gathered not just from the lake but in certain *pūnāwai* (springs), stated Ms. Pisciotta. There are *pōhaku* such as Māhoe that collect water, "perhaps it is because of the cinder cone it has [an] ice plug." In addition to the water, fossilized ice or ice from the last Ice Age can be obtained by digging two to four feet. Collecting this underground ice and snow is essential for *lā‘au lapa‘au* (curing medicine). It is an ancient practice, according to Ms. Pisciotta.

> There are reports of the *ali‘i*('s) travels to the mountain and bringing the ice down in big blocks on horseback, even contemporary times. They would use it for medicinal purposes, temple ceremonies, and other kind of cultural protocol. The water that is collected from Maunakea is water that is used for bringing life back or taking it. I only work on the side of bringing back life.



Figure 26. Photograph of the snow-covered shoreline of Lake Waiau by CSH (2009)

8.1.3 Cultural and Historic Properties

Numerous cultural studies on Maunakea have documented a profusion of natural and cultural beliefs, practices, and resources associated with the mountain, resulting in one study calling for the entire Maunakea summit down to the 6,000 feet elevation to be classified as a Traditional Cultural Property or TCP (Maly 1998). To date, SHPD has named three places as TCPs, specifically the summit Kūkahau‘ula made up of a cluster of cones (Site 21438), Pu‘u Līlīnoe

(Site 21439), and Lake Waiau (Site 21440) (see PHRI 1999). In addition, the Mauna Kea Adze Quarry, known also as Ke-ana-kāko‘i, “the adze-making cave” (Pukui et al. 1974:103), was listed on the National Register of Historic Places in 1969, and the Hawai‘i State Register of Historic Places in 1981. CIA participant Mr. Elarionoff described seeing the large basalt adze quarries, and he estimated the rock piles to be 15 feet high.

> ...It was fascinating, fascinating. You go up there, and you see these rocks…It was obvious that to chip the rocks into rough finish implements, the craftsmen used other rocks, [as] they didn’t have metal. The chips that were broken off fell to the ground and just piled up and piled up until it covered the side of the hill in a slope 30 to 50 feet long and who knows how deep. The amount of rock chips was amazing (see Section 7 for full interview).

Other *wahi pana* include: Maunakea itself, which has several meanings, one being white (*kea)* mountain (*mauna*). It is also known as Mauna a Wākea, the eldest son of Wākea and Papa, ancestors of the Hawaiian race. It is the *piko* of Hawai‘i Island, linking the heavens to the land (Maly and Maly 2005: A-3); Pu‘u Poli‘ahu, named for the snow goddess of Maunakea and literally translated as “Bosom goddess” (Pukui and Elbert 1986); various *heiau* and *ahu*; *ana* and *lua kā ko‘i* (caves and quarries used for harvesting stones); *ilina* or burial features, and othes such as trails, shelters and habitation caves. Historical features from the mid-1800s include walls, fence lines and pens, stone and wooden houses, water collection and storage facilities, and other resource collection sites (see Maly and Maly 2005: A-2 to A-4).

Hale Pōhaku, which refers to the two stone cabins constructed by the CCC in 1936 and 1939, is located at an elevation of 9,220 feet on the southern slope of Maunakea.

More recently, a *lele* was constructed at Pu‘u Kūkahau‘ula, which is the summit of Maunakea and a place of spiritual worship by Hawaiian cultural practitioners. Translating to “sacrificial altar or stand,” the six-foot-*lele* (Figure 27) was constructed by the Royal Order of Kamehameha in 1997, “as a place for spiritual ceremonies and as a monument for peace” (Ka Wai Ola, March 2006:6). CIA participant Mr. Pihana stressed the “spiritual connection” people feel for Maunakea, which for the Hawaiians of today is represented by “the humble stone and wooden *lele,* the altar at the summit” (see Section 7 for full interview). For Ms. Pisciotta, the *lele* at the summit is “aligned” with the sky and people have brought and buried their personal belongings inside or around it. She noted that there are other *lele* that have been built in different areas of the mountain such as at Hale Pōhaku where silversword plants can be found,” so people again have another place to offer ho‘okupu and give prayer and reconnect themselves” (see Section 7 for full interview). Mrs. Sherlock also described the practice of performing rituals and presenting *ho‘okupu* on the summit.

Ahu has been defined as “stone mounds as land markers” and like *heiau*, can also mean “ceremonial sites, shrines, and places where *mele* (chants and offerings were presented)” (Maly and Maly 2005: A-3). Community participant Halealoha Ayau described Maunakea as “the largest ahu in all of Hawai‘i which contributes to it being a sacred place” (see Table 6). Ms. Pisciotta, who has her own personal *ahu* on the mountain, also discussed the practice of leaving personal artifacts in numerous *ahu* on Maunakea. Ahu-a-Umi, located between the three great *pu‘u*, is one of the important *ahu*, she said. In addition, Ms. Pisciotta pointed out that *ahu* around Lake Waiau function as “markers for directionals.”

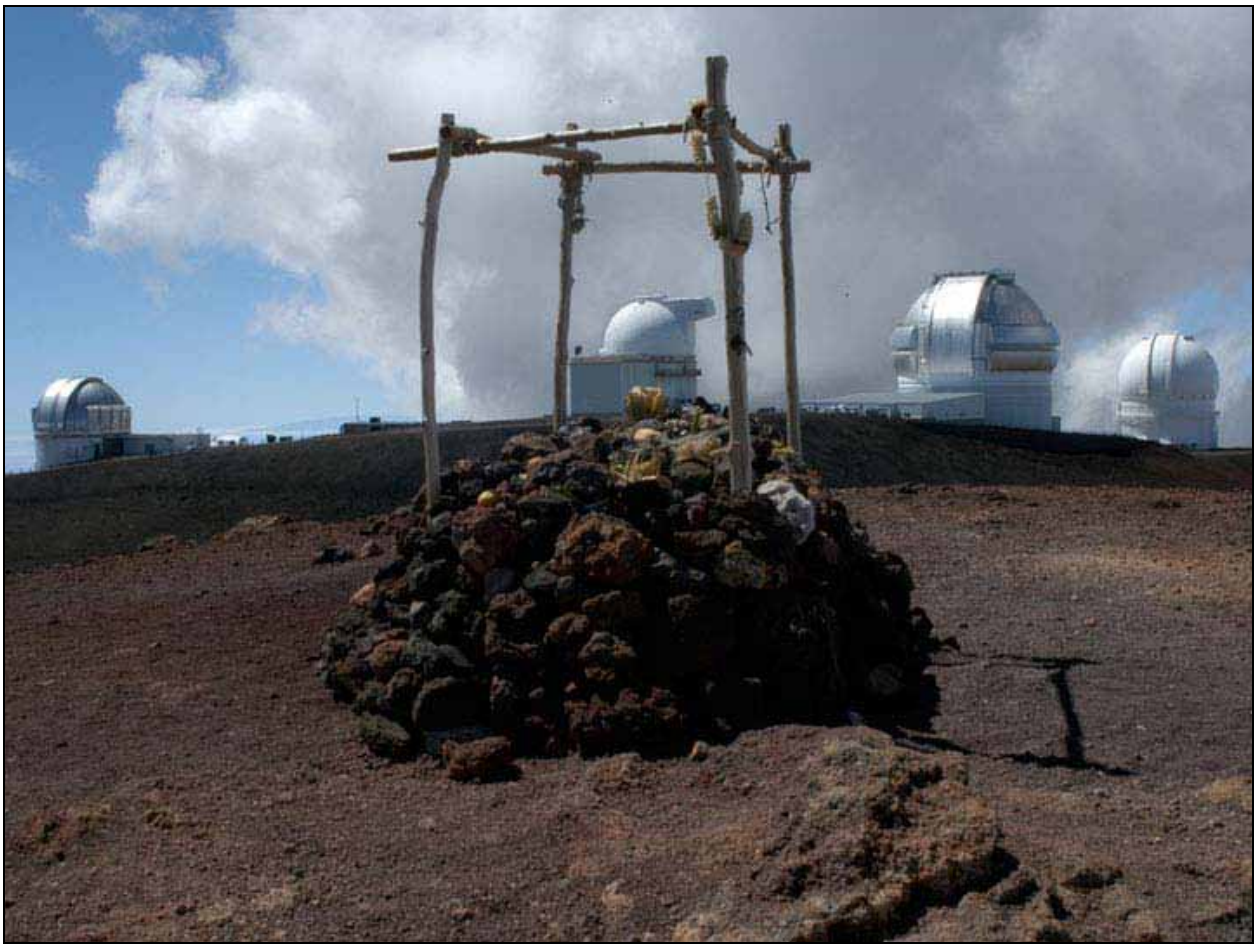

Figure 27. Lele at Pu‘u Kūkahau‘ula on the summit of Maunakea built in 1997 by the Royal Order of Kamehameha (source: CSH)

> So there are directionals not only of the primary four pillars, north, south, east, and west, but also the solstice, so you have the eight, the *he‘e* [octopus], *nanana* [spider], the *pe‘a* [bat] (see Section 7 for full interview).

Besides *ahu*, there are shrine sites where the way offerings are placed or rituals held "appear to be intentionally directed away from Mauna Kea," suggesting astronomical concepts at work (see McCoy 1982). The 22 sites, including an open air shelter and 21 shrine sites, were reported to be between 12,900 to 13,100 feet elevation, implying that these shrines "request for permission to pass over the summit" and that their distribution may relate to "the lower margins of snow fields" which may well extend to the goddess Poli‘ahu (McCoy 1982: A-37). CIA participant Mr. Ed. Stevens identified shrines on Maunakea as "unalterered select slabs of stone, the *pōhaku* of a certain size and shape…stood upright to represent a god or a goddess." Other structures such as *heiau* have been also been interpreted by Ms. Pisciotta to be navigational alignments, connecting Poli‘ahu Heiau on Kaua‘i to the summit of Maunakea, for example (see Section 7 for full interview). Heiau have also been specifically built as places to honor deities (Maly and Maly 2005:28-29).

8.1.4 Burials

The subject of the presence of burials in the Maunakea summit region is a topic of considerable disagreement between the scientific, archaeological perspective, on one hand, and Native Hawaiian perspectives, on the other. In short—and the details are presented in full above (see Section 5.4.1), the archaeological evidence until recently was relatively limited concerning confirmed human burials in the summit region. While historical accounts and *mo‘olelo* tell of the presence burials on Maunakea (Maly and Maly 2005), archaeological evidence is relatively minimal concerning confirmed human burials in the summit region. Early documentation of archaeological sites in the upper reaches of Maunakea was somewhat anecdotal. McEldowney's summary (1982:A-11) of the ethnographic background of the Maunakea summit region notes:

> Although most accounts speak in general terms, those that specifically locate the presence of human bones, "graves," "burial caves" or mortuary features indicate that burials are "not uncommon" between 7,800 ft and 13,000 ft elevation along the northern and eastern slopes of Mauna Kea.

William D. Alexander described a trip up Maunakea with a surveying party, and observed ancient graves:

> That same afternoon [July 25, 1892] the surveyors occupied the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills [the "summit"] and a little over 13,000 feet in elevation. Here, as at other places on the plateau, ancient graves are to be found. In olden times it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial. (cited in McCoy 1999)

Prior to 2005, archaeological authorities on Maunakea, including Pat McCoy, had documented only one confirmed burial site (with multiple burials) and four possible burial sites in the summit region (McCoy 1991). Pu‘u Mākanaka, northeast of the subject project area, is the only documented place in the uplands of Maunakea in which human remains have been confirmed—although McCoy makes reference to "the well-known burial center at Kanakaleonui" and also to "a small group of cairns on the eastern rim of Pu‘u Waiau that are also believed to be burials" (McCoy 1999).

However, McCoy (1999:28) also comments:

> There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rockshelter or overhang. The basis of this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridgetop amongst any of the shrines. There in fact appears to be a clear separation between burial locations and shrine locations.

His predictions have been accurate: current in-progress work by McCoy and Nees has documented 28 sites designated as burials and possible burials (McCoy et al. 2008).

Past ethnographic studies about Maunakea have noted the presence of burials:

Maly's 1999 archival study included a reference in border testimony to burials within Ka‘ohe Ahupua‘a:

> [Pu‘uokihi] it belongs to Kaohe and above that is where people were buried in old times, when people used to make fishhooks from the bones. [Testimony of Kahue, 1880, BCB, Hawai‘i, B:444] (Maly 1999:D-4).

The participants in the subject CIA also stated that there are burials in the area. In a CSH interview with Kealoha Pisciotta, she offered her concerns regarding burials located on Maunakea:

> Burials are in the *pu‘u* and along important astronomical alignments. Burials are hard to talk about: on the one hand, you need to speak to it to have them protected; on the other hand, culturally, the different levels of *kapu* on speaking to it. One of our greatest concerns is that there has been no actual burial treatment plan. The one plan that the Hawai‘i Island Burial Council [reviewed] basically said…the best treatment is no development, because the burials include not only important national figures, but also important spiritual figures. So, the question is, what is the burial treatment for Līlīnoe? The problem has been is that there have been reports. Mr. Patrick McCoy and Holly McEldowney have done extensive work on the burials, but they never got to finish their work. Also Pu‘u Mākanaka, of course it is listed only as a burial, but really it is a burial complex, hence the name Mākanaka. The problem is - do not list it as one when it has many. The *kūpuna* have testified extensively in the past as eyewitness that on Pu‘u Mākanaka that there is so many *iwi* that you can see them through the cinder. So they immediately know better not go over there.

She also added:

> I have familiar genealogical ties to the mountain and some of the *iwi* there, actually ancient and modern. I feel it is important to mention modern because that is still an ongoing cultural practice continuing today. Famous people of today have their ‘*ohana* there.

When asked about the cultural practices she has witnessed or participated in she says:

> Burials, contemporary and historic. Contemporary burials though I am not going to say that it is only limited to, but it tends to be more of the ashes, not all because people are still fighting the health department on the Hawaiian burial of bone. I have personally participated in a number of them.

It is feasible that some of the burials that are present in Maunakea may be related to the adze makers, stated Mr. Leningrad Elarionoff:

> Because of their dedication to adze making and their craftsmanship, it is fitting that they be buried up there. The same honor afforded fisherman. A fisherman is buried in his canoe in a cave down by the ocean. The principle is the same. To

> have burials on the mountain is not a mystical thing like some strange god came down and got buried there. It's a normal thing. People die, and when they die, they rot. So what do you do? You bury them to hide the stench and protect the deceased from scavengers. The craftsman's life dedication to the culture was to make adze which earned him the right to be buried where he labored.

When asked about his knowledge of burials and burial practices on Maunakea, Mr. Keali‘i Pihana mentioned:

> The burial grounds are much further out than that area, 13 North they call it, but even then it is too close to our *kūpuna* and early caretakers of the mountain have been put up there, some of our *ali‘i* are buried up there. It would really be another hurt or you are going to put more salt on the wound so to speak and I don't think our people are going to accept that development. You are going to have a bigger protest than ever because of that.

In a written response, Mr. Harp added the following cultural concerns about burials:

> Besides what I have already shared with you, my "cultural concerns" regarding Mauna Kea astronomy development includes fear of unintentional disturbance of kahiko burials on Mauna Kea, some of which are hundreds of years old or older. Many of these are burials of persons from the highest ranks of maoli society whose iwi were carried to Mauna Kea from all corners of Hawaii for interment on the summit, the realm of Wakea and Papa.

There are widespread perceptions among many Kānaka Maoli, some of which are backed by various types of documentary evidence, that the area holds or once held many more burials than archaeologists have been able to document. In a written statement, Mrs. Ululani Sherlock pointed to burial caves and their location as being "known only to the ‘ohana where remains of iwi kūpuna were stored by their ‘ohana." Further accounts regarding burials on Maunakea can be found on a website maintained by Nā Maka o ka ‘Āina (see Section 3.8).

8.1.5 Trails

As depicted in Figure 6, there are several trails traversing the Maunakea summit region including, from the west, the Waiki‘i-Waiau Trail leading up to Waiau; from the northwest, the Makahālua-Kemole-Waiau Trail also leading up to Waiau; from the northeast, the Mauna Kea-‘Umi Koa Trail, leading to and from the Hāmākua area; and, from the south and leading to the Mauna Kea Adze Quarry, the Mauna Kea-Humu‘ula Trail.

There are several historical references to the trails of Maunakea:

In Fornander's "Story of ‘Umi: One of the Most Noted of Hawaiian Kings (*He Mo‘olelo no ‘Umi: Kekāhi Ali‘i Kaulana o ko Hawai‘i Nei Pae‘āina*)," the ruling chief ‘Umi-a-Līloa leads a war party out of Waipi‘o, Hāmākua, to attack Hilo using the trail of Poli‘ahu:

> Up through the mountains of Mauna Kea and right back of Kaūmana, running towards Hilo, was a short cut over the mountains to the trail of Poli‘ahu and the well of Poli‘ahu at the top of Mauna Kea, the trail leading down to Hilo. It was an

> old trail for those of Hāmākua, of Kohala and of Waimea to take when going to Hilo. Therefore, preparations were made and the army ascended the Mauna Kea mountain and descended on the upper side of Hilo…(Fornander 1919: Volume IV:224-225)

In his retelling of the Story of ‘Umi-a-Līloa (the 16th century ruler of Hawai‘i), Kamakau describes the time when ‘Umi was mistreated by his in-laws at Hilo, and names a trail and a spring at the summit of Maunakea called “Poli‘ahu:”

> As soon as they were released in Hilo, ‘Umi and his companions returned to Hamakua and went down to Waipi‘o. There he conferred with his chiefs and his father’s old war leaders. It was decided to make war on the chiefs of Hilo and to go without delay by way of Mauna Kea. From back of Ka‘umana they were to descend to Hilo. It was shorter to go by way of the mountain to the trail of Poli‘ahu and Poli‘ahu’s spring at the top of Mauna Kea, and then down toward Hilo. It was an ancient trail used by those of Hamakua, Kohala, and Waimea to go to Hilo. (Kamakau 1992:16)

Fornander (1919) provides an account of “Famous Men of Early Days (*Po‘e Kaulana o ka Wā i Hala*)”; he tells a story of Uma of Pūehuehu, Kohala, who lived in the time of Kamehameha I and has a number of adventures dispatching brigands and muggers as he proceeds from southern Kohala to Kapia to upper Hilo. The account notes that at the time “there was much robbery amongst the people in lonely places (*he nui loa ka pōwā ana o nā kanāka ‘oia wā ma nā wahi mehameha*),” and certainly suggests that the trails around the north slope of Maunakea were among such lonely places (Fornander 1919: Volume V:500-501).

W.D. Alexander, Surveyor General, ascended Maunakea along the Waimea-Waiki‘i trail in 1892. His description of the route is as follows:

> A wagon road made by the owners of the Humuula Sheep Ranch leads from Waimea around the western and southern sides of Mauna Kea. On the western side of the mountain it passes through a region which only needs more rainfall to make it a superb grazing country. The ancient forests here, as at Waimea have been nearly exterminated, but a fine grove of mamane trees still survives at the Auwaiakeakua Ranch. The manienie grass is gradually spreading and will in time add immensely to the value of the land. At the half-way station, called Waikii, water tanks and a rest house have been provided for teamsters.

In 1936, the CCC carried out improvements to the old Maunakea-Humu‘ula Trail from near the main base of the sheep station at Kalaieha to the summit (Bryan 1938). It was recorded that “the summit road only extended to Hale Pōhaku in 1938” (Bryan 1938:38).

Holly McEldowney’s (1982) ethnohistorical report states that guides and informants were often familiar with land features but traveled from landmark to landmark rather than on trails. She notes that access to the mountain in the second half of the 1800s appeared to utilize ranching establishments, such as Humuula Sheep Station and Umikoa Ranch; and may not have related to pre-Contact approaches (McEldowney 1982). Many Hawaiian place names were noted to be modern.

The botanical components of the Lei-o-Poli‘ahu, including *nohoanu, liko,* the *mu‘o* (leaf bud) of *‘ōhi‘a, pūkiawe and* white *limu*, can be found “along the eastern segment of the long trail in the saddle between Mauna Loa and Mauna Kea that connects Hilo and North Kona” (McDonald and Weissich 2003:72).

Documented in the PHRI study, SHPD identifies the Kūka‘iau-‘Umiko Trail, and the Mauna Kea-Humu‘ula Trail as traditional cultural properties.

When CSH asked Mr. Pihana about Maunakea’s cultural resources and sites, he stated:

> Early development where one of the observatories was on top of Pu‘u Poli‘ahu, prior to me working at the university, that observatory was removed, brought down, and taken off Pu‘u Poli‘ahu I had brought the new established Office of Maunakea Management, Office of Hawaiian Affairs, Civic Clubs, and many other community leaders, and other local community leaders to close the road to Poli‘ahu. Today there is only a trail and the only way to get up there is by walking. No vehicles allowed on top of that mountain. No vehicles allowed at the Lake. No vehicles allowed into the area where we consider where our burial grounds are. Pu‘u Māhoe and Pu‘u Mākanaka, those areas are off limits even to hikers.

Ms. Pisciotta, discussing cultural sites within the Project area and the mountain, also mentioned trails, “all over the mountain.”

8.1.6 Wahi Pana (Storied Places)

The project area is associated with a wealth of *mo‘olelo* and *mele* about its sacred cultural landscape. In native lore, it is known as Mauna a Wākea (The Mountain of Wākea), “the first-born mountain son of Wākea and Papa, who were also the progenitors of the Hawaiian race” (Maly and Maly 2005: A-3). It is also the dwelling of snow goddess Poli‘ahu who is the rival of Pele (the fire goddess) and the residence of other deities such as Līlīnoe and Kūkahau‘ula. The mountain represents the *piko* of the Hawai‘i Island and is the link of the land to the heavens (Maly and Maly 2005: A-3). Located near the summit at 13, 020 feet, Lake Waiau is named after Waiau, the mountain goddess who is one of the attendants to Poli‘ahu, said to bathe in its cooling waters. The name “Waiau” translates to “swirling water,” and it is guarded by the powerful *mo‘o* Mo‘oinanea. Many contributors to this CIA such as Mr. Halealoha Ayau emphasized the *mana* (power) of Maunakea and its *kapu* space, with Mr. Pihana, Mr. Stevens, and Ms. Keakealani among many stressing its sacredness.

There is also a wealth of *‘ōlelo no‘eau* describing the ethereal qualities of Maunakea. Two examples are “*Mauna Kea, kuahiwi ku ha‘o i ka mālie* (Mauna Kea, standing alone in the calm)” and “*Poli‘ahu, ka wahine kapa hau anu o Mauna Kea* (Poli‘ahu, the woman who wears the snow mantle of Mauna Kea)” (Pukui 1983:234, 294).

The terrain of the mountain, including the many *pu‘u*, is also the subject of traditions and stories. It is said that Pu‘u o Kūkahau‘ula, the summit cluster of cones named for a form of the god Kū, is where people took the *piko* of their newborn children “to insure long life and safety,” a tradition that is still ongoing (Maly and Maly 2005: A-3) and confirmed by community

participants such as Mr. Patrick Kahawaiola‘a. Lake Waiau is also another place where the *piko* of newborns were placed, and from where some people collected the sacred water of Kāne or “*ka wai kapu o Kāne*” for its healing powers (Maly and Maly 2005: A-3).

Pu‘u were also named for goddesses, such as Pu‘u Poli‘ahu, Pu‘u Līlīnoe, and Pu‘u Waiau. As CIA contact Ms. Ku‘ulei Keakealani mentioned, the deities would like to be remembered and have their *pu‘u* respected (see Section 7 for interview). Accounts of burials placed in *pu‘u* such as Pu‘u Mākanaka are also reported (McCoy et al. 2008). In addition, ceremonies that mark life’s rites of passage take place in the numerous *heiau* and *ahu* which also double as navigational markers. There are also stories connected to important *heiau* like the four sites that ‘Umi-a- Līloa constructed to honor Halulu, the god who provided his power (Maly and Maly 2005:28-29).

Maunakea as a navigational guide is also mentioned in the *mo’olelo* of community participants. Mr. Arthur Mahi emphasized that the mountain is a *kupuna* who guides the people of Hawai‘i, especially when one is in the ocean and needs direction. *Pu‘u* not only contain burials but are critical astronomical alignments, stressed Ms. Kealoha Pisciotta. With help from *kūpuna*, she shared how she found the solstice equinox alignment and her discovery of how one view plane linked Maunakea to Poli‘ahu Heiau on Kaua‘i and vice versa. Canoe navigators often climb up to Maunakea to consult the alignment of the *lele*, and of Lake Waiau. The navigators could then consult the reflection of the sky on the lake. She stated:

> They are codifying the alignments in their mind’s eye. That is how the *kūpuna* could see the pathway, see in the lake, hold it in their minds and follow it on the sea. Some people say, “The navigation is all about the ocean.” But it is really all about the sky. That is where the difficulty is on finding the *mo‘olelo* on Maunakea. It isn’t just under Maunakea, it is under all the navigational lore. I remember Kepā Maly talking with me years ago, and I kept saying, “You know what you see on the ground, Kepā, is only the reflection of the heavens? This is our connection. When you are looking, you have to look for those things over head.” (see Section 7 for full interview)

According to Ms. Pisciotta, ceremonies observing the winter and summer solstices and the equinoxes are held on Maunakea by the Royal Order of Kamehameha. But she indicated that many others come up at other times to use the navigation of the lakes and to check the *pu‘u*. Anything that obstructs a view plane on the mountain is bound to destroy the navigational purpose of that particular area by interrupting the alignment.

Then there is the connection of deities and their association with navigation, as pointed out by Ms. Pisciotta.

> Papa and Wākea, Wākea as Orion is super significant for navigation because Orion’s belt rises due east and sets due west, so you must know Orion and of course Orion comes winter and there was a time that I really got it because some say the sword is the ‘*ule* [penis], so at certain angles you can see right over the summit how they are touching is loving embrace. Papa is clear when there is no snow and then is Poli‘ahu when there is snow. And those alignments are significant and major. There are different levels of each story as there are the levels of heavens. (see Section 7 for interview)

Since Orion is always travelling east and west, and Maunakea sits in the middle, the whole archipelago can be set on a base line, stated Ms. Pisciotta. She added that some *heiau* built on Maunakea that are related to the deities are also aligned with their astronomical appearances.

The goddess Līlīnoe, whose name translates to “fine mist,” can be seen when the right weather conditions are in place. Again, her figure can be drawn out with the help of the terrain of the land.

> I walked out and the snow had been perfect and there was a cloud bank, a typical cloud bank that always is on the mountain, and right there you could see her whole body, her face, her hair, her shoulder, and her arm, her *nene* [nipples of a woman’s breast] and then of course the telescopes are right there by her ‘*ōpū* [belly, stomach] and her *nene* and then you go down and then two *pu‘u* on the mountain that if you look from Hilo side, like looking from Moku‘ula is a good way to see, and then you can see her two feet. Then what happens is that she floats like a cloud of the tree line. (see Section 7 for full interview).

The different forms of Līliīnoe, or her *kino lau*, can be discerned especially during the solstice, when there is snow. Ms. Pisciotta noted that “the legends tell of her adorning her *kīhei* [shawl, cape], or mantle.” Because of the leveling of the *pu‘u*, however, the physical manifestations of deities such as Līlīnoe and Poli‘ahu are being destroyed:

> Another level of the desecration is the leveling of the *pu‘u*, or the cinder cones. The cinder cones are sacred in and of themselves because they make up some of the *kino lau*, or the divine bodily manifestations of the gods…Unfortunately though, Poli‘ahu’s image and bodily form is being destroyed. They are altering the images of our deities because the *pu‘u*[s] are being leveled and the telescopes are being built on top of her. (see Section 7 for full interview)

There are *ahu* all over the mountain, noted Ms. Pisciotta, and many by Lake Waiau are markers for directionals (see Section 7 for interview). For example, Ahu-a-‘Umi is aligned with Venus, she said. “Our traditions are not antiquated, they are ancient, but that does not mean they are useless in the world today and their science. They are not just religious belief they have practical use to us every day.”

For Ms. Ku‘ulei Keakealani, the *mo‘olelo* of what she calls Mauna a Wākea is critical to understanding the place itself. Knowing the *mo‘olelo wahi pana* of a certain area can often change the way one views the place:

> If we went to another layer…or dimension, for me, the stories of a place are something that I almost don’t even have words to describe. Sometimes, all I need to know, all you need to know, is the story of a place that’s hundreds and thousands of years old that can change my perspective or your perspective of a place. (see Section 7 for interview)

She narrated a traditional version of Poli‘ahu and her fateful meeting with Kūkahau‘ula. With the help of Mo‘oinanea, her father Kāne reluctantly allows the two lovers to meet twice a day, at sunrise and sunset. When Mauna a Wākea turns into colors of pink, purple and red, we bear

witness to the loving of the two deities. “So Kūkahau‘ula is embracing and placing his love like no other man could, as he loves Poli‘ahu two times, everyday, *no na kau a kau*, forever and ever” (see Section 7 for full account).

Other *mo‘olelo* such as the one from community contact Mr. Danny Akaka Jr. related the battle that Poli‘ahu has with Pele the fire goddess, her elemental opposite. In this story, the two goddesses fight over ‘Aiwohikupua using fire and ice (see Section 7 for full story).

Trails and springs can also be named after deities, such as the story of ‘Umi-a-Līloa (the 16th century ruler of Hawai‘i) when ‘Umi was mistreated by his in-laws at Hilo, and names a trail and a spring at the summit of Maunakea called “Poli‘ahu.” According to Kamakau, “It was an ancient trail used by those of Hamakua, Kohala, and Waimea to go to Hilo” (Kamakau 1992:16).

Other *mo‘olelo* tell of spiritual entities like nightmarchers. CIA participant Mr. Kimo Keali‘i Pihana told of many accounts, stating that the nightmarchers’ appearances to visitors and employees are their way of saying:

> “Who are you? What are you doing up here? Where are you from? Go home, you don’t belong here.”…Yes, these are guardians to the mountain and area, they are known as the nightmarchers, not only walking below lands, but up here too. They show themselves because they don’t really want to be exposed. They want everything up there now to be left alone.

From years of hiking and hunting on the mountain, Mr. Ed Stevens grew to discern what he calls the “three levels of transition” on the mountain. Just as Mr. Pihana described the nightmarchers as protecting the higher levels of the mountain, Mr. Stevens also discussed the sacred elevations of the mountain. Well aware of the three levels before any signs were posted, Mr. Stevens describes the first level to be 11,000 ft., the first transition into “*wao akua*,” which he defined as the place where gods dwell. This level is allowable for anyone to enter. From 12,000 to 13,000 ft., the level becomes more sacred and it is here that he notes most shrines are to be found. The last and final level is 13,000 ft. and up, which is forbidden for most, and only *ali‘i* and the priesthood can enter into this realm.

For the use of Maunakea as a last landmark for the Hawaiian Islands, see Fornander (1919; Volume IV: 160-161). For other mentions of Maunakea, see Fornander (1919; Volume IV: 224-225), Kalākaua (1888: 249-315), and Maly and Maly (2005).

Section 9 Summary and Recommendations

CSH conducted this CIA at the request of PB. The CIA includes, broadly, the *ahupua‘a* of Ka‘ohe, Hāmākua District, on the island of Hawai‘i; and, more specifically, a portion of TMK: (3) 4-4-015: 009 and 012. The proposed Project includes the construction and operation of the Thirty Meter Telescope Observatory Project (TMT) on the Science Reserve located near the summit, and a construction staging area and new electrical transformer, both of which are located at the Hale Pōhaku site at the 9,200 foot level on Maunakea.

In January 2010, Project proponent PB changed the acreage of the proposed TMT Mid-Level Facility near Hale Pōhaku from approximately six acres to 3.2 acres after the community consultation was conducted. The downsized acreage has been noted in this report along with figures that have been revised to depict the reduced acreage.

9.1 Results of Background Research

Background research conducted for this Project yields the following results:

1. Maunakea is a sacred cultural landscape; symbolic of Wākea (the ‘Sky Father’ to all Hawaiians), home of Poli‘ahu, the goddess of snow and foe of Pele (the fire goddess), and of many other resident deities and supernatural entities (e.g., Līlīnoe, Kūkahau‘ula and Mo‘oinanea) and the *piko* (umbilical cord) of the island-child, Hawai‘i which connects the land to the heavens (Maly and Maly 2005:v); home of Waiau, the highest permanent lake in the Hawaiian Islands; location of the highest and most extensive basalt quarry in all of Polynesia and perhaps the entire world; and numerous trails, *ahu* (stone markers), *heiau* (temple, place of worship) and cinder cone *pu‘u* (hills).
2. Maunakea is rich in *mo‘olelo* (legends), *mele* (songs), *oli* (chants), and *‘ōlelo no‘eau* (proverbs, poetical sayings) associated with *akua* (God, male and female deities, spirits) and storied places (*wahi pana*). Poli‘ahu, the snow goddess, and Pele, the volcano goddess, engaged in legendary battles to control Maunakea. Pele also had legendary battles with the pig demi-god Kamapua‘a on the summit of Maunakea. Numerous stories of Wākea and Papa, Poli‘ahu, Līlīnoe, Kūkahau‘ula and Mo‘oinanea, to name a few, are written into the landscape.
3. The TMT Observatory Project area is located on a plateau at 13,150 feet elevation north of the summit cone, Pu‘u Kūkahau‘ula. The Hale Pōhaku Project area is located at approximately 9,200 feet in elevation. Maunakea, the tallest mountain in the Hawaiian Islands at 13,796 feet elevation, is also the tallest mountain on earth as measured from the ocean floor to the summit, a distance of some 29,500 feet (thus, exceeding by approximately 1,000 feet the non-volcanic Mount Everest).
4. Vegetation is almost non-existent in the summit region of Maunakea; the tree-line is located nearly a mile in elevation below the summit (at approximately 9,000 feet elevation); the highest major vegetation zone, known as the Alpine Scrub Zone, generally ends at approximately 11,300 feet elevation. Plants in the so-called Alpine Stone Desert Zone of the summit region are mostly limited to small lichens and mosses. More plant life is present in the Hale Pōhaku Project area characterized by

scrub vegetation including a number of natives such as *māmane* (*Sophora chrysophylla*), *pūkiawe* (*Styphelia tameiameiae*) and the endangered endemic, *‘āhinahina*, also known as Maunakea silversword (*Argyroxiphium sandwicense*) as well as introduced exotics such as mullein (*Verbascum thapsus*) and various grasses.

5. Maunakea translates literally as white (*kea*) mountain (*mauna*), so named for its breathtaking snow-capped summit. However, according to Nā Maka o ka ‘Āina (2008) and according to other authorities on Hawaiian culture (e.g., Kepā Maly, Pualani Kanahele), Maunakea has numerous other meanings and translations. It is a short version of Mauna a Wākea, a name that connects it to the sky father, Wākea; this would be one of its *kaona* (hidden or more subtle meanings).
6. Hale Pōhaku, literally “stone house,” refers to the two stone cabins constructed by the Civilian Conservation Corps in 1936 and 1939 at an elevation of 9,220 feet on the southern slope of Maunakea. L.W. Bryan, who served as the Territorial Forestry Office and oversaw the construction of the “stone houses,” also named them Hale Pōhaku.
7. Pu‘u Poli‘ahu is named for Poli‘ahu, “the woman who wears the snow mantle of Mauna Kea;” Poli‘ahu, which is also the name of a land division on Maunakea, is translated as “garment [for the] bosom (referring to the snow)” by Pukui et al. (1974) and as “Snow goddess of Mauna Kea. Lit. Bosom goddess” by Pukui and Elbert (1986). Maly and Maly include a citation by W.D. Alexander regarding the naming of Pu‘u Poli‘ahu. As the peak was nameless, Alexander called it “Poliahu” since it had “a poetical name, being that of the demigoddess with snow mantle who haunts Mauna Kea” (Maly and Maly 2005:200).
8. Waiau, the permanent lake located within Pu‘u Waiau near the summit of Maunakea at approximately 13,020 feet elevation, translates as “swirling water,” and is associated with the snow goddess Poli‘ahu and is guarded by the supernatural water spirit (*mo‘o*) known as Mo‘oinanea. Queen Emma went to the top of Maunakea to bathe in the waters of Waiau. The ceremony was to cleanse in Lake Waiau at the *piko* of the island. The water caught at Lake Waiau is considered pure water of the gods much like the water caught in the *piko* of the *kalo* (taro) leaf and is thought of as being pure, therefore it is used medicinally (Nā Maka o ka ‘Āina 2008).
9. The Mauna Kea Adze Quarry, also known as Ke-ana-kāko‘i, “the adze-making cave” (Pukui et al. 1974:103), is located on the southern slopes of the mountain, at elevations up to 12,400 feet. The site was listed on the National Register of Historic Places in 1969, and the Hawai‘i State Register of Historic Places in 1981.
10. The *ahupua‘a* of Ka‘ohe was government land on which four native claims were made following the Māhele in 1848. Only one *kuleana* claim was awarded in the entire *ahupua‘a*. The single awarded claim indicates coffee, arrowroot, banana, and taro were all cultivated in the lands of Ka‘ohe. Ka‘ohe was also known as a habitat for *uwa‘u*, or *‘ua‘u* (dark-rumped petrel) seabirds that reside in rocky, dry, elevated areas (Foster 1893).

11. While historic accounts and *mo‘olelo* tell of the presence burials on Maunakea (Maly and Maly 2005), archaeological evidence until recently, was relatively limited concerning confirmed human burials in the summit region. Prior to 2005, archaeological authorities on Maunakea, including Pat McCoy, had documented only one confirmed burial site (with multiple burials) and four possible burial sites in the summit region (McCoy 1991). All of these sites are located on Pu‘u Mākanaka to the northeast of the subject Project area. In progress work by McCoy and Nees however, has documented 28 sites designated as burials and possible burials (McCoy et al. 2008).
12. Several extensive cultural studies have been previously carried out for Maunakea (McEldowney 1982; Kanahele and Kanahele 1997; Maly 1998; Langlas et al. 1999; Maly 1999; PHRI 1999; Maly and Maly 2005). The most comprehensive study by Maly and Maly (2005) builds on archival and oral historical research conducted by the authors beginning in 1996 (to 2005) and presents a wide range of information on natural and cultural beliefs, resources and practices associated with Maunakea. Among the many critical findings of Maly and Maly's (2005) cumulative research is the emphasis on Maunakea as a sacred landscape and native lore associated with traditional knowledge of the heavens—documenting 270 Hawaiian names for stars.
13. Past studies identify Traditional Cultural Properties (TCP) on Maunakea. Three places that have been identified by the SHPD as TCPs and documented in a study done by PHRI (1999) are: (1) Kūkahau‘ula, the summit (Site 21438), (2) Līlīnoe (Site 21439) and (3) Lake Waiau (Site 21440). Other traditional places may also qualify (see Figure 6). Maly (1998:29) has suggested the entire Maunakea summit region down to the 6,000 foot elevation contour be designated a Traditional Cultural Property see (see Figure 16).
14. Archival and oral-historical evidence confirms that Maunakea has long been, and continues to be, a place where significant cultural practices are carried out: where, the *piko* of newborn children are taken to Pu‘u Kūkahau‘ula and Lake Waiau to ensure long life and safety; the remains of individuals with generational ties to Maunakea are taken to *pu‘u* and the summit plateau for interment (Maly and Maly 2005:vi); shrines and stone markers are erected and; ceremonial and other activities occur related to birth, death, healing, navigation and more.

9.2 Summary of Community Consultation (Individuals)

CSH attempted to contact 60 community members (government agency or community organization representatives, or individuals such as cultural and lineal descendants, and cultural practitioners) for the purposes of this CIA. Twenty-five people responded and 14 *kūpuna* (elders) and/or *kama‘āina* (native born) were interviewed for more in-depth contributions. The results of cultural consultations indicate that there are major concerns (and several ancillary ones) regarding potential adverse impacts on cultural and natural resources and associated beliefs and practices as result of the proposed development of the Thirty Meter Telescope, construction of the staging area for the TMT Observatory Project and the HELCO electrical transformer needed to supply electrical power to the TMT Observatory Project:

1. All of the community members interviewed for this study stress that Maunakea is a sacred landscape and that any future development activities on the mountain proceed with greater awareness of, and the utmost respect for Hawaiian culture, Hawaiians' spiritual connection to the mountain, and the sanctity of Maunakea.
2. Several participants discussed the association of Maunakea with other places in Polynesia, from its shared tradition of Polynesian celestial observation and navigation to its cultural and spiritual links in *mo‘olelo* (myths, legends, oral histories), *wahi pana* (legendary or storied places), *mele* (chants and songs) and poetical sayings as well as proverbs (*ōlelo no‘eau*).
3. Ten of the community members interviewed, and three of the respondents who provided brief commentary, explicitly stated their opposition to the proposed actions on Maunakea which is traditionally, and continues to be, one of the most sacred locations in all of Polynesia, not to mention Hawai‘i. These participants voiced sadness, frustration or negative feelings about the cumulative impacts of past and present developments on Maunakea. In the words of one participant, referring to the telescopes on the summit of Maunakea, "When is enough, enough?" Specific *mana‘o* (concerns) and recommendations from those that oppose the proposed TMT Observatory Project and TMT Mid-Level Facility Project are:
    a. Three participants called for astronomy facilities to be removed and for Maunakea to be repaired to its original condition. Two of these participants recommended that the proponents of the TMT Observatory Project make an effort to better reach out to the community about the findings of the Mauna Kea Science Reserve and scientific intent of the proposed TMT Observatory Project through public education events.
    b. One respondent stated that there should be no further development until issues are rectified with the Hawaiian people.
    c. One participant called for the proposed TMT Observatory Project to be installed in Chile rather than in Hawai‘i. Two participants called for the TMT to be installed on the mainland or other countries.
    d. Three of these participants stressed the importance of astronomy to Hawaiians, especially to their voyaging traditions.
    e. Five interview participants and respondents expressed concern about the disturbance of burials and associated cultural artifacts, markers and shrines (*ahu*) and *pu‘u* as result of construction of the proposed TMT Observatory Project and support facilities.
    f. Five participants discussed environmental concerns, particularly about Lake Waiau and the mountain aquifer, as well as other impacts to environmental services. These participants assert that Maunakea—the principle aquifier and watershed for Hawai‘i Island—is being contaminated by human use (i.e., sewage and toxic chemicals leaching from astronomy facilities). Participants also mention the threatened endemic Maunakea Wēkiu Bug (*Nysius wekiuicola*) and cleaning up trash left by visitors to Maunakea.

g. One participant notes that the entire Mauna Kea Science Reserve has been identified by SHPD as an historic district; suggesting that a Cultural Reserve be created and that the following landscape features qualify as TCPs: the Mauna Kea Adze Quarry Complex; the cluster of three *pu‘u* of Kūkahau‘ula that make up the summit region of Maunakea; Lake Waiau; and Līlīnoe, referring to the *pu‘u* southeast of the summit and within the Science Reserve (Section 7.7, Appendix D).

h. Five participants question legal aspects of the lease agreement between the University of Hawai‘i and the State and legitimacy of the Mauna Kea Science Reserve to operate on ceded and/or occupied lands.

i. Three participants question the benefits to the local economy and education promised by past and proposed telescope projects on Maunakea.

j. One participant commented on the view plane and noted that if the TMT project did proceed with development on Maunakea, it should be built away from sacred sites on the summit. S/he added that it should be built off the summit at the 13,000 ft. level near the VLBA (Very Long Base Array) Telescope Facility to avoid interfering with the major view planes of the summit area and to avoid being visibly intrusive from lower levels on the island (e.g., Waimea).

4. Three participants interviewed for this CIA, and one respondent who provided brief commentary, are in favor of the development of the TMT Observatory Project and its associated facilities on Maunakea. These participants recommend Project proponents proceed with care and respect to the sacredness of Maunakea and advised mitigation measures and/or alternatives to the current proposed design and location of the TMT Observatory Project and support facilities. In the words of one participant, “The future of Maunakea…can serve as an educational center and a place for man to view the stars and the universe but it has to remain a sacred and holy place. It’s like stepping into a sanctuary, a very sacred place of peace, a place that one can learn the things beyond what man knows now.” Concerns and recommendations from these participants are:

   a. One participant believes the TMT Observatory Project should be built on a recycled site. He states that if an outdated telescope site on Maunakea is identified, the site should be recycled for TMT Observatory Project usage to avoid unnecessary intrusions that detracts from the beauty and majesty of Maunakea.

   b. One participant calls for a process to be put in place that respects community and allows projects such as TMT Observatory Project telescope to continue.

   c. One participant recommends the removal of all other telescopes and that only one telescope be utilized and shared by interested parties.

   d. All three of these participants state that if the TMT Observatory Project proceeds, it should be developed to blend in with the natural setting and not detract from the natural beauty and sacredness of Maunakea.

5. Interviewees discussed salient features of the cultural landscape, resources and associated uses of Maunakea including, *mo‘olelo* about Wākea and Papa, Poli‘ahu, Līlīnoe, Kūkahau‘ula and Mo‘oinanea; the summit as an area where families take the *piko* of their babies to bury, and where the bones or ashes of deceased family members are placed; burials and burial complexes; shrines and stone markers; navigation traditions and astronomy; the adze quarry; ancient and historic trails; the healing and purifying waters of Lake Waiau and snow and ice collected for medicinal and ceremonial purposes; bird hunting; and other past and present cultural practices (see Sections 7 and 8).

9.3 Agency Responses

CSH received comment letters from the SHPD and OHA:

1. SHPD, responding in a memo sent on May 4, 2009, states, “As you may have discerned from the most recent Mauna Kea Comprehensive Management Plan (MCMP) for the UH Management Area (January 2009) and the public hearings for that plan that Maunakea is a very sensitive subject that truly needs and deserves more time to consider all the cultural impacts to this iconic symbol of all cultural connections including but not limited to the genealogical connections, and the spiritual connections to all of the deities in the Hawaiian cosmos and to the kanaka maoli world view.” Additionally, SHPD recognizes Maunakea’s place in Hawaiian navigation as “the first sighting for voyaging canoes to arrive safely to our islands in the middle of the Pacific [and] a significant part of the Pacific Rim mythological connections to all the Pacific Rim.” SHPD recommends:
    a. An assessment of buildings no longer functional be done before building new structures or “perhaps no more development on this sacred mountain;”
    b. Access for cultural practitioners be clearly addressed and defined;
    c. The entire summit of Maunakea be treated as one traditional cultural landscape and not as a piecemeal analysis of just the Science Reserve and that;
    d. More community outreach occur for all cultural impacts on the summit and the proposed area to properly assessed—see list of contacts in the MCMP.
2. OHA, responding in a letter dated January 9, 2009 (Appendix C), acknowledges the different perspectives on Maunakea as a spiritual, sacred place, home to “wao akua” (dwelling, place of the gods) and the place where the presence of numerous *ahu* and *iwi kūpuna* provide silent testimony that generations of Hawaiians have worshipped and buried loved ones at “the highest point possible to rest in peace.” The “life sustaining waters known as Kanekawaiola…contribute to a healthy natural environment, which in turn allows man to thrive.” The letter describes the 40-year debate surrounding the development of Maunakea and recommends that the current proposed TMT Observatory Project study be viewed in context of this long history to “consider the overall impacts of development on Mauna Kea.” OHA suggests several parties for consultation. In a letter dated May 27, 2009, OHA wrote that the

comments provided in their initial letter of January 9, 2009 remain the same (Appendix C), despite the addition of the TMT Mid-Level Facility Project area information to the CIA.

3. Both the SHPD and OHA asked that the current proposed TMT Observatory Project and TMT Mid-Level Facility Project be viewed in light of the long history of development on Maunakea and cumulative impacts to cultural resources and practices and not on an isolated basis.

9.4 Summary of Additional Community Consultation

After the DEIS, Project proponent PB requested CSH contact additional community members (government agency or community organization representatives, or individuals such as cultural and lineal descendants, and cultural practitioners) for the purposes of this CIA. Four individuals (Mr. Ed Stevens, Mr. Gene Leslie, Mr. Patrick Kahawaiola‘a, and Mrs. Ululani Sherlock) were referred by PB to CSH. The remaining four individuals (Mr. Paul Chung-Hoon of the Royal Order of Kamehameha, Superintendent Geraldine Bell, Dr. Pualani Kanahele, and Mrs. Cynthia Nazara) were contacted at the recommendation of Mrs. Sherlock. Of these eight, four people responded and two *kūpuna* (elders) and/or *kama‘āina* (native born) were interviewed for more in-depth contributions. The results of the additional community consultations indicate that there are major concerns (and several ancillary ones) regarding potential adverse impacts on cultural and natural resources and associated beliefs and practices as result of the proposed development of the Thirty Meter Telescope, construction of the staging area for the TMT Observatory Project and the HELCO electrical transformer needed to supply electrical power to the TMT Observatory Project:

1. All four of the additional community members contacted emphasize the historic and sacred place Maunakea occupies in Hawaiian beliefs and practices:
    a. Two participants note that Maunakea should not be crowded with more telescopes, with one of the participants stating “culturally, there’s no more room for new telescopes on Mauna Kea…the most sacred part of Mauna Kea, the summit, is already overbuilt, overcrowded with telescopes.”
    b. One respondent states “the entire Pu‘u is considered sacred from the ocean to the very top of Mauna Kea” and that “mere digging…is considered by most a desecration of Mauna Kea in itself.” Another participant calls for the observation of the sacredness of the mountain by not leaving anything manmade on the summit as to do so “diminishes the mana [power] that adds to the sacredness of Mauna Kea.” This same participant discusses “the three levels of transition” that an individual passes on the way to the summit, which lies at the 13,000 ft level and above, where only *ali‘i* (chiefs, royalty) and the priesthood could go.
    c. One participant discusses the belief that Maunakea belongs to Hawaiians, stating that “the mountain, the highest part of the land, comes to us with an alloidal title.”

d. One participant described how traditional practitioners such as members of *hālau* (meeting house for either canoe or hula instruction) or those from Royal Orders and Ali‘i Societies “often go to the Summit to perform their rituals, respects and present Ho‘okupu.” Another participant notes the ongoing practice of people bringing the “piko [umbilical cord] of their young ones [to the summit].”

2. Two participants express their preference for the de-commissioning of telescopes from the summit.
    a. One participant states that telescopes should be taken out as they get older and near “obsolescence,” so that “the summit would be cleared whether it be 20 years or 50 years…there would be no remaining telescope facilities on the summit.”
    b. One participant notes that if a replacement telescope is needed, then the lower northern plateau, the proposed location for the TMT, would be his area of preference for the replacement telescope, as that location is “more benign and [it] has less cultural artifacts that can be disturbed.”
3. Of the four who responded or were interviewed, three community members state their support for the development of the TMT Observatory Project and its associated facilities on Maunakea. However, they stress that any development of the TMT and its supporting facilities should be kept far away from any historic or cultural features and sites such as *ahu* and *iwi kūpuna*. They also call for Project proponents to proceed with extreme care and respect for the sacredness of Maunakea in addition to addressing several critical issues:
    a. One of these participants, the president of the Keaukaha Community Association, states that “the association is opposed to any new development, without some of it [telescopes] being taken down.” Another participant states that he does not see a cultural impact, but if anything temporary will be put up, it should be taken down.
    b. Another participant calls the TMT telescope “an outstanding piece of equipment” that has “amazing potential.” However, he stresses that before the TMT can go ahead, the master lease has to be revised and modified so that “it would be fair and equitable to all” with “appropriate compensation” to help educate students.
    c. One participant notes that the proposed location for the TMT, the northern plateau, is an area that does not have *iwi* or *heiau*. However, he sees a problem regarding “the proximity to several *pu‘u*.” He adds that in the event that *iwi* are found, “they would have to stop.”
    d. One participant points to the lack of “any cultural historic objects within a 200 ft. radius of the site” while another participant notes that the proposed supporting facilities such as dormitories and a cafeteria are necessary, and will have little or no impact at Hale Pōhaku.

4. All four community members stress their concern for cultural features and historic sites to remain undisturbed.
    a. Two of these members discuss the importance of treating *iwi kūpuna* with respect and extreme care if any additional burials are found.
    b. One respondent recommends that *kūpuna* from the *ahupua‘a* as well as the HIBC be consulted in the event that any inadvertent burial sites are uncovered during ground disturbances.
    c. One participant notes that the location of burial caves on Maunakea are known only to the *‘ohana* [family] caring for the *iwi kūpuna*.
5. One respondent raises the issue of pollution. She asks who will be responsible for transporting waste and/or water run-off away from Maunakea. She voices concern about the light pollution that may be generated by the temporary dormitory at night. She also voices concerns about waste generated by hunters and tourists visiting Maunakea.
6. One participant provides the background, history and purpose of Kahu Ku Mauna ("Guardians of the Mountain"), while another participant describes the group's deep understanding of the cultural protocol for the mountain.

9.5 Summary of Community Consultation

For 15 participants in this cultural impact study, as well as a few invited participants who opted not to participate in the CIA study (see Section 6.1.1), there are *no* mitigation measures that could begin to address the variety of cultural concerns and concomitant issues (legal, economic and environmental) raised by the proposed actions; future developments are viewed as further desecration of a sacred mountain (a realm of the gods) and do not honor Maunakea's place in Native Hawaiian contributions to navigation and astronomy. For seven participants in this assessment, careful planning, better attention to community desires and cultural concerns regarding protection of Maunakea, access to cultural and natural resources and other considerations suggest a way forward; the proposed actions are viewed as an extension of Native Hawaiian knowledge of the stars and voyaging traditions.

9.6 Recommendations

Recommendations are based on a synthesis of all available findings to date, including background research and community consultation, gathered during preparation of this CIA. Some of the themes expressed in past CIAs and cultural studies completed for Maunakea (Sections 4.7 and 4.8) were echoed in this current assessment:

1. Based on the majority view of participants in this current study who have voiced their concerns against proposed actions on Maunakea, it was recommended that Project proponents strongly consider no further development, including the TMT Observatory Project and the TMT Mid-Level Facility at Hale Pōhaku, take place on Maunakea. Consequent to their determination of no action, it is further suggested that Project proponents consider alternative proposals and remediation measures

suggested by CIA study participants (see Community Consultation Results above and Mitigation Measures below).

9.7 Mitigation Measures

The following mitigation measures are offered as a way to remediate and address present and future adverse impacts to Hawaiian cultural beliefs, practices and resources as result of developments on Maunakea generally, and specifically for the proposed TMT Observatory Project and TMT Mid-Level Facility Project:

1. Should the Project move forward in Hawai‘i, faithful attention to the following measures may help minimize adverse impacts:
    a. As expressed by one participant in this current study and several participants in past cultural studies (see Maly 1998, 1999; Maly and Maly 2005), it is recommended that the TMT Observatory Project be built on a recycled site of an outdated telescope on the summit instead of Area E of the Northern Plateau.
    b. An *exit plan* should be created, including an estimated life span for the TMT Observatory Project and a detailed strategy for the removal of the TMT Observatory Project from the summit of Maunakea, before development begins.
    c. Cultural monitors should be present during ground disturbance and construction phases of the TMT Observatory Project and its TMT Mid-Level Facility Project. In addition, personnel involved in development activities in the Project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law.
    d. Access for all cultural practitioners to culturally significant sites on Maunakea should be clearly addressed, defined and allowed before, during and after construction of the TMT Observatory Project and its TMT Mid-Level Facility.
    e. Project proponents should consider expansion and further development of education programs, such as the star gazing program at the annual Makahiki festival, that share the findings of the TMT Observatory and astronomy research with schools and the general public. At the same time, Project proponents should consider training programs for TMT Observatory staff that incorporate Polynesian perspectives in the study of astronomy.
    f. Based on prior cultural studies (e.g., Maly 1998, PHRI 1999) and the statements of respondents in this CIA—including the SHPD—it is recommended that the landowners (State of Hawai‘i) explore the possibility of nominating the entire summit region of Maunakea, from the 6,000 foot level to the summit at Pu‘u Kūkahau‘ula as Traditional Cultural Property for the State Register of Historic Places. The SHPD maintains the Hawai‘i and National

Register of Historic Places and processes all nominations to either register (see http://www.state.hi.us/dlnr/hpd/ hpinvntory.htm).

g. Generally, it is recommended that Project proponents—to employ a phrase used by OHA in their response letter for this CIA—develop a paradigmatic shift in how they engage with the community in a way that truly recognizes cumulative impacts and addresses interrelated concerns (cultural, legal, environmental and socio-economic) enumerated in this CIA report.

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Appendix A Authorization and Release Form

Cultural Surveys Hawai'i, Inc.
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AUTHORIZATION AND RELEASE FORM

Cultural Surveys Hawai'i (CSH) appreciates the generosity of the *kūpuna* and *kama'āina* who are sharing their knowledge of cultural and historic properties, and experiences of past and present cultural practices in Ka'ohe Ahupua'a for the Cultural Impact Assessment CSH is preparing for the proposed Thirty meter Telescope Project at the request of Parsons Brinckerhoff.

We understand our responsibility in respecting the wishes and concerns of the interviewees participating in our study. Here are the procedures we promise to follow:

1. The interview will not be tape-recorded without your knowledge and explicit permission.
2. You will have the opportunity to review the written transcript or notes of our interview with you. At that time you may make any additions, deletions or corrections you wish.
3. You will be given a copy of the interview transcript or notes for your records.
4. You will be given a copy of this release form for your records.
5. You will be given any photographs taken of you during the interview.

For your protection, we need your written confirmation that:

1. You consent to the use of the complete transcript and/or interview quotes for reports on cultural sites and practices, historic documentation, and/or academic purposes.
2. You agree that the interview shall be made available to the public.
3. If a photograph is taken during the interview, you consent to the photograph being included in any report/s or publications generated by this cultural study.

I, _____, agree to the procedures outlined above and, by my
(Please print your name here)
signature, give my consent and release for this interview and/or photograph to be used as specified.

_____
(Signature)

_____
(Date)

Appendix B Executive Summary Copied from Maly and Maly (2005:v-viii)

Executive Summary

At the request of Stephanie Nagata, on behalf of the University of Hawai‘i-Office of Mauna Kea Management, *Kumu Pono Associates LLC* undertook research, compiled a detailed collection of archival-historical records, and conducted oral history interview with *kūpuna* and elder *kama‘āina*, pertaining to the *ahupua‘a* (native land divisions) of Ka‘ohe, Humu‘ula and neighboring *‘āina mauna* (mountain lands) of Mauna Kea, on the island of Hawai‘i. This work was undertaken as a part of ongoing archival and oral historical research conducted by *Kumu Pono Associates LLC,* since 1996, and builds upon the accounts published by Maly in 1997, 1999, 2002, and 2003. The study is multifaceted, and includes detailed verbatim accounts and descriptions of Mauna Kea, the larger Humu‘ula-Ka‘ohe lands, and *‘āina mauna*, covering the periods of Hawaiian antiquity and traditions, to first-hand accounts of travel on and around Mauna Kea, dating from the early 1820s to the 1960s.

One of the primary goals of this study has been to bring a significant collection of historical resource material, describing – native Hawaiian traditions, traditional and customary practices and beliefs; early descriptions of the landscape, land use, and access; changes in the environment; efforts at conservation of the mountain landscape; and the events leading to development of observatories on Mauna Kea – into one manuscript. Such a manuscript will provide readers with access to the diverse, and at times, difficult to locate, historical narratives that document the cultural landscape, and history of land use on Mauna Kea. It being believed that this information may in turn serve as a platform for informed discussions – in the field of cultural and historical resources – in planning for the future well-being of Mauna Kea as a cultural, natural, and scientific resource.

Because of the nature of the Hawaiian system of beliefs and land management, this study looks not only at the upper regions of Mauna Kea, but also at the lands which lie upon the slopes of Mauna Kea. In the traditional and historical setting, the people living on the lands which rested upon, or even viewed Mauna Kea, shared ties to the upper mountain regions as will. The historical records – including oral testimonies of elder *kama‘āina* of the mountain lands – provide readers with detailed descriptions of traditional and customary practices; the nature of land use, and the types of features found on the mountain landscape; and early efforts in conservation on Mauna Kea and the adjoining *‘āina mauna*. The descriptions of land use and subsistence practices range from antiquity to the 1970s, and represent the knowledge of generations of life upon the land.

It is important to note that in the summit region of Mauna Kea (from approximately 11,000 feet and above) and on the lower mountain slopes are found several features named for, or associated with Hawaiian gods and deity. These associations are indicators of Mauna Kea’s place

in the cultural and history of Hawai‘i as a scared [*sic*] landscape. With each part contributing to the integrity of the whole cultural, historical, and spiritual setting.

Through the collection of historical-archival texts and oral history interviews, we have found that a wide range of traditional knowledge and practices, including, but not limited to the following, are described for Mauna Kea and the adjoining *‘āina mauna*:

- **Mauna Kea** - though simply translated as “White Mountain” since at least 1823, the name, Mauna Kea is also known in native traditions and prayers as Mauna a Wākea (Kea), “The Mountain of Wākea.” It is the first-born mountain son of Wākea and Papa, who were also progenitors of the Hawaiian race. Mauna Kea is symbolic of the *piko* (umbilical cord) of the island-child, Hawai‘i, and that which connects the land to the heavens.
- **Pu‘u o Kūkahau‘ula**[1], named for a form of the god Kū, where the *piko* of new-born children were taken to insure long life and safety. This practice is still participated in at the present time.
- **Waiau**, named for the mountain goddess, Waiau (Ka piko o Waiau), and home of the *mo‘o* (water-form) goddess Mo‘o-i-nanea. Place where *piko* of newborn children were taken to ensure long life; and from which *“ka wai kapu o Kāne”* (the sacred water of Kāne) was collected. These practices are still participated in at the present time.
- **Pu‘u Poli‘ahu**[2] and **Pu‘u** Līlīnoe, named for, and the abode of goddesses of Mauna Kea.
- In 1823, the first missionary party to visit the summit of Mauna Kea learned from the natives that it was “the abode of the gods,” and none could be induced to travel to the summit (Goodrich in Ellis, 1963:292).
- *Heiau* and *‘ahu* – ceremonial sites, shrines, and places where *mele* (chants and offerings) were presented.
- *‘Ah*u – stone mounds as land markers.
- *Ana* and *lua kā ko‘i* (caves and quarries from which stone was harvested for making tools).
- *Ilina* (burial features) extending from the summit to the lowlands. Specific mention is made in several important historical accounts – recorded by both native witnesses and non-Hawaiians – of the presence of burials in the *pu‘u* and summit plateau of Mauna

[1] The name of Pu‘u o Kūkahau‘ula is the traditional name of the summit cluster of cones on Mauna Kea, appearing in the native accounts and cartographic resources until ca. 1932. The recent names, Pu‘u Wekiu, Pu‘u Hau‘oki and Pu‘u Haukea, have unfortunately been used since the 1960s (since the development of astronomy on Mauna Kea), and have displaced the significant spiritual and cultural values and sense of place associated with the traditional name, Pu‘u o Kūkanhou‘ula.

[2] The place name Poli‘ahu, was recorded in native texts (cf. Kamakau, 1961 in this study), and as a part of Boundary Commission proceedings in 1872 (in this study); it was also widely documented as the name of the primary goddess of Mauna Kea. The specific usage of the place name “Puu Poli‘ahu” (also referred to a Peak A), was apparently given to the present-day location in 1892, by W.D. Alexander, commemorating the goddess, Poli‘ahu (cs. Alexander and Preston, 1892-1893, in this study).

Kea. The remains of individuals who share ties to Mauna Kea are still taken to the various *pu‘u* on Mauna Kea for interment.

- Native trails – portions of which, on the ascent to the summit, and around the base of Mauna Kea, are overlaid by modern routes of access.
- Shelters and habitation caves.
- Resource collection sites.
- Later features, dating from the middle 1800s, including pens – such as **Kulaka**, on Humu‘ula above Pu‘u ‘Ō‘ō; and **Aiakala**, in Ka‘ohe, above the Pu‘u Nanahu section of the mountain – walls and fence lines.
- Stone and wooden houses.
- Water collection and storage facilities;
- Bird hunting blinds – in the form of single, double or tri-sided stone walls; former garden plots; and other ranch “support” features.

Another facet of this study was a review of native lore associated with traditional knowledge of the heavens. While we have uncovered no specific archival references to native astronomy on Mauna Kea, the association of the gods and deities whose forms are seen in the heavens and whose names are commemorated at locations on Mauna Kea is significant. We have found, that as is the case in all areas of Hawaiian life, the traditions, customs and practices associated with the *‘oihana kilokilo* (astronomy) and *kilo hōkū* (observing and discerning the nature of the stars) were deeply tied to the spiritual beliefs of the Hawaiian people. The stars are physical manifestations of the gods who created the heavens, earth, and humankind, or are body-forms granted to select individuals or beings of nature (Malo 1951 and Beckwith 1951). The combined writings of native and foreign historians on this subject – recorded between the 1830s to 1935 – provide us with a list of more than 270 Hawaiian names for stars (not including alignments of stars which marked the heavens and pathways of traditional navigators).

Also, of importance in discussions regarding modern astronomy on Mauna Kea, the narratives cited in this collection provide readers with first-hand accounts – from archival documents and oral history interviews – of the early days of astronomy on the mountain, including the thoughts and recommendations of the pioneer scientists, responsible agencies, and community members on the Island of Hawai‘i, in regards to use and limitations of Mauna Kea. An example of the kind of information recorded by the early scientists and community on the island of Hawai‘i, between 1964 to 1980, was the development of telescope facilities on Mauna Kea should be carefully limited – by 1980, the recommended number being six observatories.

Historical Land Use on the Mountain Lands

As early as the 1820s, introduced cattle, sheep, goats, and wild dogs had made their way up to the mountain lands, and were bothersome to those who traveled the *‘āina mauna*. In 1834, Scottish naturalist, David Douglas was killed by a wild bullock at Keahua-ai (now called Douglas Pit or Kaluakauka) near the boundary of Humu‘ula and Laupāhoehoe. By 1850, the natural-cultural landscape of the *‘āina mauna* was being significantly altered by the roving herds of wild bullocks, sheep and other ungulates, and ranching interests were being formalized in the

region. In 1857, the Crown and Government mountain lands of Humu‘ula and Ka‘ohe – including the summit of Mauna Kea – were leased to Francis Spencer and the Waimea Grazing and Agricultural Company, which established ranching stations and operations around the mountain lands. Portions of the land of Pi‘ihonua were leased to native bird hunters in the middle 1860s, and subsequently to native and foreign bullock hunters. As a result, Humu‘ula and the larger *‘āina mauna* have been intensively ranched for more than 150 years.

Because hunting, and subsequently ranching of bullocks, cattle and sheep were the primary historic activities on the mountain lands, areas once forested soon became open pasture land. While the first formal lease of Humu‘ula and Ka‘ohe was issued in 1857 (Keoni Ana to F. Spencer), it was Samuel Parker and Parker Ranch that held the longest lease on the Humu‘ula and Ka‘ohe mountain lands. In between 1900 to 2002, their leases extended around Mauna Kea to the Pu‘u Huluhulu vicinity, and for a period, the leases also included portions of the ‘Āina Hou lands. The Parker Ranch interests initially focused on sheep ranching in the Humu‘ula-Kalai‘eha section, but in 1964, the ranch terminated its [*sic*] sheep program. Cattle operations were maintained till the end of the Parker lease in August, 2002.

Today, limited ranching of cattle is continued on the lands extending from Humu‘ula to Hānaipoe, Pā‘auhau, and the Parker Ranch lands – the Humu‘ula section being worked under a permit by the Department of Hawaiian Home Lands, and leases from the State of Hawai‘i. While the Humu‘ula section is still partially grazed, some 6,000 acres between the Pu‘u ‘Ō‘ō and Pu‘uloa, have succumb to an infestation of the introduced gorse (first recorded on the land in 1892), which has had little maintenance since ca. 1980.

As early as 1831, portions of the land of Pi‘ihonua Uka and neighboring forest lands were being worked by Daniel Castle, and later, by the Castle and Hitchcock brothers for lumber milling and bullock hunting operations. Subsequently by the 1860s, native lessees were granted the right of hunting in the Pi‘ihonua uplands. Then in 1887, the *ahupua‘a* of Pi‘ihonua (everything from above Hilo Town to the upland boundary with Humu‘ula) was leased to John Timoteo Baker, who undertook ranching operations in Pi‘ihonua in the 1890s.

Prior to Baker’s lease, the Puu Oo Ranch Station had been established, with its buildings developed as part of the Humuula Sheep Station Company; this due to an error in locating the boundary between Humu‘ula and Pi‘ihonua. In 1896, the boundary matter was settled, and Baker maintained cattle and livestock ranching operations in the area. Baker sold his lease to W.H. Shipman in 1899, which was followed by the sale of a 40 acre parcel – the Pu‘u Oo Ranch headquarters – in Patent Grant No. 8970, to W.H Shipman, In 1902, Shipman secured leases on the lands of Pāpa‘ikou, Makahanaloa and other Hilo District lands, which were incorporated into the Pu‘u Oo ranching operation. W.H. Shipman, Limited, sold its interest in the Pu‘u ‘Ō‘ō parcel in the 1970s, and it remains in private ownership to the present day.

Early leases of the Ka‘ohe mountain lands date back to 1857 (Keoni Ana to F. Spencer), and the operations of Francis Spencer’s Waimea Grazing and Agricultural Company. The lease took in all of the mountain lands (to the summit of Mauna Kea), across Ka‘ohe to its’ Mauna Loa boundary. Activities were all tied to sheep and cattle ranching. Subsequently, in 1870, the lease was acquired by Parker Ranch, which held most of the Ka‘ohe mountain lands until their removal in 1905 for the Mauna Kea Forest Reserve, and later withdrawals as a part of the Pōhakuloa Military installation in 1956 (Governor’s Executive Order No. 1719; and Presidential

Executive Order No. 1167). Portions of the land of Ka‘ohe, generally those on the northern (Waimea) side of Mauna Kea, are still grazed by Parker Ranch. The land of Ka‘ohe IV (the Pōhakuloa section), were turned over to the United States Army, and have been used for military training operations since that time.

The summit of Mauna Kea, situated in the *ahupua‘a* of Ka‘ohe, was noted as a site of importance for modern astronomical observations by the Pendulum Party of 1892. In 1964, the first modern observatory was built on top of Pu‘u Poli‘ahu. By 1965, the National Aeronautics and Space Administration (NASA) and the University of Hawaii initiated their program *"to exploit the exciting potentialities of the Mauna Kea site for astronomical purposes"* (cf. Newell to Hiatt, Feb. 16, 1965, in this study). In 1967, the University of Hawaii Institute for Astronomy was founded, and in 1968, the Board of Land and Natural Resources leased the entire summit of Mauna Kea to the University by Lease No. S-4191. While the practice and activities associated with astronomy on Mauna Kea represent the shortest of the periods of history and land use described in this study, its forty-one years (at the time of this writing) in the summit region of Mauna Kea, also represent the period of most significant changes in the natural and cultural landscapes on the mountain.

Archival Resources of the Present Study

Records cited – many as verbatim transcripts, allowing readers to understand the full context of the accounts as meant by the original authors – include native accounts translated form Hawaiian language sources; the records of Kingdom and Government agencies; journals of historic visitors; records of the lessees and ranching operations on the mountain lands; and narratives from scientific expeditions to Mauna Kea through the 1960s. There are also cited, a number of the early letters by participants in the development of astronomy on Mauna Kea, dating from 1963 to 1980.

Archival-historical resources were located in the collections of the Hawai‘i State Archives, Survey Division, Land Management Division, and Bureau of Conveyances; the Bishop Museum Archives; the Hawaiian Historical Society; University of Hawai‘i-Hilo Mo‘okini Library; private family collections; the Parker Ranch & Paniolo Preservation Society (PPS) collections; the National Archives and Records Administration, and NOAA Central Library; the Houghton Library-Harvard; the USGS Central Library, Denver; the Hawaiian Historical Society; the Hawaiian Mission Children's Society Library; the Hilo Public Library; the Archives of the Institute for Astronomy; and in the collection of *Kumu Pono Associates LLC*. The oral history interviews cited in this study represent selected interviews conducted by Maly between 1999 to 2005, and reflect the recollections of elder native Hawaiians and *kama‘āina* of lands of the *‘āina mauna*. The interviewees ranged in age from their 60s to 90s, and in their stories they describe life upon the land, practices associated with travel and work on the mountain lands, and the early days of astronomy on Mauna Kea.

Appendix C Office of Hawaiian Affairs Letters

COPY

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STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
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HONOLULU, HAWAI'I 96813

HRD08/3874B

January 9, 2009

Lehua Ka'uhane
Cultural Surveys Hawai'i
P.O. Box 1114
Kailua, Hawai'i 96734

RE: Cultural Impact Assessment consultation
Thirty Meter Telescope project
Mauna Kea, Ka'ohe Ahupua'a, Hāmākua District, Hawai'i Island
Tax Map Key: (3) 4-4-015:009 and 012

Aloha e Lehua Ka'uhane,

The Office of Hawaiian Affairs (OHA) is in receipt of your December 4, 2008 letter initiating consultation and seeking comments ahead of a cultural impact assessment (assessment) for the proposed construction and operation of the Thirty Meter Telescope (TMT) project. Based on the information within your letter the proposed TMT is an optical-infrared telescope and would be situated on an estimated 4 acres of presently undeveloped land within the 525-acre Astronomy Precinct of the Science Reserve near the summit of Mauna Kea.

From one perspective, the summit of Mauna Kea is a wao akua, home to deities such as Lilinoe, Kukahau'ula, Poli'ahu and Waiau to name but a few. This is the point where Papa and Wakea meet in the physical world. It is Mauna Kea who stops the rainclouds which provide pristine life sustaining waters known as Kanekawaiola. These waters contribute to a healthy natural environment, which in turn allows man to thrive. The numerous ahu and iwi kūpuna known to be situated in the summit area provide silent testimony that generation upon generation of Hawaiians have respected their gods and taken loved ones to the highest point possible to rest in peace.

From another perspective, Mauna Kea is a unique astronomical observation site. The dry and stable atmosphere in the summit area results in a proportion of clear nights that is among the highest in the world. This ideal astronomical atmosphere allows for observation of the faintest galaxies at the very edge of the observable Universe. For these reasons, Mauna Kea now hosts

the world's largest astronomical observatory with telescopes operated by astronomers from eleven countries.

In the forty years that have passed since the first telescope was constructed, the debate surrounding the continued development on Mauna Kea has intensified and the divide between the above mentioned perspectives has not changed. The proposed TMT project should be viewed as one part of this long history. With this in mind, your assessment should not only be focused on the proposed TMT project, but also consider the overall impacts of development on Mauna Kea.

OHA recommends that consultation occur with the following individuals and organizations who may be willing to share their thoughts with you: Kealoha Pisciotta, Clarence Ching, Reynolds Kamakawiwo'ole, Ke'alakahi Meyers, the Royal Order of Kamehameha I, KAHEA, the Edith Kanaka'ole Foundation, Kahu Ku Mauna and the 'Imiloa Astronomy Center. Please remember that this list is not all encompassing and we are sure you will identify additional individuals and organizations as you move forward with your consultation process.

OHA hopes to continue working with you to develop a paradigm shift in assessments which will truly identify the impacts proposed undertakings will have on cultural resources and traditional practices. OHA respectfully maintains the position that all parties bear a responsibility to work towards building successful working relationships with individuals, organizations and communities throughout Hawai'i which will result in a true understanding of what resources and practices are important to the Hawaiian people.

Thank you for initiating consultation at this early stage and we look forward to the opportunity to review the draft assessment and provide additional comments. Should you have any questions, please contact Keola Lindsey, Lead Advocate-Culture at (808) 594-1904 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Administrator

C: OHA-East and West Hawai'i CRC Offices

CC: Y

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HRD09/3874C

May 27, 2009

Brian Kawika Cruz
Cultural Surveys Hawai'i
P.O. Box 1114
Kailua, Hawai'i 96734

RE: Additional Project Area Description
Thirty Meter Telescope project
Mauna Kea, Ka'ohe Ahupua'a, Hāmākua District, Hawai'i Island
Tax Map Key: (3) 4-4-015:009 and 012

Aloha e Mr. Cruz,

The Office of Hawaiian Affairs (OHA) is in receipt of your April 2, 2009 letter informing us that your letter dated December 4, 2009 initiating consultation ahead of a cultural impact assessment (assessment) for the proposed Thirty Meter Telescope Project (project) did not include a description for a Hawaiian Electric Light Company electrical transformer and a construction staging area, both of which are located approximately 3.5 miles south of the TMT site.

Thank you for continuing consultation at this stage. Our comments detailed in our initial response letter dated January 9, 2009 remain the same. We look forward to the opportunity to review the draft assessment and provide additional comments. Should you have any questions, please contact Keola Lindsey, Lead Advocate-Culture at (808) 594-1904 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Administrator

C: OHA-East and West Hawai'i CRC Offices

Appendix D Written Testimony of Kealoha Pisciotta

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President
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Hallett Hammatt, President
Cultural Surveys Hawai`i, Inc.
P.O. Box 1114
Kailua, Hawai`i 96734

DATE: 3-14-09

RE: Cultural Impact Statement for the Thirty Meter Telescope Project
Cultural Surveys Hawai`i, Inc., Kailua Hawai`i

Aloha Pumehana Hal and Auli`i,

I wish to thank you very much for your work on a Cultural Impact Statement (CIS) for the TMT Telescope Project, as well as your efforts to protect Mauna Kea, its sacred landscape and resources. As I am sure you are already aware, Mauna Kea has been the subject of extensive litigation over the last ten (10) years. In 2003 a federal court case was brought by OHA against NASA –that resulted in NASA being ordered to comply with the National Environmental Policy Act (*Please see*, Civil No. 02-0027 SOM BMK -- Office of Hawaiian Affairs v. Sean O`Keefe, in his capacity of Administrator, National Aeronautics and Space Administration et al.).

In 2007, the Third Circuit Court case (*Please see*, Civil No. 04-1-397 – Mauna Kea Anaina Hou *et al.*, v. State of Hawai`i *et al.*). In the case against NASA, I was a plaintiff witness testifying with regards to Mauna Kea sacred resources and associated customary and traditional practices. In the state's Third Circuit Court case, Mauna Kea Anaina Hou was a primary litigant along with the Royal Order of Kamehameha I, Moku O Mamalahoa, Heiau Helu `Elua (represented by Paul K. Neves), the Sierra Club Hawai`i Island Chapter (represented by Debbie Ward, and Nelson Ho), individual Practitioners Clarence Ku Ching and Hank Fergerstrom. Both cases (i.e. federal and state) the courts found in favor of the people, ruling specifically against the University, NASA and the State's BLNR.

Currently, our Third Circuit Court case is in the Intermediate Court of Appeals (ICA). The University Institute for Astronomy (UHIFA) filed the appeal seeking to have the Third Circuit Court Judge Glenn S. Hara's judgment overturned by the higher court. In response to the UHIFA appeal our lawyers (Alston, Hunt, Floyd and Ing) filed a cross appeal under the Private Attorney General Doctrine (PAGD), in short the PAGD, is a law that permits any party (private or public) that defends the public interest in a court of law (i.e. getting a

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Mar 23 09 01:11p Auli Mitchell 808-965-6582 p.2

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state agency to follow its own rules etc.) to request the court award them their attorney fees and courts costs (or in our case returned to our lawyers.). Apparently, the UHIFA believes only their lawyers should be paid using tax dollars even when they loose and were found to be in violation of state law.

For the above legal reasons, I must request a few things from you both. First, the comments provided in section I (legal disclaimer information), must be included in full in the CIS if my name and testimony is to be used in the CIS.

I. Legal Disclaimer Information

It is my understanding that Cultural Surveys Hawai`i, Inc. (CSH) is performing a CIS pursuant to state law for the Thirty Meter Telescopes. It is also my understanding that this will not be used for any other purpose(s). I ask this because in the past and even the present our testimonies have been used in various documents for various purposes without our express consent. Therefore, any information provided by me in the interview with you for CSH, may be used only for the purposes stated, and may not be used for anything other purpose with out my express written consent.

I do not support the TMT project. I do not support the project, first, because the TMT project will exceed the carrying capacity of Mauna Kea, including the number and size of astronomical facilities legally permitted on Mauna Kea. The BLNR set a legal limit on the number of telescopes (also a limit on size and height of astronomical facilities), in the 1983-85 Mauna Kea Science Reserve Complex Development Plan. The BLNR limit is thirteen (13), that is eleven (11) major and two (2) minor telescopes. The 1995 plan while a plan meant to override the BLNR's 1983-85 plan, directs all astronomy related uses (and limits) to continue to comply with the 1983-85 BLNR plan. Therefore, the TMT may not be permitted under the current legal constraints provided in the BLNR rules and regulations.

The TMT has received significant federal funding and is a federal undertaking pursuant to the National Environmental Policy Act (NEPA), therefore, the TMT must begin NEPA and National Historic Preservation Act (NHPA) section 106 consultations. A state level CIS will not suffice under federal law. Furthermore, the TMT will have substantial, significant and adverse impact on the cultural and natural resources of Mauna Kea. This is so, because the cumulative impacts on the cultural and natural resources where previously evaluated in the NASA federal EIS (please see NASA EIS cumulative impact section). The NASA's EIS is the first and only federal EIS that has ever been conducted on the resources of Mauna Kea. More importantly the BLNR may not

Mar 23 09 01:12p Rui'i Mitchell 808-965-6582 p.3

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approve projects with significant and adverse impacts on the cultural and natural resources in any Conservation District.

I am providing the following testimony as a Native Hawaiian traditional and cultural practitioner with cultural and lineal ties to Mauna Kea. I can speak only from my own house of knowledge regarding traditional and customary practices on the various areas of Mauna Kea. While I absolutely appreciate the funds provided ($100.00) for my testimony, I personally do not take funds for my work for Mauna Kea, the funds you have provided to me will be sent to our legal team and or KAHEA to help with the Mauna Kea work. I appreciate the offer, and I believe this is important since many people are not paid for their expertise—it is only my personal policy not to receive funds for my work for Mauna Kea.

I could not complete the Hale Pohaku (HP) area comments, because the maps provided and project descriptions are unclear and inadequate. For example, the language used in the project description does not match the maps provided and the maps did not have color keys. The maps should include color indication lines of where the HELCO power lines will be located and what lands in particular at HP the TMT wants to use and for what purpose. Because Mauna Kea is a burial ground any land altering activities must be clearly delineated—in order to prevent impact to the burial(s).

We recommend you and your staff review the attached (1) OHA's position (3/9/09) on the UH-UHIFA's "Comprehensive Management Plan"(UH CMP), (2) CMP Draft EA and (3) Joint plaintiff testimonies in opposition to the UH-UHIFA Bills seeking to transfer authority and control of Mauna Kea to the UH-UHIFA.

II. Additional Cultural Concerns

The additional cultural concerns regarding the TMT project include but are not limited to the following:

1. Destruction of the landscape is the primary threat and "cultural concern" on Mauna Kea (because the landscape once destroyed can never be fully restored). The protection and prevention of the cultural and natural resources from further destruction and degradation cause by further construction of telescopes on and around the summit of Mauna Kea, is the greatest of the "cultural concern". Judge Hara, found the resource that needs to be protected is Mauna Kea itself, the entire summit, and not

Mar 23 09 01:12p Aulii Mitchell 808-965-6582 p.7

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simply protection on a project by project basis. Conducting a CIS only for the TMT project is problematic and violates the circuit court ruling.

2. Mauna Kea is a burial ground containing the `iwi of our most sacred and revered ancestors. The ground altering activities involved in the construction of many of the telescopes included digging many stories under ground as well and many stories above ground. Mauna Kea is considered the Wao Akua, and the meeting place of Papa and Wakea. The landscape is comprises of countless traditional and cultural practices and properties. It is a national landmark and eligible for listing on the National Historic Register, as a historic district, a conservation district and NAR.
3. These rights and resources are what state and federal law protect not development. Conservation is the primary purpose of the Mauna Kea Conservation District, not development. Development therefore is not a guaranteed or protected land-use activity on Mauna Kea. Development in other words is a privilege specifically dependent on conservation and therefore, is not a right.
4. The historic properties that are of importance to Native Hawaiians and possess traditional cultural significance derived from associated cultural practices and beliefs (i.e. Traditional and Cultural Properties) of Mauna Kea include but are not limited to the following:

    1. The summit region from approximately 6,000 feet elevation to the Kukahau`ula (summit), including burial and burial complexes
    2. Many of the Pu`u [cinder cones], associated burials and kinolau;
    3. View plane (including mauka-makai and makai-mauka view planes)
    4. Mountain landscape in navigational traditions;
    5. Lake Waiau and adjacent cinder cone;
    6. Numerous Trail systems.
    7. Snow, ice and water collected for medicinal and ceremonial purposes, and kinolau.

The cluster of pu`u (cinder cones) forming the Summit of Mauna Kea have been identified by the State Historic Preservation Division ("SHPD") of the

Mar 23 09 01:13p Ruiii Mitchell 808-965-6582 p.5

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Department of Land and Natural Resources ("DLNR") as a **Historic Property and the summit region of including most of the Mauna Kea Science Reserve has been identified by SHPD as a Historic District**. Both Historic Properties are eligible for listing on the National Historic Register.

Generally a historic district is defined as a historic property that '...possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

The Mauna Kea Summit as a "cultural landscape" has been determined eligible for the National and State Register of Historic Places under multiple criteria including cultural significance to the native Hawaiian People (cf. letter of D. Hibbard to R. Evans, September 12, 1991). As a result, archaeologists with DLNR-SHPD have referred the summit region of Mauna Kea as a "ritual landscape," with all of the individual parts contributing to the integrity of the whole summit region. (pers. comm. P. McCoy and H. McEldowney; Group 70 meetings of September 10, 1998). *Id* Citing McCoy and McEldowney).

The historic district of Mauna Kea incorporates virtually the entire Science Research area, extending beyondthe limits of the entire reserve, and also portions of the Natural Area Reserve and the district includes 93 archaeological sites, three landscape features which qualify as traditional cultural properties, including but not limited to the Mauna Kea Adze Quarry Complex, encompassing over 76 shrines of varying complexity, four are adze manufacturing workshops, burials.

The largest of the three traditional and cultural properties, 'Kukahau`ula refers to the cluster of three pu`u that merge and collectively make up the summit of Mauna Kea...The second property, 'Waiau' refers to the small lake and adjacent pu`u situated southwest of the summit and within the Natural Area Reserve. The third property, 'Lilinoe' refers to a pu`u situated southeast of the summit and within the Science Reserve.

Cultural and Social impacts must be considered

The social impacts, those impacts that specifically impact Native Hawaiian cultural and religious beliefs relating to the sacred landscape and the Temple-Mauna Kea, must be considered. For the Native Hawaiian People Mauna Kea is home of Na Akua (the Divine Deities), Na 'Aumakua (the Divine Ancestors), and the meeting place of Papa (Earth Mother) and Wakea (Sky Father)

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who are considered the progenitors of the Hawaiian People. Mauna Kea, it is said, is where the Sky and Earth separated to form the Great-Expanse-of-Space and the Heavenly Realms. Mauna Kea in every respect represents the zenith of the Native Hawaiian people's ancestral ties to Creation itself.

The upper regions of Mauna Kea reside in Wao Akua, the realm of the Akua-Creator. It is also considered the Temple of the Supreme Being.

There are over 93 Astronomical Observatories and Observatory complexes around the world in which to do world class astronomy. Mauna Kea is already considered a world premier site for astronomy work, and houses the largest and most advanced observatories in the world. However, **TMT must consider that Mauna Kea represents the only place on earth where the special and unique Native Hawaiian ritual and ceremonies are conducted**. TMT must consider the impacts to the Native Hawaiian Communities cultural and religious practices. The TMT must also consider the socio-economic impacts this project will have on the Hawaiian Community. The U.S. Civil Rights Commission statistics reports that there are approximately 6000 pure blooded Hawaiian people left in the world today, and their projected survival is only through the year 2044. the Commission further reports that approximately 54% of native Hawaiian people (those with 50% or more blood), make less than 9000 dollars per year.

Cumulative Impacts: Hydrology, Hazardous Materials and Sewage Treatment

TMT must consider and evaluate the impacts from the use, storage and handling of hazardous materials, and sewage upon the Mauna Kea aquifer system (water shed lands of Mauna Kea). Mauna Kea is the principle aquifer and water shed for Hawai`i Island.

The waters, ice and snow collected from Mauna Kea are used for Native Hawaiian healing and other ritual and ceremony.

There is serious concern also for the protection of the waters of Lake Waiau, and the other Pu`u (cinder cones) that also pool water. The Lake is a Traditional Cultural Property, and is home to deities. Waters are harvested for ceremony from Lake Waiau, and other pooling waters.

The TMT is obligated to ensure the Public Trust doctrine is protected.

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P.04 808-969-6582 Ruth Mitchell Mar 23 09 01:13p

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During the NASA EIS process, copies of the over 10,000 Material Safety Data Sheets (MSDS) we received by subpoena in the State CCH. The TMT must consider the impacts of these hazardous materials on the TCP and associated Native Hawaiian practices (i.e. collection of snow, ice and snow) and should also consider the watershed conditions after thirty years of sewage and hazardous material release into the ground of Mauna Kea.

According to the Material Safety Data Sheets ("MSDS") received, the following Observatory/Telescope Facilities were found to use "elemental" mercury. The University Of Hawai`i 88 inch or 2.2 meter Observatory ("UH88") (Exhibit F-64), The Canada-France-Hawaii Telescope ("CFHT") (Exhibit F-62), The William M. Keck Observatory I and II ("WMKO") (Exhibit F-61), The NASA Infrared Telescope Facility ("IRTF") (Exhibit F-60), and The United Kingdom Infrared Telescope ("UKIRT").

There have been 3 Mercury spills reported at the William M Keck Telescope. August 10, 1995, September 15, 1995, and November 6, 1995. There have been 7 recorded spills from other facilities over the years.

The Hazardous materials listed below were found to be stored and used at the Observatories/Telescope Facilities they include but are not limited to, the following:

Hydrochloric-Acid (Note: not listed in JCMT Exhibit F-66)
Potassium Hydroxide
Hydraulic, Motor, and Lubricating Oils
Pesticides
Insecticides
Calcium Carbonate
Sulfuric Acid
Diesel, Jet Fuel, and Unleaded Gasoline
Ethylene Glycol
Kerosene
Methyl Ethel Keytone
Toluene
Paints, Thinners and Solvents
Rush Treatments and Inhibitors
Carbon Disulfide
Elemental Mercury

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Mar 23 09 01:14p Rui'i Mitchell 808-965-6582 p.8

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I hope this information helps. If you have any further questions please feel free to contact me at the contacts above.

Mahalo for your time, consideration, hard work and Aloha for Mauna Kea,
In Aloha I remain,
Kealoha Pisciotta

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Mar 23 09 01:14p Ruth Mitchell 808-965-6582 p.2

Appendix E Resolution on TMT Observatory (Isaac Harp)

Resolution in Opposition to Thirty Meter Telescope (TMT), as amended, was adopted at the duly convened November 15, 2008 meeting of Na Kupuna O Moku O Keawe ("Na Kupuna") held at Kapa'au, North Kohala, Island of Hawai'i

WHEREAS, Na Kupuna states that the Hawaiian Kingdom was and remains a neutral independent nation, was a member of the Family of Nations until removed under false representation by the United States, and has Treaties with many major nations of the world, including the U.S., France and Great Britain. Here we list for the record those Treaties, Conventions, and other International Agreements of the Hawaiian Kingdom:

United States of America, December 23rd, 1826 (Treaty)
Great Britain, November 13th, 1836 (Lord E. Russell's Treaty)
France, July 17th, 1839 (Captain LaPlace's Convention)
France, March 26th, 1846 (Treaty)
Great Britain, March 26th, 1846 (Treaty)
Denmark, October 19th, 1846 (Treaty)
Hamburg, January 8th, 1848 (Treaty)
Agreement Touching Consular Notices (Danish and Hamburg Treaties), January 25th, 1848
United States of America, December 20th, 1849 (Treaty)
Sweden and Norway, July 1, 1852 (Treaty)
Tahiti, November 24th, 1853
Bremen, March 27th, 1854 (Treaty)
France, September 8th, 1858 (Treaty)
Belgium, October 4th, 1862 (Treaty)
Netherlands, October 16th, 1862 (Treaty)
Italy, July 22nd, 1863 (Treaty)
Spain, October 9th, 1863 (Treaty)
Swiss Confederation, July 20th, 1864 (Treaty)
Russia, June 19th, 1869 (Treaty)
Japan, August 17th, 1871 (Treaty)
New South Wales, March 10th, 1874 (Postal Convention)
United States of America, January 30th, 1875 (Reciprocity Treaty)
German Empire, 1879-80 (Treaty)
Portugal, May 5, 1882 (Provisional Convention)
United States of America, December 6, 1884 (Supplementary Convention)
Hong Kong, December 13th, 1884 (Money Order Regulations)
Universal Postal Union, March 21st, 1885 (Additional Act of Lisbon)

Japan, January 28th, 1886 (Convention)
Universal Postal Union, November 9th, 1886 (Ratification)
Samoa, March 20th, 1887 (Treaty)

WHEREAS, Na Kupuna states that the Hawaiian Kingdom continues to exist - as recognized by the Permanent Court of Arbitration at the Hague, Netherlands, that entertained the case of Larsen vs. Hawaiian Kingdom, an arbitration that the U.S. refused to participate in for fear of being cited by the Permanent Court of Arbitration as a belligerent occupier of Hawai‘i;

WHEREAS, Na Kupuna - in the absence of an operating government of the Hawaiian Kingdom, and in the absence of a line of succession to a monarch (Hawai'i is a constitutional monarchy) – states henceforth that as recognized under international law, the elders of descendants of Hawai‘i subjects are among the next in line of lawful authority having sole lawful jurisdiction over Hawai'i island. This is an adjunct of Hawaiian Kingdom law that continues, although the present U.S./State of Hawai‘i regimes ignore international laws of occupation by applying their own fabricated laws rather than the laws of the occupied Hawaiian Kingdom. The current situation reflects intentional misrepresentation, deceit and fraud by the U.S./State of Hawai‘i;

WHEREAS, Na Kupuna states that the so-called “ceded lands” are lands unlawfully taken from the Hawaiian Kingdom in 1893 and unlawfully “ceded” to the U.S. as part of the unlawful annexation of Hawai‘i to the U.S. in 1898;

WHEREAS, Na Kupuna states that the so-called annexation of Hawai‘i to the U.S. in 1898 is a myth, as the attempt was made by a “resolution” of the U.S. Congress - a domestic document having no legal significance outside of the boundaries of the sponsoring nation, the U.S. - and not by legally accepted treaty. Hawai‘i was and remains a foreign nation to the U.S.;

WHEREAS, Na Kupuna states that the Republic of Hawai‘i that allegedly “ceded” the Hawaiian Kingdom National lands to the U.S. had no title to those lands. There is no “chain of title” giving any degree of good and legal title to the Republic of Hawai‘i;

WHEREAS, Na Kupuna states that the Mauna Kea Science Preserve – upon which numerous astronomical observatories have been built - is part of the so-called “ceded lands” of the State of Hawai‘i;

ADDITIONALLY, following current U.S. law - a law that Na Kupuna disagrees with -- under Section 5(f) of the Admissions Act (1959) – the so-called “ceded” lands were transferred to the so-called “State” of Hawai‘i “in trust,” among other things, for the benefit of Native Hawaiians;

WHEREAS, Na Kupuna claims lawful jurisdiction and authority over these so-called “ceded” lands;

RECOGNIZING, the U.S. congress, in U.S. Public Law 103-150, dated November 23, 1993, states: Whereas, the indigenous Hawaiian people never directly relinquished their claims to their inherent sovereignty as a people or over their national lands to the United States, either through their monarchy or through a plebiscite or referendum;

WHEREAS, Na Kupuna suggests that the time line offered by TMT's sponsors, allowing 7-years for construction of the facility is grossly understated. Na Kupuna notes that litigation based on the Conservation District Use Application for the Keck Observatories Outrigger Telescope Project is on-going (7 years at the moment). Na Kupuna predicts a probable timeline for the TMT project of: litigation taking place on the Comprehensive Management Plan (CMP) that is in progress (estimated at 7 years), litigation on the TMT EIS (estimated at another 7 years - which will NOT take place concurrently with the CMP litigation), construction of TMT (if the project survives the 14 years of predicted litigation - of another 7 years) and 3 years for decommissioning. The total of 24 years - added to the present date of 2008 moves us into the year 2032 - leaving 1 year for operation of the TMT before termination of University of Hawai‘i’s general lease of the Science Reserve that terminates in 2033;

THEREFORE, Na Kupuna states that the $1.1 Billion budget for TMT, combined with costs of litigation, payment of Plaintiffs' attorneys fees, etc., will increase total costs for the TMT to over U.S. $5 Billion. This figure enormously exceeds any practical cost/benefit;

WHEREAS, Na Kupuna states that in recent years, as part of the process for permitting the Keck Observatories Outrigger Telescopes, that NASA generated an EIS that concluded that “past, present and ‘reasonably foreseeable’ future astronomical activities at the summit of Mauna Kea have had a substantial and adverse cumulative impact on the mountain's cultural resources.”;

FURTHERMORE, while TMT attempts to disengage its project from the conclusions of the NASA EIS by stating that it is not a “federal agency” and thus not affected by conclusions of the NASA EIS, it is. TMT is a “federal agency” as it has applied for federal operational funds, or is expected to do so in the future;

FURTHERMORE, even if TMT were not a "federal agency," Na Kupuna believes that any EIS generated by TMT MUST, when considering the same or similar issues as the NASA EIS, come up with the same or similar conclusions;

FURTHERMORE, Na Kupuna believes that even if TMT is not a "federal agency," that BLNR (so-called "State" of Hawai‘i Board of Land and Natural Resources), no matter what the conclusion of a proposed "State" EIS might be - that any and all incremental impacts attributed to the TMT would add further substantial impacts to the conclusions of the NASA EIS of "substantial and adverse cumulative impact ...," and MUST reject such an application for conservation use permit;

MOREOVER, in the event that the proposed TMT EIS results in a conclusion substantially different from NASA's EIS, Na Kupuna believes that the conclusion of NASA's EIS (of substantial and adverse cumulative impact) would be the effective determining factor that would attach to all present and proposed astronomy activities on Mauna Kea, including the proposed TMT permit application;

FURTHERMORE, Na Kupuna believes that in the case above, there is no alternate method to handle such potentially conflicting conclusions, but to adopt the conclusion (of the NASA EIS) that best protects the cultural resources, cultural practices, and environmental protections on Mauna Kea;

WHEREAS, Na Kupuna and its individual representatives (of the several districts of Hawai'i Island) maintain their cultural beliefs in the sacredness of Mauna Kea;

WHEREAS, the principals of TMT Corporation, the sponsors of this proposed telescope with a proposed budget of $1.1 Billion (U.S.) to be potentially situated on Area E of the Mauna Kea Science Preserve are the California Institute for Astronomy, the University of California and the Association of Canadian Universities for Research in Astronomy;

WHEREAS, Na Kupuna objects to the involvement of the Association of Canadian Universities for Research in Astronomy, as it is a foreign-based organization of a nation (Canada) that is a participant in the RIMPAC Naval Exercises held periodically in and around Hawai‘i, where in the past, it has taken part in the bombardment of Hawaiian island targets, which are actions Kupuna Council continues to condemn;

FURTHERMORE, Na Kupuna further objects to the involvement of the Association of Canadian Universities for Research in Astronomy, as it is a foreign-based organization of a nation (Canada) that does not support Indigenous Peoples (such as the Hawaiian people of Hawai'i) by refusing to vote in support

of the recently passed UN Declaration of the Rights of Indigenous Peoples, which it now wants to use, in its hypocrisy, Hawaiian Indigenous lands - the so-called "ceded" lands - to build its telescope on;

FURTHERMORE, Na Kupuna objects to the TMT being sited on Area E of the Mauna Kea Science Reserve as it will begin (and result in) the degradation of a pristine area of sacred Mauna Kea by necessarily building new roads and extending various pernicious infrastructure;

ADDITIONALLY, Na Kupuna believes that initiating construction in the currently pristine Area E will set a precedent for opening up this area to further construction of future observatories that will desecrate an increasingly larger area of the sacred temple;

FURTHERMORE, Na Kupuna believes that the power requirements of TMT will substantially squander the increasingly deficient power capacity of Hawai'i island - eventually mandating construction of new generating system capacity that will result in increasing the cost of citizens' electric bills, pro rata or otherwise;

ADDITIONALLY, Na Kupuna believes that situating the TMT where it is proposed, with its expected (approximately) 360 feet diameter dome (the ten meter Keck lenses have domes with a diameter of 120 feet), will be very detrimental to the observation and enjoyment of the natural beauty of Mauna Kea. This is especially so for observers from the South Kohala/Waimea area - where this dome - approximately three (3) times the diameter of the individual Keck domes - will be an extreme eyesore. The existing, and much smaller observatories on Mauna Kea already create an excessively ugly scene that is directly responsible for degrading the natural beauty of Mauna Kea;

WHEREAS, Na Kupuna states that the Mauna Kea lands are "conservation" lands of the so-called State of Hawai‘i, and are administered and managed with priority as conservation lands;

WHEREAS, Na Kupuna believes that no comprehensive studies of the Insecta, Aves and Mammalia classes on Mauna Kea have been done. Members of Na Kupuna, for instance, have knowledge that there are other insects, other than the Wekiu bug, that at times inhabit Mauna Kea, including a number of spiders, lady bugs, etc. Members of Na Kupuna also suggest that the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) may be a visitor to the summit areas (the Science Reserve) of Mauna Kea. In addition, there is the report by Kealoha Pisciotta that at a ceremony held outdoors on the summit (a number of years ago when she was an employee on the mountain), that she observed a Hawaiian Hawk or ‘Io (*Buteo solitarius*) circling directly above the summit;

WITH CONCERN, Na Kupuna inquires about the possible use of insecticides/pesticides in and around a possible TMT at Mauna Kea;

WHEREAS, Na Kupuna states that astronomy, whose participants enthusiastically consider their activity to be superior to all other uses on Mauna Kea, is, by law, only a sub-use of the conservation lands on Mauna Kea, not THE major use of Mauna Kea;

WHEREAS, Section 171 of Hawai‘i Revised Statutes requires that fair market rent be paid for the lease of any of the so-called "ceded" lands;

WHEREAS, Na Kupuna has serious objections to past and present practices that allows lease rent paid by the University of Hawai‘i (lessee - hereinafter "U.H") of the so-called "ceded" lands from the State of Hawai‘i (lessor) for $1 per year;

HOWEVER, Na Kupuna states that if TMT wants to maintain a "legal and lawful" project under Section 171 of Hawai‘i Revised Statutes in the highest ethical and legal standards, then even if not required by U.H. - a fair market lease rent should be voluntarily paid to the Board of Land and Natural Resources ("BLNR") as agent for the State of Hawai‘i (to whom the rent is owed);

WHEREAS, Na Kupuna believes that while public lands are often set aside to public agencies for use in serving the public, subsequent transfer to 3rd parties outside of Hawai‘i government, especially when the benefits go to foreign nations that are obtuse to the Indigenous peoples of Hawai‘i, are, or should be, subject to fair market rents. This is especially so as fair market rents are statutorily mandated by Hawai‘i Revised Statutes;

HOWEVER, Na Kupuna suggests that a fair market lease rent be 120% of proposed rents and viewing times that TMT would pay for a similar site in Chile. The additional 20% would make up for detriments (such as deficiencies for currency transactions, access to site, travel time, language, schools for employee children, standard of living, utilities, TV, shopping, site amenities such as wind flow and lower altitude, cultural differences, transportation difficulties, living communities, etc.) that a Chilean location would necessitate;

WHEREAS, while BLNR continues to complain of not having sufficient budget for the management and administration of Mauna Kea, Na Kupuna believes that the statutory fair market lease rents could go far to remedy the financial straight-jacket that BLNR is currently saddled with, particularly in this time of U.S. and Hawai‘i state financial instabilities;

WHEREAS, Na Kupuna also objects to other foreign-nation telescopes built on its sacred lands, including the Japan National Telescope and the Canada-France

Telescope. All telescopes built on Mauna Kea burden the Hawaiian Nation culturally and (by subsidy) economically by paying an insulting rent of $1 a year;

WHEREAS, Na Kupuna believes that the foreign-nation telescopes built on our sacred temple constitutes further unlawful occupation of our national lands and these telescopes should be deconstructed and rebuilt on the subject nations' own national lands;

THEREFORE, Na Kupuna believes that the Association of Canadian Universities for Research in Astronomy should join other similar agencies and/or organizations - to pursue astronomical facilities and projects in its own country;

FURTHERMORE, Na Kupuna states that the Hawaiian community, through the Hawai‘i State Office of Hawaiian Affairs ("OHA"), is benefited by 20% of the $1 annual rent (from each observatory) - amounting to 20 cents per year;

FURTHERMORE, Na Kupuna states [that] with 13 observatories currently on Mauna Kea, that OHA's income from astronomy activities amounts to the ridiculous sum of a mere $2.60 per year;

WHEREAS, Na Kupuna states that with the inclusion of adaptive optics and interferometry - the twin Keck telescopes having an equivalent resolution of approximately 8 times the lens' effective diameter – or 80 meters - which when compared with the TMT (of a "single" lens of only 30 meters) - has almost 3 times TMT's resolving power. Other than TMT's light gathering ability - the resolution of the TMT is inferior when compared to the adoptive optic- and interferometry-assisted Keck telescopes and therefore have cost-effective issues;

MOREOVER, Na Kupuna believes that the cost/benefit ratio of TMT, when compared to such telescopes as the Keck's, is skewed to the side of inefficiency;

WHEREAS, Na Kupuna observes that Mauna Kea is positioned over one of the major aquifers of Hawai‘i island and MUST be conserved and protected to insure that the life-giving water from this aquifer remains pure for future generations of Hawai‘i Island;

WHEREAS, Na Kupuna believes that all water and chemicals taken to the summit of Mauna Kea in support of TMT's telescope operation, and all human wastes and trash produced, must be taken back down the mountain and disposed of properly. What goes up, must come down;

WHEREAS, as the term "Sustainable Astronomy" has been used relative to public relations materials supporting the construction of TMT, Na Kupuna requests a full and comprehensive definition for the term "Sustainable Astronomy;"

WHEREAS, Na Kupuna believes that it is a matter of U.S. policy that the American Indian Religious Freedom Act applies to Hawaiians' use of Mauna Kea and that in due respect and compliance, TMT must comply with its requirements;

"It is the policy of the United States, in furtherance of the policy established in the joint resolution entitled "Joint Resolution American Indian Religious Freedom," approved August 11, 1978 (42 U.S.C. 1996), to protect and preserve the inherent right of any Native American to believe, express, and exercise his or her traditional religion, including, but not limited to, access to any Native American religious site, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites."
NATIVE AMERICAN FREE EXERCISE OF RELIGION ACT OF 1993

Senate Bill 1021
Item Key: 4770

Introduced to 103rd Congress
May 25, 1993

* * *
American Indian Religious Freedom Act Amendments of 1994
A BILL

To assure religious freedom to Native Americans.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

* * *
SEC. 2.

It is the policy of the United States, in furtherance of the policy established in the joint resolution entitled "Joint Resolution American Indian Religious Freedom," approved August 11, 1978 (42 U.S.C. 1996), to protect and preserve the inherent right of any Native American to believe, express, and exercise his or her traditional religion, including, but not limited to, access to any Native American religious site, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

SEC. 3. DEFINITIONS.

For the purposes of this Act, the following definitions shall apply:

(1) AGGRIEVED PARTY.

--The term “aggrieved party” means any Native American practitioner, Native American traditional leader, Indian tribe, or Native Hawaiian organization [including Na Kupuna] as defined by this Act.

(8) LAND.--The terms “land,” “lands,” or “public lands” mean surface and subsurface land within the jurisdiction of the United States or the respective States, including submerged land of any kind or interest therein and all water and waterways occupying, adjacent to, or running through the land.;

WHEREAS, Na Kupuna recognizes that Native Hawaiians, especially the elderly, suffer very serious health issues relative to the general population of Hawai‘i;

WHEREAS, Na Kupuna, on behalf of all kupuna (elders), Native Hawaiians and the general populace of Hawai‘i Island, and the so-called State of Hawai‘i, suggests that, if TMT is eventually permitted to build (after meeting all legal requirements and cultural concerns), although, hopefully, in an area other than Area E, that its Canadian partner, Association of Canadian Universities for Research in Astronomy, advocate for and participant in a program to import pharmaceuticals from Canada - where pharmaceuticals can be acquired for a substantially lesser expense than in the U.S. - to be sold by licensed participating pharmacies for a set (minimal) markup, thereby significantly benefiting citizens’ in their necessary healthcare;

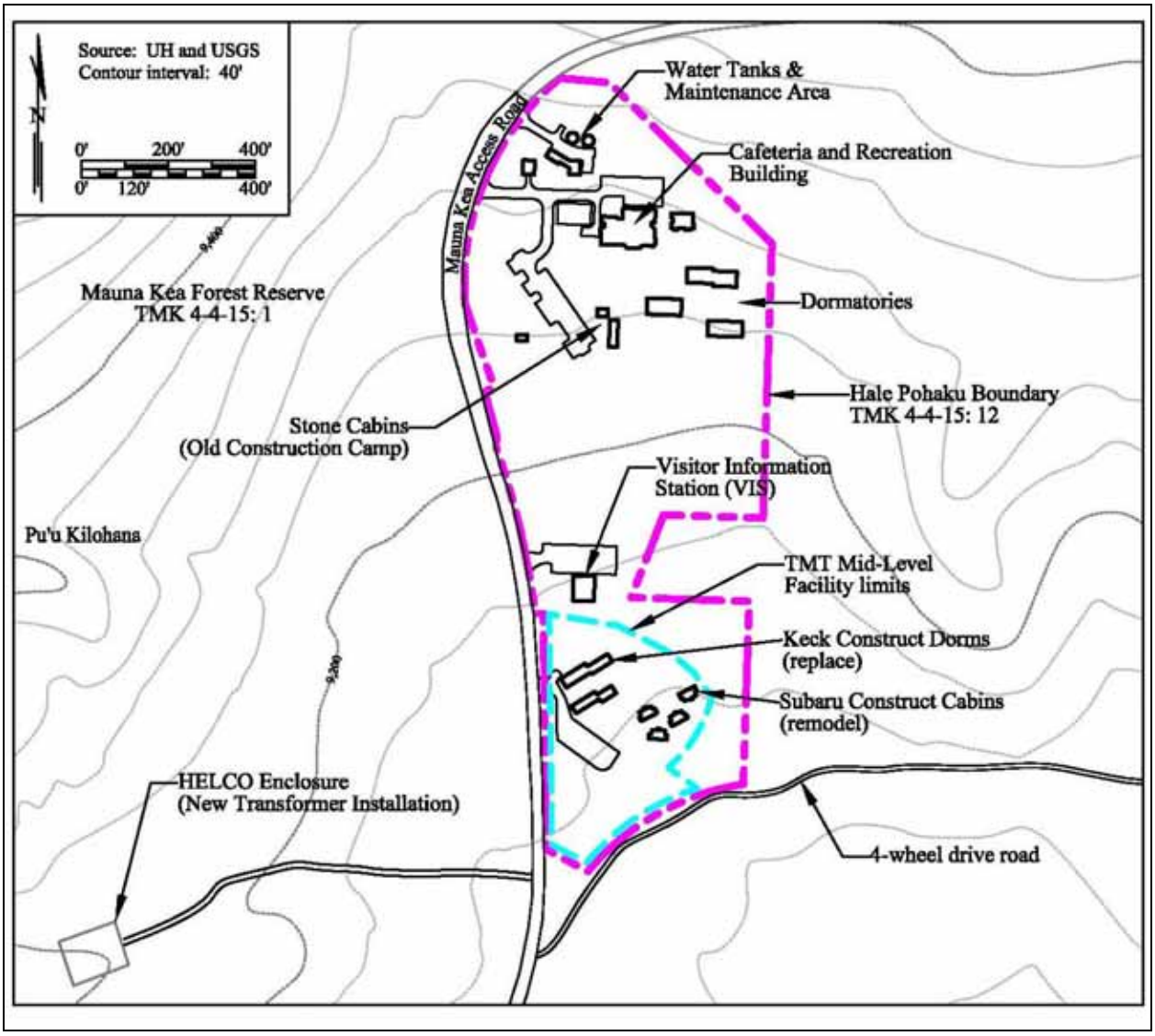
NOW, THEREFORE, Na Kupuna O Moku O Keawe opposes the permitting and construction of the TMT and any other telescopes on the sacred mountain of Mauna Kea, Hawai‘i Island, so-called State of Hawai‘i. We also call for the removal of all telescopes and related equipment on the sacred mountain of Mauna Kea as these were never intended for Hawaiian cultural or religious practices.

DATED: November 15, 2008, at Kapa’au, North Kohala, Hawai‘i Island,

_____ _____

Signed: Kihei Niheu Witnessed: Isaac Harp

Appendix F TMT Mid-Level Facility Map



Appendix E. Cultural Impact Statement (2000 Master Plan)

Paul H. Rosendahl, Ph.D. Inc. (PHRI), 1999. Cultural Impact Assessment Study: Native Hawaiian Cultural Practices, Features, and Beliefs Associated with the University of Hawai'i Mauna Kea Science Reserve Master Plan Project Area. Prepared for the UH IfA. In the 2000 Master Plan, Appendix N. August 1999.

Report 1876-040199

Cultural Impact Assessment Study

Native Hawaiian Cultural Practices, Features, and Beliefs Associated with the University of Hawai'i Mauna Kea Science Reserve Master Plan Project Area

University of Hawai'i Mauna Kea Science Reserve Master Plan
Mauna Kea Science Reserve and Hale Pōhaku

Lands of Ka'ohe (Hāmākua District) and
Humu'ula (Hilo District), Island of Hawai'i

Technical Report for Environmental Impact Study

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Technical Report for Environmental Impact Study

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AUGUST 1999

PHRI **Paul H. Rosendahl, Ph.D., Inc.**
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SUMMARY

Consisting of the upper slopes and summit region of Mauna Kea, the University of Hawai'i Mauna Kea Science Reserve is an 11,288 acre parcel of land leased by the University from the State of Hawai'i since 1968 for development and use as a scientific complex devoted to astronomical research. This cultural impact assessment study has been prepared as a technical report for inclusion in the Environmental Impact Statement submitted by the University of Hawai'i in support of the University's Mauna Kea Science Reserve Master Plan. This new master plan is currently being prepared to provide guidance for the use and development of the Science Reserve into the next decades.

The overall objective of the present cultural impact assessment study was to identify any Native Hawaiian cultural practices, features, and beliefs currently associated with the Science Reserve Master Plan project area that might potentially be in some manner constrained, restricted, prohibited, or eliminated if the proposed Master Plan were to be approved. The nature of identified cultural practices addressed was not restricted; that is, claims for all three types of practices – traditional cultural property, traditional and customary cultural practices, and contemporary cultural practices – were identified and considered.

The principal source of information utilized by the present study was the oral history and consultation study carried out by Cultural Resources Specialist Kepâ Maly, who made extensive efforts to identify and contact individuals potentially knowledgeable of Mauna Kea with regard to traditional and customary cultural practices, traditional cultural properties, and contemporary cultural practices. He conducted a total of fifteen recorded interviews with twenty-two different informants, and in the process of carrying out his study consulted with more than 100 individuals, a great number of whom had knowledge about Mauna Kea and were able to provide information which supplemented that obtained during the recorded informant interviews.

The number and variety of individuals and groups contacted and consulted by Maly demonstrates an adequate, appropriate, and reasonable good-faith effort to identify the full range of native Hawaiian cultural practices, features, and beliefs currently associated with the Science Reserve Master Plan project area on Mauna Kea. This documented effort indicates it is likely that the full range of current cultural practices, features, and beliefs associated with the Science Reserve Master Plan project area has been identified, even though in many instances only the general nature of these practices, features, and beliefs has been determined but not documented in any great detail.

Based on an evaluation of the findings of the present cultural impact assessment study, it is believed that with minor exceptions, most of the native Hawaiian cultural practices, features, and beliefs identified as being currently associated with the Mauna Kea Science Reserve Master Plan project area can be considered to be culturally and historically significant. Most, if not all, of the identified practices and beliefs would seem to qualify as traditional and customary cultural practices, while the principal *pu'u* (Kukahau'ula, Lilinoe) and the shallow lake with adjacent *pu'u* (Waiau) would seem to satisfy the criteria for being regarded as legitimate traditional cultural properties. Finally, none of the identified practices and beliefs would seem to represent strictly contemporary cultural practices or beliefs lacking some measure of traditional connection.

Based on an evaluation of the Native Hawaiian cultural practices, features, and beliefs identified as currently associated with the Mauna Kea Science Reserve Master Plan project area, and a general consideration of the potentially adverse direct and indirect effects that might result from future development and use of the summit region, it is obvious that a comprehensive plan for both the short-term and long-term management of the Science Reserve Master Plan project area is vital for the protection and preservation of significant traditional cultural resources. The Master Plan minimizes potential direct and indirect impacts to cultural practices, features and beliefs through the careful limits set upon future development within the proposed Astronomy Precinct and restrictive design guidelines. The Management Plan proposes specific necessary actions to protect the cultural resources and traditional cultural access rights and uses.

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INTRODUCTION

Consisting of the upper slopes and summit region of Mauna Kea, the Mauna Kea Science Reserve is an 11,288 acre parcel of land leased by the University of Hawai'i from the State of Hawai'i since 1968 for development and use as a scientific complex devoted to astronomical research. In 1983, the University of Hawai'i adopted a complex development plan, the Mauna Kea Science Reserve Complex Development Plan, which projected development to the year 2000 and which has provided guidance for the use and development of the science reserve up to the present. To provide guidance into the next decades, a new master plan is currently being prepared by the Honolulu firm of Group 70 International for the University of Hawai'i; the Mauna Kea Science Reserve Master Plan (1999) for continued complex development incorporates the major directions and recommendations proposed by the University of Hawai'i's Mauna Kea Advisory Committee and Group 70.

STUDY IDENTIFICATION

The present cultural impact assessment study has been prepared as a supporting technical report for an appropriate Environmental Impact Statement (EIS) (In prep.) being prepared by Group 70 for the University of Hawai'i in connection with the Master Plan in accordance with "Chapter 343 – Environmental Impact Statements" (Haw.Rev.Stat.) and "Title 11, Chapter 200 – Environmental Impact Statement Rules" (Haw.Admin. Rules, Dept. Health). The basic purposes of the EIS are two-fold: (a) to permit adequate consideration of the potential environmental, social, and economic consequences of the proposed project; and (b) to provide for public participation in the planning of the project (OEQC 1997a:4).

STUDY PURPOSE

General Purpose

The general purpose of the present cultural impact assessment study would be to assess the potential impacts of the proposed complex development plan of the University of Hawai'i Mauna Kea Science Reserve Master Plan upon the cultural resources of the upper slopes and summit region of Mauna Kea in accordance with general guidance provided by OEQC guidelines for cultural impact assessment (OEQC 1997b). Generally speaking, cultural resources include a broad range of often overlapping categories of cultural items – places, behaviors, values, beliefs, objects, records, stories, and so on. For the purpose of this cultural impact assessment study, cultural resources would be defined more specifically as the cultural practices, features, and beliefs of Native Hawaiians that are associated with the defined University of Hawai'i Mauna Kea Science Reserve Master Plan project area atop Mauna Kea on the Island of Hawai'i.

One specific type of cultural resource that falls within the purview of the historic preservation review process is called a "traditional cultural property" (TCP). A traditional cultural property is a historic property or place that is important because it possesses "traditional cultural significance":

> "Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property, then, is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices. . . .

> A traditional cultural property, then, can be defined generally as one that is...[important/significant]. . . because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King 1990:1).

In addition, it is important to realize that sometimes a traditional cultural property may not have a visible physical manifestation:

> Although many traditional cultural properties have physical manifestations that anyone walking across the surface of the earth can see, others do not have this kind of visibility, and more important, the meaning, the historical importance of most traditional cultural properties can only be evaluated in terms of the oral history of the community (Sebastian 1993:22).

Two significant differences distinguish traditional cultural properties as a subset within the larger sphere of cultural resources. First, while cultural resources such as practices and beliefs may be spatially associated with general types of geographical areas, such as the upper slopes of Mauna Kea, a traditional cultural property is a specific physical entity or feature with a definable boundary, such as a specific cinder cone, or *pu'u*, situated on the upper slopes of Mauna Kea. Second, while cultural resources such as practices and beliefs can include general cultural behaviors such as the use of a general area for the collection of natural resources, meditation and ceremonial purposes, or the conduct of religious activities, a traditional cultural property is a specific place or feature directly associated with specific cultural behaviors, the continuity of which over time can be demonstrated.

Given these two significant distinctions, there are three types of practitioner claims relating to cultural practices, beliefs, and features that are likely to be encountered in the course of conducting a cultural impact assessment study. These claims can be referred to as (a) traditional cultural property claims, (b) traditional and customary cultural practice claims, and (c) contemporary (or neo-traditional) cultural practice claims.

Traditional cultural property claims would be those which lie within the purview of the historic preservation review process; that is, they are claims involving the traditional practices and beliefs of a local ethnic community or members of that community that (a) are associated with a definable physical property (and entity such as a site, building, structure, object, or district), (b) are founded in the history of the local community, (c) contribute to the maintenance of the cultural identity of the community, and (d) demonstrate a historical continuity of practice or belief up to the present – through either actual practice or historical documentation (including both written and oral historical sources). Furthermore, a potential traditional cultural property must have demonstrable historical significance in terms of established evaluation criteria, such as those of the National Register of Historic Places and/or the Hawai'i Register of Historic Places, to qualify as a legitimate traditional cultural property within the historic preservation context.

Traditional and customary cultural practice claims would be those which lie within the purview of Article XII, Section 7, of the Hawai'i State Constitution ("Traditional and Customary Rights"), and various other state laws and court rulings, particularly as reaffirmed in 1995 by the Hawai'i State Supreme Court in the decision commonly referred to as the "PASH decision," and as further clarified more recently in its 1998 decision in *State of Hawai'i v. Alapai Hanapi*. The notable points of the decisions in PASH and in *Hanapi* can be summarized as follows: (a) the reasonable exercise of ancient Native Hawaiian usage is entitled to protection under Article XII, Section 7, of the Hawai'i State Constitution; and (b) those persons claiming their conduct is constitutionally protected must prove that they are a Native Hawaiian as defined in PASH, that the claimed right is constitutionally protected as a traditional and customary Native Hawaiian practice, and that the exercise of the right is occurring on undeveloped or less than fully developed property.

While traditional cultural property claims, as defined above, would certainly fall within the general domain of traditional and customary cultural practice claims, not all traditional and customary cultural practice claims would necessarily qualify as traditional and customary cultural property claims. Traditional and customary cultural practice claims subsume a broad range of cultural practices and beliefs associated with a general geographical area or region, rather than a clearly definable property or site – for example, the gathering of various plant products from an upland or forest area for traditional subsistence or ceremonial purposes, in contrast to the gathering of a specific plant species for a specific use by current generation members of a family that had obtained the same plant from the same recognized site for several generations.

Contemporary, or "neo-traditional", cultural practice claims do not necessarily overlap with either traditional property claims or traditional and customary practice claims. Contemporary cultural practice claims would be those made by cultural practitioners relating to current practices or beliefs for which no clear specific basis in traditional culture can be clearly established or demonstrated – for example, the conducting of ritual ceremonies at sites or features for which no such prior traditional use and associated beliefs can be demonstrated. In some cases, however, it may be possible to demonstrate the reasonable evolutionary development of a contemporary practice from an earlier traditional practice.

Specific Purpose and Objectives

The specific purpose of the present cultural impact assessment study was to assess the potential effects of the proposed Complex Development Plan of the University of Hawai'i – Institute for Astronomy (UH-IfA) upon Native Hawaiian cultural practices (including features and beliefs) associated with the defined University of Hawai'i Mauna Kea Science Reserve Master Plan project area atop Mauna Kea on the Island of Hawai'i. To accomplish this purpose, the following specific objectives were established:

1. Identify any traditional Native Hawaiian cultural practices currently being conducted by individual cultural practitioners or groups;

2. Collect information sufficient to define and document the nature, location, and authenticity of identified traditional cultural practices and practitioners or groups;

3. Assess potential impacts of the current project upon identified traditional cultural practices; and

4. Recommend appropriate mitigation measures for any potentially adverse effects upon identified traditional cultural practices.

Thus, the overall goal or objective of the present cultural impact assessment study was to identify any Native Hawaiian cultural practices currently being conducted within the defined project area that might potentially be in some manner constrained, restricted, prohibited, or eliminated if the proposed UH-IfA project were to be approved. The nature of identified cultural practices would not be restricted; that is, claims for all three types practices – traditional cultural property, traditional and customary cultural practices, and contemporary cultural practices – would be identified and considered.

CULTURAL IMPACT ASSESSMENT AND OEQC GUIDELINES

Background

To understand the cultural impact assessment issue, particularly as it is addressed in the present study, a concise consideration of the intent and evolution of the OEQC guidelines is necessary. The guidelines evolved out of what are commonly referred to as "PASH/Kohanaiki" issues – issues relating to Native Hawaiian traditional and customary access and land use rights as they were reasserted by a State Supreme Court decision

in August 1995 and further clarified in its 1998 decision in State v. Hanapi – and the need for appropriate means to address these issues within the State environmental impact review process. For a good discussion of the issues and options involved, the recently completed "Report on Native Hawaiian Traditional and Customary Practices Following the Opinion of the Supreme Court of the State of Hawai'i in Public Access Shoreline Hawai'i vs. Hawai'i County Planning Commission" prepared by the PASH/Kohanaiki Study Group (1998) should be consulted.

Initial attempts to address various issues relating to Native Hawaiian traditional and customary access and land use rights within the framework of the State environmental impact review process were made in the form of proposed changes to the State EIS law as contained in Chapter 343 (HRS). These attempts to require a formal cultural impact assessment failed to pass the State legislature in 1996 and 1997.

A subsequent, second attempt to address various issues relating to Native Hawaiian traditional and customary access and land use rights was made in the form of proposed changes in the "Administrative Rules" for compliance with Chapt. 343 (DOH Title 11, Chapt. 200). This attempt to require an explicitly defined cultural impact assessment also failed, as the governor declined to approve the proposed amendments.

The third attempt to address various issues relating to Native Hawaiian traditional and customary access and land use rights within the State environmental impact review process has resulted in the current OEQC "Guidelines for Assessing Cultural Impacts" (OEQC 1997b). Draft guidelines were initially issued for public review and comment on September 8, 1997. The guidelines in their final form were formally adopted by the Environmental Council on November 19, 1997.

The relationship of the OEQC guidelines to the State Supreme Court "PASH" decision was clearly stated on front page of the September 8, 1997 issue of the OEQC bulletin, *The Environmental Notice,* when the draft guidelines were first issued for public review and comment:

> For years, a controversy has simmered over developer's responsibility to perform a "Cultural Impact Study" prior to building a project. The recent Supreme Court "PASH" decision reaffirmed the state's duty to protect the gathering rights of Native Hawaiians. In light of these events, the Environmental Council has drafted a guidance document to provide clarity on when and how to assess a project's impacts on the cultural practices of host communities.

It should be noted that the guidelines for cultural impact assessment are meant to include consideration of all the different groups comprising the multi-ethnic community of Hawaii; however, this inclusiveness is generally understated, and the clear emphasis is meant to be upon aspects of Native Hawaiian culture.

More than 20 letters were received by OEQC in response to the publication of the draft guidelines, and relevant comments were said to have been incorporated into a final version of the guidelines (OEQC n.d.). The final guidelines (OEQC 1997b) were formally adopted by the Environmental Council on November 19, 1997. The final guidelines are virtually identical to the draft guidelines initially published on September 8, 1997, and the degree to which any of the received comments on the draft guidelines were considered prior to issuance of the final guidelines is uncertain. In fact, the overall process through which the guidelines were prepared and adopted brings out several important questions relating to such topics as (a) the source or basis utilized for the content of the guidelines, (b) the background and qualifications of the preparer(s) of the guidelines, (c) the criteria to be used for the adequacy of cultural impact assessment studies prepared in response to the guidelines, and (d) the legal question of how compliance can be required when the standards are guidelines.

According to the Chair's Report contained in The 1997 Annual Report of the Environmental Council, the guidelines were drafted by the Cultural Impacts Committee:

> The Committee drafted guidelines recommending a methodology to assess the impact of proposed actions on cultural resources, including Native Hawaiian cultural resources, values, and beliefs. The guidelines also specify the contents of a cultural impact assessment.
>
> To prepare the Guidelines, the Committee reviewed public testimony and solicited input from interested parties. Expertise from the DLNR's Historic Preservation Division as well as Federal regulations governing the "Protection of Historic Properties" were used to model the draft guidelines.
>
> The draft cultural impact guidelines were published for review and comment in the Sept. 8 Environmental Notice, and over 20 letters were received. Relevant comments were incorporated into a final draft versions of the guidelines, which were adopted as a policy document by the Environmental Council on November 19, 1997 (OEQC n.d.:5).

Direct inquiries to OEQC (Gary Gill, Director) and SHPD (Dr. Holly McEldowney, Staff Specialist in the History and Culture Branch) provided additional background information relating to the formulation of the cultural impact assessment guidelines. The principal author or compiler of the guidelines was Arnold Lum, Esq., a member of the Environmental Council's Cultural Impacts Committee, and also a staff attorney at the Native Hawaiian Legal Corporation. OEQC staff also assisted in the preparation of the guidelines. Several internal drafts were prepared, reviewed, and revised. Preparation of the guidelines relied to some degree upon National Register Bulletin No. 38, "Guidelines for Evaluating and Documenting Traditional Cultural Properties" (Parker and King 1990) for basic content information. Other sources, including the SHPD draft rules for conducting ethnographic surveys and dealing with traditional cultural properties (DLNR n.d.), were consulted; in fact, a copy of the SHPD draft rules was provided to OEQC and the Cultural Impacts Committee by SHPD Administrator, Dr. Don Hibbard. Professional staff in the SHPD - History and Culture Branch took part in the preparation and review of the guidelines. Certainly the inclusion of such professional anthropological and historical expertise in the preparation of the guidelines was appropriate; however, much of the professional advice on the extent to which detailed expectations – regarding study scope, content, methodology, documentation, and impact assessment – should be explicitly addressed in the guidelines was apparently discounted.

Discussion

The OEQC guidelines consist of three basic sections. The first section is an introduction which notes the various statutory and other bases for addressing potential impacts upon cultural resources within the context of the environmental assessment review process, and "...encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area" (OEQC 1997:1). The second section of the guidelines discusses methodological considerations for conducting cultural impact assessments, and presents a recommended six-step protocol to be followed by the assessment preparers. The third section of the guidelines outlines eleven topics or "matters" that a cultural assessment should address; these topics basically represent the proposed or desired content and organization of a cultural impact assessment report.

As "guidelines", the OEQC guidelines would seem to have neither the specific statutory authority of law, nor the regulatory authority of administrative rules. As guidelines, they should be regarded as providing general guidance; that is, they represent suggestions and recommendations as to how to approach the assessment of potential cultural impacts. The guidelines provide little or no guidance relative to many important questions, perhaps the most significant of which would be the following:

1. How would project-specific determinations be made as to whether or not a cultural impact assessment study might even be necessary or appropriate, given the specific nature and location of a proposed project;

2. If a cultural impact assessment study is to be conducted, how does one determine what would constitute an appropriate project-specific level of effort – that is, the general scope of work or objectives for the study, and the specific tasks or activities required to accomplish successfully the scope of work or objectives;

3. What criteria are to be used for determining the credibility and reliability of potential cultural information sources (generally referred to as "informants" or "knowledgeable individuals");

4. If specific cultural practices, beliefs, or features are definitely identified as being associated with a project area, what criteria are to be applied for evaluating (a) the descriptive adequacy and (b) the cultural authenticity of the identified practices, beliefs, or features;

5. If specific culturally authentic practices, beliefs, or features are definitely identified as being associated with a project area, what criteria are to be used for assessing the nature and extent of potential impacts of a proposed project on the identified practices, beliefs, or features – "no effect", "no adverse effect", and/or "adverse effect";

6. If a project were determined to have potentially adverse effects upon specific identified, culturally authentic practices, beliefs, or features, what criteria are to be used for evaluating the adequacy and appropriateness of alternative potential mitigation actions;

7. The review and acceptance or rejection of a completed cultural impact assessment study would legitimately fall within the purview of what regulatory office or agency; and

8. What standards or criteria are to be used to evaluate the overall adequacy or acceptability of a completed cultural impact assessment study?

Consideration of these questions, and their implicit implications, would have direct relevance to cultural impact assessment studies. These implications relate most importantly to (a) the level of study effort believed appropriate for the project-specific context, and (b) the rational adopted for both the study overall, as well as for the identification and evaluation of identified cultural practice claims, the assessment of potential project-specific impacts, and the formulation of any specific recommendations for further study or other actions.

PRESENT STUDY SCOPE

Level of Study Effort and Rationale for Approach

Determination of the level of study effort appropriate in any project- specific context should involve the consideration of several factors, including the following:

1. Probable significance and number of known or suspected traditional cultural properties, features, practices, or beliefs within or related to the specific project area;

2. Potential number of individuals (potential informants) knowledgeable of the specific project area;

3. Availability of historical and cultural information on the specific project area or immediately adjacent lands;

4. Size, configuration, and natural history of the specific project area; and

5. Potential effects of the project on known or expected traditional cultural properties, features, practices, or beliefs within or related to the specific project area.

In some instances, consideration of these factors within the specific nature and context of a project might indicate that the most appropriate level of study for an adequate assessment of potential cultural impacts would be that which could be characterized as an identification study. The distinctive characteristics of an identification study are that it would be limited to (a) the identification of Native Hawaiian cultural practices currently being conducted by individual cultural practitioners or groups, and (b) the collection of information minimally sufficient so as to define the general nature, location, and likely authenticity of identified cultural practices. An identification study is believed to comprise a reasonable approach for the assessment of potential cultural impacts when the potential for a project to result in adverse impacts upon any current Native Hawaiian cultural practices, beliefs, or features would seem likely to be minimal or indeterminate; that is, given the specific details of a proposed project, it would be very unlikely that the continued exercise of any current practices would be in any way restricted, constrained, prohibited, or eliminated.

An identification study would not involve the considerably greater level of effort – both calendar months and hours of labor – needed to carry out what could be characterized as a documentation study. The distinctive characteristics of the latter, more commonly be referred to as a full ethnographic or oral history study would be (a) the collection of detailed information regarding identified Native Hawaiian cultural practices by means of formal oral history interviews which are usually tape recorded and transcribed, and (b) the analysis and synthesis of all collected data – from interviews, as well as relevant historical documentary and archival research – within the general cultural-historical context of traditional Native Hawaiian culture and the defined specific geographical area of a specific project.

The overall rationale guiding the present study has been that the level of study effort should be commensurate with the potential of the proposed project for making any adverse impacts upon any Native Hawaiian cultural practices currently conducted by cultural practitioners within the Science Reserve Complex Development Plan project area. Because the proposed project was believed likely to have potentially adverse impacts, the level of study effort referred to as a documentation study, or a full ethnographic or oral history study, was determined to be appropriate. Proposed future development within the Science Reserve Complex Development Plan project area would involve construction and operation of substantial and widespread, or dispersed, astronomy facilities and related support facilities and infrastructure, and would appear to have significant potential for both direct and indirect effects of short-term and long-term duration on current Native Hawaiian cultural practices associated with the project area.

Therefore, intensive efforts were made to seek out and interview knowledgeable informants and cultural practitioners in an effort to identify and document traditional and customary practices, traditional cultural properties, and contemporary cultural practices associated with the project area so that adequate and appropriate mitigation measures might be developed to minimize or eliminate adverse effects upon existing Native Hawaiian cultural practices, features, and beliefs. Adequate identification and documentation for the present study entailed considerable efforts to interview knowledgeable informants and cultural practitioners in order to collect and record the details of identified cultural practices, features, and beliefs. The study did not,

however, make any exhaustive efforts to evaluate the authenticity of identified cultural practices, or to determine whether such practices represented more recently established contemporary cultural practices rather than traditional and customary cultural practices. This position was taken for two reasons: (a) disagreement or argument with informants and practitioners as to the cultural authenticity of specific practices, features, or beliefs would seem to be both insensitive and presumptuous; and (b) efforts made to minimize or avoid potentially adverse effects upon identified Native Hawaiian cultural practices, features, and beliefs would seem to be the more productive and appropriate course of action.

Specific Scope and Work Tasks

While the specific purpose of the cultural impact assessment study was to assess the potential effects of the proposed Complex Development Plan of the University of Hawai'i - Institute for Astronomy (UH-IfA) upon Native Hawaiian cultural practices (including features and beliefs) associated with the defined University of Hawai'i Mauna Kea Science Reserve Master Plan project area, the specific scope and work tasks of the study were defined by several assumptions, constraints, and limitations. In order to accomplish the specific purpose and objectives outlined for the present study, the following specific tasks were formulated:

1. Review available historical documentary, traditional cultural property, and archaeological background research;

2. Review and evaluate available oral history informant interview summary and transcripts;

3. Prepare an appropriate cultural impact assessment report; and

4. Consult and coordinate with client and client representatives, regulatory agencies, advisory groups, and any other individuals or groups as necessary and/or appropriate.

Assumptions, Constraints, and Limitations

At the direction of the client and with the agreement of the SHPD, the present cultural impact assessment study was be carried out in accordance with two specific assumptions that would constrain and limit the scope of work and tasks. First, no additional or new historical documentary, traditional cultural property, and archaeological background research would be conducted. Background review would utilize only available materials, particularly recently prepared ones, including (a) an archival literature research overview and oral history report prepared for the present Complex Development Plan project by independent Cultural Resources Specialist Kepā Maly (Maly 1999), (b) a compilation of traditional cultural property and current cultural uses information prepared by SHPD History and Culture Specialist H. McEldowney, (c) an archaeological inventory survey report prepared by SHPD Staff Archaeologist P. McCoy, and (d) a comprehensive historic preservation plan for the Mauna Kea Science Reserve prepared by SHPD staff (DLNR In prep.). Secondly, no additional oral history informant interview work was to be conducted. Review and evaluation of local informant interviews would utilize the available summaries and transcripts of the oral history interviews recently completed by independent Cultural Resources Specialist Kepā Maly (Maly 1999).

As indicated by the recent audit report on the management of Mauna Kea and the Mauna Kea Science Reserve (Auditor 1998), the protection and management of the natural resources of Mauna Kea, including the cultural resources, has generally been less than adequate. While several more or less comprehensive plans and reports for management and development have been prepared over the years since 1977, implementation of proposed measures to protect and manage significant natural resources has generally been weak; more specifically, the audit determined that historical preservation concerns had been neglected, and cultural preservation concerns largely unrecognized (Auditor 1998:15-23).

During the period 1986-1993, numerous discussions apparently took place between the University of Hawai'i and DLNR regarding the preparation of a historic preservation plan for the identification, protection, and management of historic properties on Mauna Kea and in the Mauna Kea Science Reserve. A detailed scope of work for the preparation of a historic preservation management plan (DLNR 1993) was finally completed and approved in 1993, and archaeological survey field work related to the preparation of the plan was subsequently carried out between 1995 and 1997 (McCoy 1999).

In February 1999, the University of Hawai'i and DLNR executed a formal Memorandum of Agreement under which the University would provide financial support to DLNR for the preparation by SHPD of a historic preservation management plan for Mauna Kea. This agreement, which incorporated the approved 1993 scope of work, called for DLNR to complete and submit a final plan within nine months (i.e., by the end of October 1999), with draft versions of different component sections of the plan to be completed and submitted within six months (i.e., by the end of July 1999).

A detailed outline for the organization and content of the historic preservation plan had been previously prepared by SHPD and finalized in December 1998. This outline conceptualized a comprehensive plan consisting of two essential major components: (a) an information component which described the significant historic properties of Mauna Kea and the Mauna Kea Science Reserve, and (b) a management component which identified potential impacts of proposed development and appropriate measures through which potentially adverse effects could be avoided or mitigated.

The information component of the historic preservation plan was organized to address the following topics:

1. Introduction, including plan objectives and background, geographic areas to be covered, and operational jurisdictions (applicable State and Federal laws and policies);

2. Environmental Setting;

3. Cultural-Historical Background, including overview of social-political context, prehistoric and early historic land use patterns (to 1850) of the summit region and Hale Pōhaku/mid-elevation forest zone, and historic period land use patterns of the summit region and Hale Pōhaku (c. 1830s to 1960);

4. Historic Property Inventory, including history and extent of past archaeological survey coverage, and results (property types, distribution patterns, analysis, traditional cultural properties);

5. Evaluations and Eligibility for the National Register, including definition of a Summit Region Historic District, and discussions of Kalepamoa Area (Hale Pōhaku area) historic properties and the Mauna Kea Adze Quarry);

6. Land Uses, Potential Threats, and Regulated Activities; and

7. Jurisdictions.

The management component of the historic preservation plan was organized to address the following topics:

1. Plans for Specific Development Projects and Related Activities, including maintenance and routine operations, and proposed development and construction projects, in terms of potential direct and indirect adverse effects, and proposed mitigation measures to avoid or minimize adverse effects; and

2. Long-Term Management Plan for Historic Properties within the Science Reserve, including plans for interpretive development, monitoring, routine consultation with Native Hawaiian organizations and individuals, cultural uses, and continued inventory of historic properties.

In addition to a Reference section and a Glossary of terms used in the plan, the historic preservation plan was to incorporate five technical Appendices:

1. Report of Archaeological Surveys Conducted by DLNR (1995 to 1997), including survey methods, areas covered, relocation of previously identified sites, and survey results;

2. Catalogue of Historic Properties, including descriptions of all historic properties identified between 1982 and 1997;

3. Annotated Bibliography of Archaeological and Related Studies in the Mauna Kea Science Reserve and Mauna Kea, including all archaeological studies and related scientific studies;

4. Annotated Bibliography of Historic and Ethnographic References to Mauna Kea, including associated cultural references (myths, legends, and traditions), historic period accounts of the upper regions, and historic period land use records of areas; and

5. Annotated List of Applicable Historic Preservation Laws and Regulations.

The scope of work and level of preparation effort agreed upon for the present cultural impact assessment study were formulated with the understanding and assumption that draft versions of major substantive sections of the historic preservation plan being prepared by DLNR would be available and would be utilized extensively in the preparation of the present cultural impact assessment study. With the exception of a detailed content outline and partial draft discussion of the management component of the historic preservation plan, and a draft summary inventory of archaeological sites identified within the Science Reserve (including short descriptions of individual sites), these expectations had not been fulfilled as of early August 1999.

This situation has resulted in limitations to the present study report, which have been dealt with as follows. First, intended overview sections on cultural-historical background and archaeology have been replaced by a single cultural-historical-archaeological overview section that has been taken from, with minor changes, the *Mauna Kea Science Reserve Master Plan - Draft #3* (Group 70 International 1999:V-1 thru 10). Second, an intended section on the proposed Mauna Kea Summit Region Historic District has been replaced by a short summary prepared on the basis of discussions with SHPD staff, and two draft maps provided by SHPD staff.

While these limitations have altered somewhat the original intended scope of the present study report, they do not prevent an adequate identification and evaluation of Native Hawaiian cultural practices, features, and beliefs associated with the Mauna Kea Science Reserve Complex Development Plan project area. Information sufficient for such identification and evaluation is provided by the oral history study and archival literature research report conducted by Kepā Maly (1999), and supported by additional documentary sources.

STUDY METHODOLOGY

Guidance Documents

Several documentary references were consulted and utilized for general guidance in the preparation of the present cultural impact assessment study. The principal sources were the following:

1. The recently adopted OEQC "Guidelines for Assessing Cultural Impacts" (OEQC 1997);

2. The "Native Hawaiian Rights Handbook" (MacKenzie 1991), and more specifically the discussions of traditional and customary rights contained in the chapters on access rights (Lucas 1991a), gathering rights (Lucas 1991b), religious freedom (Kau and MacKenzie 1991), and burial rights (Ayau 1991);

3. The recently completed "Report on Native Hawaiian Traditional and Customary Practices Following the Opinion of the Supreme Court of the State of Hawai'i in Public Access Shoreline Hawai'i v. Hawai'i County Planning Commission" prepared by the PASH/Kohanaiki Study Group (1998);

4. The Federal regulations of the Advisory Council on Historic Preservation for the National Register of Historic Places (CFR 1981) and the "Protection of Historic Properties" (CFR 1986);

5. National Register Bulletin No. 38, "Guidelines for Evaluating and Documenting Traditional Cultural Properties" (Parker and King 1990); and

6. Recent versions of the State Historic Preservation Division (SHPD) draft administrative rules, including Chapter 275 – "Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS" (DLNR 1998), and Chapter 284 – "Rules Governing Procedures for Ethnographic Inventory Surveys, Treatment of Traditional Cultural Properties, and Historical Data Recovery" (DLNR n.d.).

While the general nature and content of the first three referenced sources are self-explanatory, further comment should be made regarding the final three items. In the absence of any formally adopted administrative rules, the State Historic Preservation Division (SHPD) currently utilizes National Register Bulletin No. 38 (Parker and King 1990) as its principal source of guidance for reviewing and evaluating the adequacy and acceptability of traditional cultural property study reports prepared in connection with various permit applications for which SHPD regulatory review is required. Bulletin No. 38 provides detailed guidance for the assessment of traditional cultural properties within the framework of the National Register significance criteria evaluation process (NPS 1990).

The SHPD draft administrative rules relating to ethnographic surveys and traditional cultural properties (DLNR n.d.) have existed in finalized draft version since at least early 1997; however, they have never been circulated openly, much less formally provided for public review, comment, and eventual adoption by the Department of Land and Natural Resources. This situation is unfortunate because the draft rules go well beyond National Register Bulletin No. 38 in providing detailed guidance for conducting traditional cultural property studies, and more specifically for dealing with the identification, evaluation, and documentation of Native Hawaiian traditional cultural properties and their associated cultural practices and beliefs.

In the absence of any formally adopted administrative rules, SHPD can also be said to basically follow the Federal regulations of the Advisory Council on Historic Preservation for guidance in the evaluation of significance – as contained in Section 60.4 ("Criteria for evaluation") of the "National Register of Historic Places (CFR 1981), and for guidance in the assessment of potential effects – as contained in Section 800.9 ("Criteria of effect and adverse effect") of the "Protection of Historic Properties" (CFR 1986).

Information Sources

The principal source of information utilized by the present study was the oral history and consultation study carried out by Kepā Maly (1999). Maly made extensive efforts to identify and contact individuals potentially knowledgeable of Mauna Kea with regard to traditional and customary cultural practices, traditional cultural properties, and contemporary cultural practices. *Table 1* summarizes the background and qualifications of the knowledgeable informants and cultural practitioners whose interviews were used as the basis for Maly's report:

> In the period between September 25th to December 21st, 1998, Maly...conducted a total of fifteen tape recorded and supplemental interviews with twenty-two participants. The interviews were transcribed and returned to each of the interviewees and follow up discussions were conducted to review each of the typed draft-transcripts. The latter process resulted in the recording of additional narratives with several interviewees... Additionally, three historic interviews (recorded between 1956 to 1967) were translated from Hawaiian to English...and transcribed. With those interviews, representing three primary interweaves, the total number of interviewees represented in [Maly's] study is twenty-five (Maly 1999:ii).

Table 1. Interviewee Background: Summary of Informants and Identified Cultural Practitioners *

Previously Recorded Interviews:

Name of Interviewee	*Ethnicity*	*Year Born*	*Birth Place*	*Male (M) Female (F)*	*Place of Residence*	*Comments*
Kaleohano Kalili	Hawaiian	ca. 1884	n/a	M	Honolulu	1956 participant in Bishop Museum interview.
James Kahalelaumāmane Lindsey	Hawaiian	1882	Waimea Hawai'i	M	Waimea	1966 participant in family interview.
Kalani Ka'apuni Phillips	Hawaiian	1902	Waimea Hawai'i	F	Waimea	1967 participant in family interview.

Interviews of 1998:

Name of Interviewee	*Ethnicity*	*Year Born*	*Birth Place*	*Male (M) Female (F)*	*Place of Residence*	*Comments*
Toshi Imoto	Japanese	1928	Pu'u 'Ō'ō	M	Pāpa'ikou	Retired Cowboy.
John Ah San	Chinese-Portuguese	1907	Laupāhoehoe	M	Laupāhoehoe	Retired Mauna Kea Forestry employee.
Coco Hind	Part Hawaiian	1923	Honolulu (Raised in Waimea)	F	Hōlualoa	Descendant of Hawaiian ranching family.

**from Maly (1999)*

Table 1. Interviewee Background (continued)

Name of Interviewee	Ethnicity	Year Born	Birth Place	Male (M) Female (F)	Place of Residence	Comments
Teddy Bell	Part Hawaiian	1923	Waimea	M	Waimea	Retired Cowboy and Construction worker.
Sonny Kaniho	Part Hawaiian	1922	Kawaihae uka	M	Waimea	Retired Cowboy.
Daniel Kaniho Sr.	Part Hawaiian	1932	Waimea	M	Waimea	Retired Cowboy.
Judge Martin Pence	Caucasian	1904	Kansas	M	Honolulu	Federal Judge; Mauna Kea Hunter.
Pete L'Orange	Part Hawaiian	1933	Waipahu	M	Waimea	Retired Parker Ranch/Humu'ula Manager; Land Use Planner.
Alika Lancaster	Part Hawaiian	1930	Hilo	M	Keaukaha	Mason; Hawai'i Loa Descendant; Hawaiian practitioner.
Anita (Kamaka'ala-Poli'ahu) Lancaster	Part Hawaiian	1942	Moloka'i	F	Keaukaha	Poli'ahu-Hawai'i Loa descendant.
Tita Spielman	Part Hawaiian	1924	Waiākea	F	'Ōuli	Parker-Low family descendant.
J.K. Spielman	Part Hawaiian	1959	Honolulu	M	'Ōuli	Son of Tita Spielman; fisherman.
Hannah Kihalani Springer	Part Hawaiian	1952	Kona	F	Ka'ūpūlehu	Hawaiian Practitioner; historian; OHA Trustee.
Albert Kahiwahiwaokalani Haa Sr.	Hawaiian	1930	Kapoho	M	Waiākea	Retired from Military and State Corrections program; Hawaiian ranching family with ties to Mauna Kea.
Albert K. Haa Jr.	Part Hawaiian	1953	Honolulu	M	Waiākea	Son of A. Haa Sr.; Hawaiian Practitioner.
Lloyd Case	Part Hawaiian	1949	Waimea	M	Waimea	Construction worker; Hawaiian practitioner; and subsistence hunter.
Pualani Kanaka'ole-Kanahele	Hawaiian	1937	Hilo	F	Pana'ewa	Hawaiian Educator, cultural practitioner; Ho'opa'a Kumu Hula.
Irene Lindsey-Fergerstrom & Romona Fergerstrom-Kalalau and family members	Part Hawaiian	1932 1960	Waimea	F F	Waimea	Descendants of families with generations of practice on Mauna Kea.

In the course of conducting his oral history research, Maly attempted to contact and evaluate as many knowledgeable informants and cultural practitioners as possible:

> [D]uring the process of preparing for, and conducting the formal recorded interviews, [Maly] spoke with more than 100 individuals who were known to him, or were identified as: (1) having knowledge about Mauna Kea; (2) knowing someone who could be a potential interviewee; or (3) who represented Native Hawaiian organizations...with interest in Mauna Kea. Several of those contacts resulted in the recording of informal documentation regarding Mauna Kea, or generated written responses as formal communications (Maly 1999:ii-iii).

Other sources of information consulted were various historical documentary and cultural studies, archaeological reports, and management reports pertaining to Mauna Kea. The principal additional references consulted included *A Social Impact Assessment: Indigenous Hawaiian Cultural Values of the Proposed Saddle Road Alignments* (Kanahele and Kanahele n.d.), *Supplement to Archaeological, Historical, and Traditional Cultural Property Assessment for the Hawai'i Defense Access Road...and Saddle Road...Project* (Langlas 1998), *Mauna Kea* - Kuahiwi Ku Ha'o I Ka Malie: *A Report on Archival and Documentary Research* (Maly 1998), *Archaeological and Historical Literature Search and Research Design: Lava Flow Control Study, Hilo, Hawai'i* (McEldowney 1979), *Report 1. Ethnographic Background of the Mauna Kea Summit Region* (McEldowney 1982), *A Regional Synthesis of Hamakua District* (Cordy 1994), several archaeological paper and reports by P.C. McCoy (1977, 1978, 1981, 1982, 1984a, 1984b, 1986, 1990,1997, 1999a, 1999b, Ms.), *Revised Management Plan for the UH Management Areas on Mauna Kea* (DLNR and UH-IfA 1995), and *Mauna Kea Science Reserve Master Plan - Draft #3* (Group 70 International 1999).

UNIVERSITY OF HAWAI'I MAUNA KEA SCIENCE RESERVE MASTER PLAN

The following project description section summarizes project background and setting, and the major physical and master plan components of the University of Hawai'i Science Reserve Master Plan in connection with which the present cultural impact assessment study has been prepared. The principal source from which the following has been adapted is the *Mauna Kea Science Reserve Master Plan - Draft #3* (Group 70 International 1999).

PROJECT BACKGROUND

The Mauna Kea Science Reserve comprises the upper slopes and summit region of Mauna Kea. The Science Reserve is an 11,288 acre parcel of land leased by the University of Hawai'i from the State of Hawai'i since 1968 for development and use as a scientific complex devoted to astronomical research. The reserve was established by the Hawai'i State Board of Land and Natural Resources in 1968 when it approved a 65 year lease to the University of Hawai'i. Two summit region parcels excluded from the reserve are components of the Mauna Kea Ice Age Natural Area Reserve. Astronomy facility development has occurred primarily on the summit area above 13,200 feet elevation, while support facilities have developed downslope at Hale Pōhaku (9,800 feet elevation).

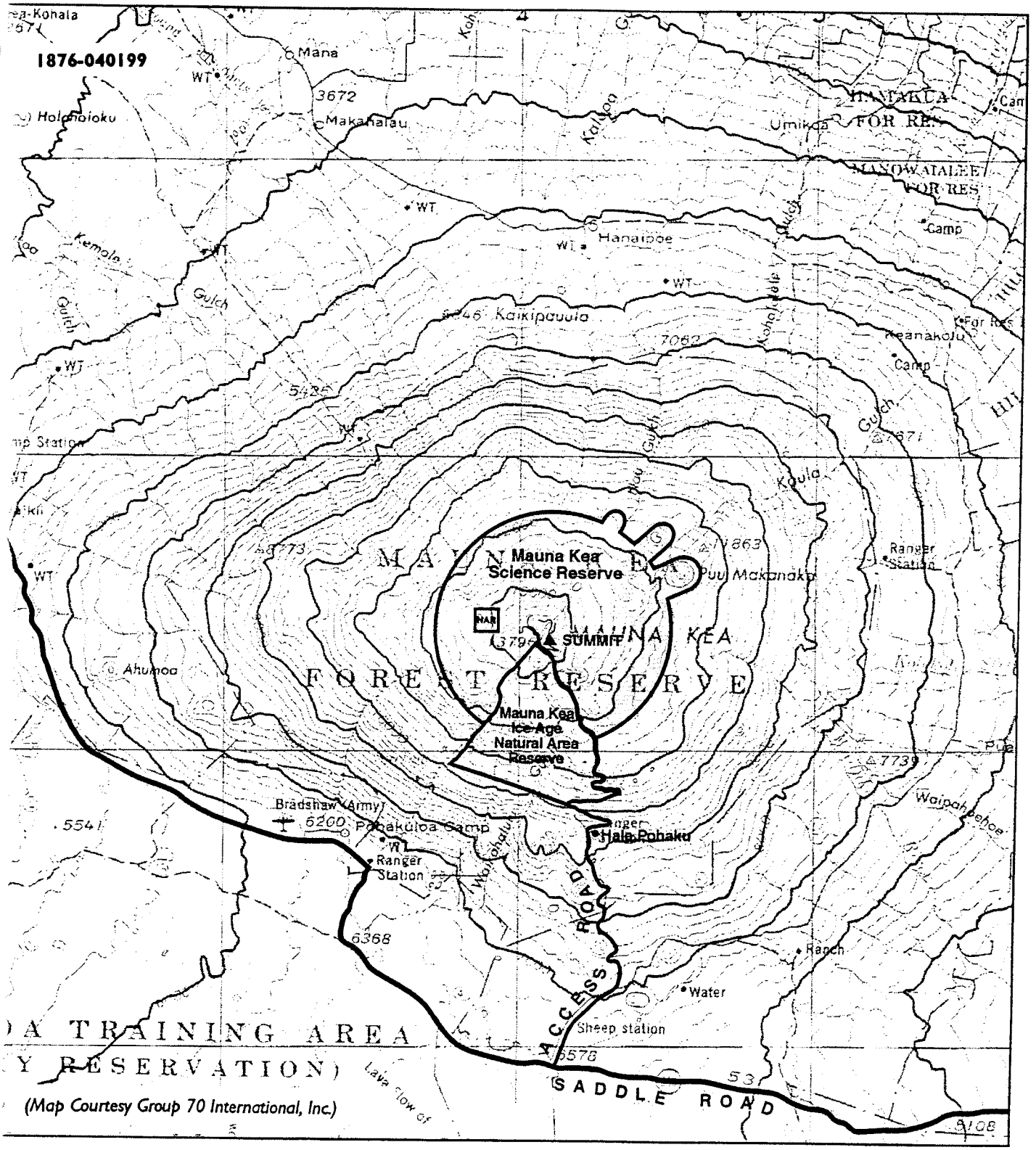
In 1983, the University of Hawai'i adopted a complex development plan, the Mauna Kea Science Reserve Complex Development Plan, which projected development to the year 2000 and which has provided guidance for the use and development of the science reserve up to the present. To provide guidance into the next decades, a new master plan is currently being prepared as an update to the Complex Development Plan by the Honolulu firm of Group 70 International for the University of Hawai'i. The Mauna Kea Science Reserve Master Plan (1999) for continued complex development incorporates the major directions and recommendations proposed by the University of Hawai'i's Mauna Kea Advisory Committee and Group 70.

PROJECT SETTING AND DESCRIPTION

Project Physical Components

The Complex Development Plan project area consists of four major physical components; the Mauna Kea Science Reserve, the Mid-Elevation Facilities at Hale Pōhaku, the Summit Road which provides access between Hale Pōhaku and the summit region, and the two Natural Area Reserve parcels *(Figure 1)*. While the latter are not technically under the management control of the University of Hawai'i, they must be considered as part of the project area because they contain significant archaeological and cultural resources (e.g., the Mauna Kea Adze Quarry Complex and Lake Waiau) which might potentially be effected by development, operational, and recreational activities within the areas under University management control.

The 11,288 acre Science Reserve itself contains the majority of significant archaeological and cultural sites that have been identified to date. Most of the archaeological sites are situated in a band that circles the actual summit area, while the existing astronomy facilities are concentrated in the immediate summit area. This distribution of archaeological sites and astronomy facilities are shown in *Figure 2*, which also shows the location of a recently proposed 525 acre Astronomy Precinct within which all future development atop Mauna Kea would be restricted. The remaining 10,760 acres surrounding the Astronomy Precinct would become the Natural and Cultural Preservation Area.

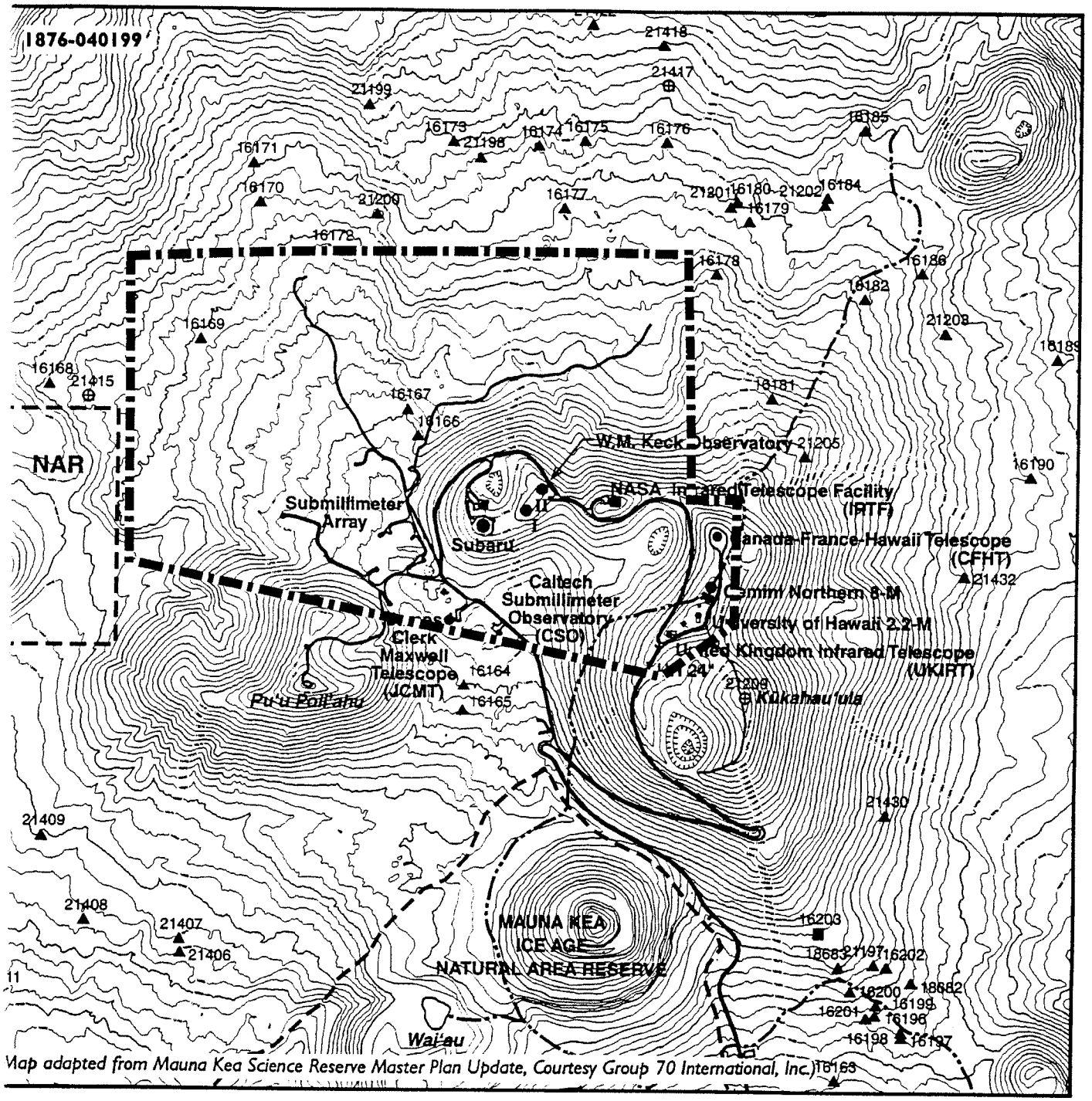


(Map Courtesy Group 70 International, Inc.)

Figure 1. Mauna Kea Science Reserve and Hale Pohaku Project Area

0' 7500' 15000' 30000'

NORTH



Map adapted from Mauna Kea Science Reserve Master Plan Update, Courtesy Group 70 International, Inc.)

Source: Hawaii Department of Land and Natural Resources
Historic Preservation Division, Feb. 1999

- Shrines
- Marker
- Unknown
- Workshop
- 25' Contour Intervals
- Natural Area Reserve
- Historic Trails

0' 750' 1500' 3000'

NORTH

gure 2. Archaeology Sites Map and Proposed Astronomy Precinct

Project Master Plan

The Master Plan prepared by Group 70 International (1999) for the update of the Complex Development Plan is structured into three major integral sections. The first section establishes the direction and process for the Master Plan; it provides an introduction to the project, outlines the goals and objectives, and summarizes the methodology used. The second section describes the various components that comprise the existing physical environment and background to the human utilization of Mauna Kea: the natural environment – including geology, flora and fauna, and the historic period destruction of native vegetation; and the cultural setting – including Native Hawaiian cultural concepts, occupation, and resource utilization, and early historic period land use patterns, as known through historical, archaeological, and ethnographic research. The second section also contains a component which discusses the range of management and use issues and opportunities that pertain to Mauna Kea. The third section contains physical and management plans, based on the analysis and integration of all available information relating to future educational, research, cultural, and recreational use of Mauna Kea.

CULTURAL-HISTORICAL-ARCHAEOLOGICAL OVERVIEW

[Note: this overview section has been taken from, with minor changes, the *Mauna Kea Science Reserve Master Plan - Draft #3* (Group 70 International 1999:V-1 thru 10)]

The ancient saying *"Mauna Kea kuahiwi ku ha'o ika mālie"* (Mauna Kea is the astonishing mountain that stands in the calm) (Pukui 1983: No.2147), expresses the feeling that Hawaiians and non-Hawaiian alike have for this special place. Standing tall over the Island of Hawai'i, Mauna Kea is home to vast physical, natural, and cultural resources. From early adze makers to modern day astronomers, Mauna Kea has long been a special place for work, worship, and reflection.

THE FIRST ARRIVALS: NATIVE HAWAIIAN USES

In Hawaiian culture, natural and cultural resources are one and the same. Native traditions describe the formation of the Hawaiian Islands and the presence of life on and around them. All forms of the natural environment, from the skies and mountain peaks, to the valleys and plains, and to the shoreline and ocean depth are the embodiments of Hawaiian gods and deities. One Hawaiian genealogical account records that Wākea (the expanse of the sky) and Papa-hāna-moku (Papa – Earth mother who gave birth to the islands) and various gods and creative forces of nature gave birth to the islands. Hawai'i, the largest of the islands, was the first-born of these island children. The account continues that the same god-beings were also the parents of the first man (Hāloa) , and from this ancestor, all Hawaiian people are descended. In some genealogical chants, Mauna Kea is referred to as "Ka Mauna a Kea" (Wākea's Mountain), and it is likened to the first-born of the Island of Hawai'i (Maly 1999).

> Cultural attachment is demonstrated in the intimate relationship (developed over generations of experiences) that a people of a particular culture share with their landscape – for example, the geographic features, natural phenomena and resources, and traditional sites, etc., that make up their surroundings. This attachment to environment bears direct relationship to the beliefs, practices, cultural evolution, and identity of a people. In Hawai'i, Hawai'i cultural attachment is manifest in the very core of Hawaiian spirituality and attachment to landscape. The creative forces of nature which gave birth to the islands (e.g., Hawai'i), mountains (e.g. Mauna Kea) and all forms of nature, also gave birth to *nākānaka kānaka nā kānaka* (the people), thus in Hawaiian tradition, island and humankind share the same genealogy" (Maly, 1999, p. 27).

According to Kanahele and Kanahele (n.d.), the first Hawaiians landed on the island's shores between 25 BCE and 125 CE. Many more Polynesians voyaged to Hawai'i and settled over the next thousand years. During this settlement period, the early Hawaiians developed stable water and food sources and adapted to their new environment (Kanahele and Kanahele n.d.). Hawaiians first settled near the shore where there was ready access to the ocean's plentiful resources. The forests provided plants and animals for food, tools, and shelter. Flightless birds, knowing no predators before, became easy prey for Hawaiian hunters. The mountain tops, the highest points of the land, were considered sacred. Mauna Kea is among the most sacred of these high points.

As early as AD 1100, adze makers came in reverence to the Mauna Kea adze quarry, Keanakāko'i (most of which is located in the Mauna Kea Ice Age Natural Area Reserve), to craft tools from the unique dense basalt found here. As part of the ritual associated with quarrying, craftsman erected shrines to their gods. Adze

makers came to the mountain for short periods of time to work on the basalt that formed from molten lava that erupted under the glacial ice cap. They chipped out chunks of basalt and then worked the stone to form refined tools in shelters and workshops they had built. Different areas were designated for chipping, rough-finishing, and fine-finishing. *Māmane* wood was preferred for adze handles. In addition to the quarrying of adze basalt, craftsmen also collected volcanic glass and dunnite/gabbro for cutting tools and octopus fishing gear sinkers (McCoy, various; and Maly 1999). Further down the mountain, near a spring, the adze makers erected shelters from which they would gather water, wood, and food to sustain them as they worked in the quarry (Langlas et al. 1999). Remnants of shelters, shrines, adze manufacturing, food and offerings remain today to tell of these early craftsmen. The adze makers are thought to have come from neighboring areas and the adzes they crafted were widely used. Keanakāko'i was an active place for hundreds of years, with intensive use after AD 1400 and eventual decline prior to Western contact.

Following the long period of initial settlement, an era of high culture ensued. The Hawaiian society advanced in all areas from the 1200s until the late 1700s. During this time political powers exerted their might and the structure of communities was refined (Kanahele and Kanahele n.d.). In the beginning of the 1600s, during the time of Umi, the Hawaiian Islands were divided into political regions. The larger islands (*mokupuni*) were divided into districts (*moku*). The *moku* were divided into *ahupua'a* and large *ahupua'a* were divided into *'ili*. *Ahupua'a* were often entire valleys spanning from the top of the mountain ridge to the ocean. The *konohiki* managed the day-to-day operations of the *ahupua'a* with the aid of *luna* who were experts in various fields such as planting and fishing. Each *ahupua'a* contained nearly all of the resources Hawaiians required for survival from fresh water, plants, and a variety of animals, and was managed so that these resources could be sustained over time.

The *ahupua'a* of Ka'ohe spans the summit of Mauna Kea and includes the Mauna Kea Science Reserve. The lower slopes of Mauna Kea reach into the *ahupua'a* of Humu'ula and Ka'ohe. Hawaiians hunted and gathered in Mauna Kea's *māmane* forests,which were rich with vegetation and native birds including the *'ua'u* (dark-rumped petrel), *nēnē*, and *palila*. So prized were the plump young *'ua'u* that they could be eaten only by the *ali'i*. Hawaiians came to the *koa* and *'ōhi'a 'ōhi'a* forest on the mountain's lower slopes to gather wood for canoe-making and to collect bird feathers. Above the *koa* forests was the open *māmane* forest where they may have hunted *'ua'u* and *nēnē*.

All aspects of Hawaiian life were steeped in ritual. For the Hawaiian people, spiritual beliefs, cultural practices and all facets of daily life were intricately bound to the natural landscape of the islands. The lake, Wai'au, was believed to contain pure water associated with the god Kāne and was used in healing and worship practices. Archaeologist Pat McCoy suggests that shrines located at the edge of the summit plateau may mark the transition to a spiritual zone associated with the summit of Mauna Kea (McEldowney and McCoy 1982). The shrines may be associated with the snow line and thus represent shrines to Poli'ahu and/or other deities. Hawaiians also buried the bones of their dead on the slopes of Mauna Kea.

ARCHAEOLOGY AND ETHNOGRAPHIC RESEARCH

What we know today of Mauna Kea's ancient use and meaning we have learned from the physical clues left behind on the mountain. Ethnographic research explores more recent human activity and the traditions that have been handed down within families over time. For the past two decades archaeologists have conducted extensive field work on the slopes of Mauna Kea, with access made much easier with the construction of a road to summit area. Approximately 3,000 acres, or 27 percent, of the Science Reserve has been surveyed to date (McCoy 1999). Much of this archaeological work has been undertaken by Dr. Patrick McCoy. Currently with the State Historic Preservation Division, McCoy and colleague Dr. Holly McEldowney are in the process of preparing a Historic Preservation Management Plan for Mauna Kea. As part of this plan, McCoy has inventoried and summarized the archaeological sites that provide a wealth of knowledge of past use of the mountain (McCoy 1999).

In addition to the archaeological field work, several individuals have recently conducted ethnographic studies concerning Mauna Kea. Their research is summarized here. Dr. Charles Langlas of the University of Hawai'i-Hilo worked with Paul H. Rosendahl, Ph.D., Inc. to prepare an Archaeological Inventory Survey and Historic and Traditional Cultural Assessment for the Hawai'i Defense Access Road A-AD-6(1) and Saddle Road (SR 200) Project (Langlas et al. 1999; Langlas 1998). Pualani and Edward Kanahele prepared a Social Impact Assessment of Indigenous Hawaiian Cultural Values for this same project (n.d.).

In association with the preparation of this Master Plan, cultural specialist Kepā Maly conducted an oral history interview and archival research effort in the later part of the 1998 to compile the thoughts and memories that those living today have of Mauna Kea (Maly 1999). Maly interviewed 22 individuals and structured his research into broad groupings that are helpful in organizing the often generalized feelings that individuals have toward Mauna Kea.

McCoy summarizes the most recent archaeological work within the Mauna Kea Science Reserve. Based on field work undertaken between 1975 and 1997, a total of 93 archaeological sites have been identified in surveys covering approximately 3,000 acres within the larger Science Reserve, including the immediate summit ridge areas. These sites tell us much about the history of man's association with Mauna Kea. Of the 93 sites, 76 are shrines, four are adze manufacturing workshops, and three are markers. One burial has been positively identified and four other possible burial sites exist. The function of five of the 93 sites is unknown (McCoy 1999).

Shrines

The term "shrine" is used by McCoy to describe all of the religious structures that exist in the summit region of Mauna Kea. The most common of the archaeological features on Mauna Kea, shrines are characterized by the presence of one or more upright stones. The shrines at Mauna Kea range from single uprights to more sophisticated complexes with pavements and prepared courts. The majority of shrines on Mauna Kea are located conspicuously on ridgetops or at breaks in the slope. It is not surprising that shrines were placed in prominent locations with commanding views of the landscape. Shrines have not been found on the tops of cinder cones.

McCoy suggests that each upright on a shrine may have stood for a separate god. The majority of uprights were made of angular slabs found in the glaciated area of Mauna Kea. These select stones were unmodified by their human gatherers and provided a place for the gods to inhabit when they were needed. Based on ethnographic information McCoy suggests that the pointed uprights might represent male gods and the flat-topped uprights, female gods. Stone uprights were typically set in a crack in the bedrock and braced with a few stones. In other shrines, most notably those in the north and east slopes, uprights were set on the top of a boulder. In shrines dispersed throughout the summit area, stone uprights were set into low rubble heaps or piles of stones. In only a few cases, cairns were built to support the stone upright. Platforms were also built to support one or more uprights.

McCoy suggests that the shrines on Mauna Kea were erected for one of two, and possibly more, functions. Though they are not distinguished from each other by physical characteristics, the shrines can be classified as occupational or non-occupational in function. The eight occupational shrines are identified by the remains of specialized workshops and adze manufacturing byproducts. The non-occupational shrines range in complexity from simple features with a small number of uprights to more complex structures with courts and larger numbers of uprights. Most of the shrines found on Mauna Kea have just 1 to 3 uprights, however, some have as many as 24 or 25 stone uprights. McCoy speculates that the simple shrines were built and used by small family groups and the larger, more complex structures were built and maintained by a priesthood. McCoy reasons that the larger number of uprights indicate a larger number of gods that most Hawaiians would

probably not have known. In addition, many of these more complex sites are isolated from the main areas of worship. McCoy has interpreted the shrine complex in the summit region as evidence of an historically undocumented pattern of pilgrimage to worship the snow goddess, Poli'ahu, and other mountain gods and goddesses.

Adze Quarrying and Manufacturing

The main adze quarry, Keanakāko'i, is located within the Mauna Kea Ice Age Natural Area Reserve. The majority of the workshops and shrines associated with adze manufacturing are located near the main quarry. Four additional adze manufacturing workshops have been found in the Science Reserve across the Summit Access Road from the adze quarry. However, these workshops are of a different kind than those found in the adze quarry. Manufacturing byproducts such as flakes, cores, adze rejects, and hammerstones have been found at these workshops, however, no stone-tool quality raw material is found. Thus it is likely that adzes were flaked elsewhere and transported to these localities at a later stage of the manufacturing process. Each workshop has one or more shrines upon which adze byproducts were offered to the tutelary gods of adze making. McCoy has identified one of these workshops as the location of initiation rites for apprentice adze makers (McCoy 1999).

Several of those interviewed by Maly have heard of or visited the adze quarry areas on Mauna Kea:

> I went up once [to Mauna Kea], a long time ago, we went up to Lake Waiau. I remember feeling kind of weak when we got up there, and it was the thin air. I wasn't that old. We went up to Humu'ula and then we took horses. We rode horses up to Wai'au. I was with my father, my mother didn't go. My mother was afraid of horses, she wouldn't go near a horse."... "... we went up and dad showed us this...there were other people with us too, my uncle Allan and his son, and others. He showed us this place where there were *'ōpihi* shells all over and it was where daddy said that they used to rough cut the adzes and then bring them down and finish them up, down below..." (Florence La'i-ke-aloha-o- Kamālu "Coco" Vrendenburg-Hind, p. A-118 *in* Maly 1999).

Trails and Access

In pre-contact times, it is suspected that travel to Mauna Kea was guided by individual knowledge of the landscape rather than by any distinct trails. It is possible that ridges were followed or that sources of water were known and visited along the way. Individuals going up the mountain likely visited the shrines erected by their family members to their gods. No evidence of pre-contact trails has been documented. (McEldowney 1982)

Maly reports that by the later nineteenth and early twentieth centuries, trails were created and often traveled on horseback. The trails of Mauna Kea linked communities and cultural and natural resources together. To reach the summit, people left the near-shore and plains lands and traveled the mountain slopes to the summit. The trails ascend the slopes of Mauna Kea from nearly all of the major, and many of the smaller *ahupua'a* which lie upon Mauna Kea's slopes. Traditions pertaining to journeys on the mountain trails, and knowledge of Mauna Kea are still retained as important family history today. Mauna Kea's trails, as told of in the oral and written histories, are depicted on the annotated interview map (Maly 1999, Figure 2). Significantly, many of these trails converge at Wai'au, in the Natural Area Reserve.

Interviewees told Maly of their elders travelling to Mauna Kea to worship in the summit region, gather water from Wai'au for healing practices, procure stone for adze making, and take individuals' ash remains to the summit area or to Wai'au for their return to the Earth. Teddy Bell describes one of the mountain trails to Wai'au:

> And then we also went from Waiki'i . . .You go so far from Pu'u Lā'au . . . There used to be one pine tree forest. And from that reserve, there's a clump of pine trees. That's where they've got a lot of cones. From that pine trees, you look at Mauna Kea, the two sides, it's almost like a *pali* but wide. And then you right up through that hollow there, and you come up to Lake Waiau. Almost to the end of the *pali* on Mauna Kea (Theodore "Teddy" Bell, Sr., p. A-128 *in* Maly 1999) (This trail is indicated as K Waiki'i-Waiau trail).

During the historic period, people have traveled the mountain for Territorial Forestry operations, ranching, hunting, and recreational activities. Lloyd Case describes game trails on the mountain:

> You know one of the most amazing things, and I don't know if some of the old timers told you this. But a lot of these Hawaiian trails, a lot of them were used by the sheep, they became game trails after a while. The sheep would use some of these trails. Some of these trails we walked 'em, on the Kemole side, Pu'u Mali side. But a lot of them, they are still there, but you have to have a good trained eye to find 'em" (p. A-348 *in* Maly 1999).

Burials

As was mentioned earlier, no shrines have been identified on top of cinder cones in the Mauna Kea Science Reserve. McCoy believes that these high and remote places were reserved for burying the dead. Although there are references to human burials on Mauna Kea in oral histories, only one burial site has been positively identified in the mountain summit area. "To date the only positively identified human remains found in the Science Reserve are located at Site 16248 on the summit of Pu'u Makanaka (Fig. 1). Jerome Kilmartin, a surveyor with the United States Geological Survey, noted the presence of human remains on this prominent cinder cone in 1925" (McCoy 1999). Four other sites within the Science Reserve have been identified as possible burials by McCoy:

> There are four other sites in the surveyed areas of the Science Reserve that have been identified as possible burials (Sites 16195, 21413, 21414, and 21416). In each case there are compelling reasons to believe that the site is indeed a burial, but because human remains were not seen at the time the site was recorded it has been called a possible burial (McCoy 1999).

Of these four possible burial sites one consists of two adjacent cairns located on the eastern rim of Pu'u Lilīnoe. The other three are located on the southern and eastern rim of a large unnamed cinder cone on the northwestern edge of the Science Reserve.(McCoy 1999). McCoy notes that archaeological sites have been found in all areas that have been surveyed to date but the distribution and density of the various types of sites follows certain patterns. The one burial and four possible burials have been found only on the tops of cinder cones and never with shrines.

While none of the individuals interviewed by Maly reported knowing of specific locations of burials in the immediate area of the Mauna Kea summit, many spoke of *ilina* (burial sites) in cinder cones, and other natural features in the region extending from about the 12,000 down to the 7,000 foot elevation. In modern times several family members or close friends of interviewees have had their cremated remains taken to the summit of Mauna Kea for release.

Summit Area

A significant pattern is the virtual absence of archaeological sites at the very top of the mountain. McCoy states that the "top of the mountain was clearly a sacred precinct that must, moreover, have been under a *kapu* and accessible to only the highest chiefs or priests." Most of the shrines in the Science Reserve are found on the northern and eastern slopes just above and below the 13,000 foot elevation. This pattern suggest that most of those who journeyed to the summit area came from the Hāmākua and Hilo sides of the mountain. Discussing the scarcity of sites on the western and southwestern slopes, McCoy makes the following observations:

> While the small number of shrines on this side of the mountain suggest the possibility of people coming from the Kona and South Kohala districts, the number would appear to have never been high. The implications are quite interesting. It suggests that while the mountain may have been viewed from a distance by people from everywhere on the island as a sacred mountain, in practice those who made the journey and worshipped there did not represent an even cross-section of the island populace. The implication is that access to the summit region was under the political control of the east Hawaii chiefdoms, a conclusion that is consistent with all of the other data (McCoy 1999).

All of those interviewed by Maly attributed spirituality and healing qualities to being on Mauna Kea; and several recorded that they still go to Mauna Kea for prayer and restoration. One described Mauna Kea as a sanctuary in ancient times. The area above the forest line was so sacred that once in the upper region, your enemies could not pursue you (Maly 1999).

In addition to the sites identified within the Science Reserve, a wealth of physical evidence can be found in the Mauna Kea Ice Age Natural Area Reserve, outside of the Science Reserve. Within the Natural Area Reserve, the main adze quarry and numerous sites at Wai'au tell of the activity in this geologically and culturally unique area. Many of these sites have been inventoried but have yet to be fully analyzed and related to the other sites found on the mountain.

Cultural Landscape

The summit of Mauna Kea has been referred to as *wao akua* (region of the gods). The most common understanding of *wao akua* is that it was a remote desolate location where spirits, benevolent or malevolent, lived and people did not live. Usually these places were deep interior regions, inhospitable places such as high mountains, deserts and deep jungles. These areas were not necessarily *kapu* but were places generally avoided out of fear or respect. Different people and family had different protocols when they traveled through these remote regions (George Atta personal communication with Holly McEldowney and Pat McCoy, June 2, 1999):

> Perhaps as a result of its prominence, isolation, and extreme environmental conditions, Mauna Kea's place in the culture and history of the Hawaiian people is significant. This 'cultural significance' extends beyond a physical siting, sites or particular features which have been previously identified in archaeological site studies. Mauna Kea is a prominent feature on the cultural landscape of Hawai'i which has been and continues to be, viewed from afar, and to which spiritual and cultural significance is attributed (Maly 1999, p. 3).

The ancient saying "Mauna Kea kuahiwi ku ha'o i ka mālie" (Mauna Kea is the astonishing mountain that stands in the calm) (Pukui 1983: No. 2147), expresses the feeling that Mauna Kea is a source of awe and inspiration for the Hawaiian people. The mountain is a respected elder, a spiritual connection to one's gods.

Thus, the landscape can be interpreted as a significant facet of a Hawaiian's identify. Mauna Kea is the focal point of numerous traditional and historical Hawaiian practices and narratives recorded by both Native Hawaiians and foreign visitors.

A number of place names recorded for this mountain landscape are associated with Hawaiian gods. Other place names are descriptive of natural features and resources, or document events that occurred on the mountain." (Maly 1999) "Native families also retain names such as Maunakea, Poli'ahu, Lilinoe, and Wai'au, which in some cases are directly tied to the mountain landscape" (Maly 1999).

The Kanaheles (n.d.) tell of Mauna Kea as the *piko* or origin point for the island of Hawai'i, and specifically the northern half of the island. Mauna Kea is, therefore, a place of great *mana*. Kanahele has also said that the three *pu'u*, Poli'ahu, Līlīnoe, and Wai'au are named for three sister goddesses who are female forms of water. Poli'ahu is embodied in the snow, Līlīnoe in mist, and Wai'au in the lake. These *pu'u* are where the goddesses manifest themselves. Of these three landforms two, Poli'ahu and Līlīnoe, are located in the Science Reserve. Wai'au is located in the Natural Area Reserve.

Many of those interviewed by Kepā Maly expressed the significance Mauna Kea holds for them as Hawaiians and as individuals. John Speilman and Pualani Kanahele describe Mauna Kea in the context of the entire Island of Hawai'i and in Hawaiian ancestral history:

> And I think too, what is important to understand and for people to realize is that it is all connected. Although we are talking about Mauna Kea, Mauna Kea and Paniau are connected. When you go fishing from Paniau, you look up to Mauna Kea and you check out the weather. You look to the mountain and see what the weather patterns are doing. The Kohala mountains. So the fishermen use the mountains as visual aids to help them in their fishing. And perhaps, I don't this as much, but from the mountain side down, but I would imagine that the farmers and the people that lived higher, would look down to the ocean to see if the weather was changing, the cloud patterns on the ocean. It's all connected. It is not separate. But Mauna Kea, I think, is the focal point of this island. It is the *piko*, the breath . . . (John K. Spielman, p. A-282 *in* Maly 1999).

> Mauna Kea was always *kupuna* [an elder, ancestor] to us. Mauna Kea and Mauna Loa, the tips, they were always *kūpuna* [elders, ancestors]. and there was no wanting to go on top. You know, just to know that they were there was just satisfying to us. And so it was kind of a hallowed place that you know is there, and you don't need to go there. You don't need to bother it. But it is there, and it exists. And it was always reassuring because it was the foundation for our island (Pualani Kanaka'ole Kanahele, p. A-366 *in* Maly 1999).

Alexander Lancaster and Tita Spielman relay the significance of Mauna Kea to each of their families:

> Yes, my grandmother Alice. Her Hawaiian name is Kamahalo – she was named after her grandmother, my great, great, great grandmother. She said " When you go up there, you going feel the spirit." And you do feel the spirit (Alexander Kanani'alika Lancaster, p. A-234 *in* Maly 1999).

Regarding her family's relationship to Mauna Kea, Spielman explains:

> Well, it was through my mother, because of course, she grew up in Kohala and spent a lot of time there. And at Pu'u Wa'awa'a and Kiholo, and always loved Mauna Kea. She used to say 'That's my mountain.' And so we got to know it and love it as we do. ("Tita" Elizabeth Kauikeōlani Ruddle-Spielman, p. A-265 *in* Maly 1999)

Teddy Bell and Lloyd Case relay their own personal feelings about Mauna Kea:

> On the slopes of Mauna Kea, there is a ridge there called Pu'u Nānā. Pu'u Nānā, if it's a clear day, you can see all of this Waimea. So that's where I want my ashes to be scattered (Theodore "Teddy" Bell Sr., p. A-139 *in* Maly 1999).

> Because the one thing I loved about it was just going up there and sitting down under the tree and looking out at space. Looking at everything. That is the most rewarding thing that I ever can say happens to me. When I go up there, it just heals me. That is a place for healing. I come back a different person (Lloyd Case, p. A-353 *in* Maly 1999).

A gentleman interviewed by Langlas was taught by his great-grandparents that there were two sites of ritual importance on Mauna Kea, the summit peak and the lake and surrounding *pu'u* Wai'au. According to this individual, the summit peak was a place to go and pray to the gods for *mana*, to cleanse the person and give him health.

Wai'au is a place of tradition and a source of inspiration. Located outside the Science Reserve in the Natural Area Reserve, Wai'au is a focal point for many visitors to the mountain. Many of the individuals interviewed by Kepā Maly discussed their own visits or visits by family members to Wai'au:

> It [Mauna Kea] brings back memories, you know. But way back, people never used to go up there. They never did go to Mauna Kea except on horseback, and that was very few. And right at Lake Waiau, had a bottle there. Whoever went up, would write their name and the date, and put it in the bottle. . . Yeah. So, I don't know what happened to that bottle. My first trip to Mauna Kea was in 1934. And there were a few peoples names in that bottle already.(Theodore "Teddy" Bell Sr., p. A-123 *in* Maly 1999).

> [In response to Kepā Maly's statement that Waiau was a favorite place of her grandfather Eben Low] A very favorite place. Yes, and that's why his plaque was put there. Because that was one of his favorite places. Although, his ashes were scattered at the top, the plaque was put at Waiau" ("Tita" Elizabeth Kauikeōlani Ruddle-Spielman, p. A-270 *in* Maly 1999).

In addition to feelings of *aloha* expressed for the place, numerous oral traditions of the importance of Wai'au have been handed down through families:

> Kepā Maly, "So he [your father] would go *mauka* to Waiau and gather water there?" Anita Landcaster, "And he would bring it, and he had my mom and I drink that water. And if we had it for a week, it never went into the refrigerator, it stayed on the counter, but it was always cold. And that was the sweetest water. It was so pure. I thought nothing of it because I was so young. But as I grew older, I would always remember

> it because my dad always had this gallon hanging, you know when he didn't go hunt, the gallon was always hanging in the house. In fact, the last time I saw it was just before he died, and then I don't know what happened to the gallon..." (Anita Leilani (Kamaka'ala) Landcaster, p. 245 *in* Maly 1999).
>
> "The water they used...the *lā'au lapa'au*, the healers went to this particular place, and another place in the Kohala mountains, there is another spring up there which Papa Auwae uses." . . . "So, I've heard of the old ones getting water from Waiau to use for healing" (Lloyd Case, p. A-353 *in* Maly 1999).
>
> "And so here, within the Mauna a Wākea, sits this *'apu wai* [water container] which is Waiau. What they are calling Lake Waiau. And as it hasn't had a chance to come down to the rest of us, then it is sacred water, like the water that is in the piko of *lau kalo* [taro leaf], and the water that is found in the *'ohe* [bamboo – interpreted as the meaning of the *ahupua'a* name Ka'ohe, within which the summit of Mauna Kea and Waiau are situated]. And the water that is found also in the *niu* [coconut]. So you have all of these different, sacred waters, but to me, that water, Waiau, is the most sacred because it isn't the water that has been spilled, it is still up there in the realm of Wākea.". . . "The most sacred of all the waters." (Pualani Kanaka'ole Kanahele, p. A-368 *in* Maly 1999).

In ca. 1881, Dowager Queen Emma ascended Mauna Kea on a journey of spiritual and physical well-being. At the time, Queen Emma was in competition with David Kalākaua for the position of ruling chief for the Kingdom of Hawai'i. Each of the two embarked on journeys to prove their connection to the senior line and connect back to a *wahi pana* (a sacred physical place). Emma went to the top of Mauna Kea to bathe in the waters of Wai'au, and cleanse herself in the *piko* of the island (Kanahele and Kanahele 1997).

For some, Wai'au has a special family tie. "...Hawaiian members of the Lindsey family have a tradition of taking the *piko* of their children to Wai'au and the summit of Mauna Kea." "Other interviewees who had not heard of the practice of taking *piko* to Mauna Kea all felt that it was likely to have occurred, and they shared similar stories from their own families of the custom at various localities" (Maly 1999).

Kanahele explains the importance of this tradition of taking the *piko* to a particular place:

> I don't personally know any families [who took the *piko* to Waiau]. I know that people took *piko* there, I just don't know who. . . . Well, the *piko* is that part of the child that connected the child back to the past. Connected the child back to the mama. And the mama's *piko* is connected to her mama, and so on. So it takes it back, not only to the *wā kahiko* [ancient times], but all the way to *Kumu Lipo*. . . . So, it's not only the *piko*, but it is the extension of the whole family that is taken and put up in a particular place, that again connects to the whole family line. And it not only gives *mana* or life to the *piko* and that child, but life again to the whole family" (Pualani Kanaka'ole Kanahele, p. A-368, *in* Maly 1999).

THE FIRST EUROPEAN CONTACT TO THE ISLANDS

As evidenced by the archaeological evidence and though oral histories, Hawaiian adze-making and worship at Mauna Kea continued through the 1700s. In 1778, the first foreigner arrived in Hawai'i. In the decades that followed, life in Hawai'i changed dramatically with the introduction of new technologies, religion, diseases, animals, and industry. The population of Hawaiians was decimated by the effects of diseases that had

never been seen before in the islands. Port towns such as Kailua, Kealakekua and Hilo developed into commercial centers accommodating Western ships. Adze quarrying on Mauna Kea ceased to exist as stone adzes were soon replaced by metal tools after European contact.

In the late 1700s and through the 1800s several Europeans led expeditions to Mauna Kea. The names Goodrich, Baldwin and Alexander are well-known to students of the mountain. Their maps and documents are the earliest written descriptions of Mauna Kea. Early in the 20th Century, the Board of Agriculture and Forestry designated the Mauna Kea Forest Reserve.

In 1793 the first cattle were brought to Hawai'i and offered by Captain George Vancouver to King Kamehameha. By the early 1800s more cattle had arrived and escaped to forested areas where, in the absence of natural predators, their populations multiplied (Juvik and Juvik 1984). In addition to wild cattle, sheep and goats thrived on the mountain. In 1809, John Palmer Parker settled in Hawai'i and became friends with King Kamehameha I. The king placed Parker in charge of the wild cattle. With a land grant from King Kamehameha III in 1845, Parker established a ranch, Parker Ranch, which has been in continuous operation until the present. Other ranches also operated in the mid-1800s, however, much of the cattle and sheep continued to run free on the mountain's slopes destroying the native vegetation. By this time, hunting had become a vital lifestyle for many island residents. Hunters continued to pursue the animals for their hides and meat which were consumed locally and bartered for goods from visiting ships.

After the decline in adze making on Mauna Kea, there was limited human activity on the mountain. On the lower portions of the mountain animals grazed and hunters pursued them. On the higher slopes a few Western explorers conducted expeditions up to the summit region. The next major phase of activity began in the early 1960s with the exploration of Mauna Kea as a potential site for astronomy observations.

The travel journals of the first Westerners to explore the mountain's summit region highlight some of the first information on the physical evidence of past activity. McCoy (1999) shares some of these earliest observations. The first documented trip to the summit of Mauna Kea was that of Reverend Joseph Goodrich in 1823. Later writings of this trip record some of the observations and thoughts about the summit region:

> Rev. Joseph Goodrich, who, on this occasion, was unfortunately laid up with mountain sickness, had on 26th August, 1823, reached the summit of Mauna Kea. This is the first recorded instance of the ascent of this mountain, although Mr. Goodrich mentions that on reaching the top of one of the terminal cones that encircle the main plateau of Mauna Kea, he discovered a heap of stones, probably erected by some former visitor. Who this former visitor was is unknown, but he was probably one of the white men that in the early years of the nineteenth century got a living by shooting wild bullocks that roved on the side of Mauna Kea. It is very unlikely that any native had reached the top to the terminal cones on the summit, owing to being unprovided with warm clothing to resist the great cold and also to the fact that the natives had a superstitious dread of the mountain spirits or gods (Macrae 1922).

An account of Alexander's journey in 1892 mentions the presence of a cairn at the top of a cinder cone:

> Messrs. Muir and Alexander ascended the second highest peak on the northwest, overlooking Waimea, 13,645 height to continue their survey. In the cairn on the summit a tin can was found, which contains brief records of the visits of five different parties from 1870 to the present time, to which we added our own (Alexander 1892).

Reflecting this notion, Ellis (1979) looked back to the travels of Goodrich and Blatchely, who ascended the peak about six months after Goodrich, and provided this description of Hawaiians' view of Mauna Kea:

> The snow on the summit of the mountain, in all probability, induced the natives to call it Mouna-Kea (mountain white), or, as we should say, white mountain. They have numerous fabulous tales relative to its being the abode of the gods, and none ever approach the summit – as, they say, some who have gone there have been turned to stone. We do not know that any have been frozen to death; but neither Mr. Goodrich, nor Dr. Blatchely and his companion, could persuade the natives, whom they engaged as guides up the side of the mountain, to go near its summit (Ellis 1979).

CULTURAL PRACTICE TODAY

In their ethnographic work Maly, Langlas, and Kanahele and Kanahele describe some of the practices that individuals and families conduct on Mauna Kea today. Several of the individuals interviewed by Maly stated that "they still go to Mauna Kea for prayer and restoration". All interviewees attributed spirituality and healing qualities to being on Mauna Kea (Maly 1999).

Dr. Langlas interviewed a woman of the Poli'ahu line, meaning that Poli'ahu is one of her family's *'aumakua*. This family has designated an individual as their *kahu* for worship of Poli'ahu. This individual has constructed a shrine on Mauna Kea to worship Poli'ahu and has incorporated a stone given to her by the family. She considers the whole mountain to be sacred and feels that it is appropriate to worship anyplace on the mountain if one is spiritually guided there. Thus, worship should not be limited to traditional sites. The shrine placed by this *kahu* is not located in a traditional site but rather in a place that she was guided to.

Maly's interviewees also report of the practice of taking ash remains to the summit of Mauna Kea for release. Two of the individuals interviewed by Maly have instructed that upon their deaths, their ashes are to be taken to specific places on the slopes of Mauna Kea.

While the ethnographic research provides few accounts of actual cultural practices on the mountain, other individuals and groups may visit the mountain for worship on special occasions or on a regular basis. Many more carry with them an esteem and respect for Mauna Kea:

> In both its genealogical associations and its physical presence on the island landscape, Mauna Kea is a source of awe and inspiration for the Hawaiian people. In Hawaiian practice elders are revered – they are the connection to one's past – and they are looked to for spiritual guidance. Because of its place in the Hawaiian genealogies, Mauna Kea, the landscape itself is a sacred ancestor (Maly 1999, p. D-25).

This is the spirit with which many view the mountain today.

PROPOSED MAUNA KEA SUMMIT REGION HISTORIC DISTRICT NATIONAL REGISTER NOMINATION

SHPD staff have recently indicated that they will be proposing a historic district designation for the summit region of Mauna Kea which they believe will meet the eligibility criteria for inclusion in both the Hawai'i State and the National Register of Historic Places. This historic district proposal has evolved in the course of reviewing historical, ethnographic, and archaeological information for the preparation of a historic preservation plan for the protection and management of historic properties and cultural resources on Mauna Kea. Within the historic preservation domain, a historic district is defined as a historic property that "...possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development" (NPS 1990:5).

Figure 3 indicates the approximate boundary of the proposed district. Provisionally referred to as the "Mauna Kea Summit Region," the proposed historic district incorporates the virtually the entire Science Research summit area, extending beyond limits of the reserve, and also portions of the Natural Area Reserve. The district boundary has been tentatively set to correspond with the moraine fields and the incidence of topographic change which provides the general appearance of a summit plateau. The proposed district includes the total of 93 archaeological sites identified within the Science Reserve, three landscape features within the reserve believed to qualify as traditional cultural properties, and the Mauna Kea Adze Quarry Complex situated within the Natural Area Reserve. Of the 93 archaeological sites identified to date, 76 are shrines of varying complexity, four are adze manufacturing workshops, one is a confirmed burial, four are possible burials, three are marker cairns, and five are of undetermined function.

Figure 4 indicates the location and approximate boundaries of the three landscape features believed to qualify as traditional cultural properties on the basis of traditional Native Hawaiian cultural practices and beliefs associated with them. The boundaries of the properties have been set to coincide with the base of the component *pu'u*, or cinder cones. The largest of the three properties, "Kukahau'ula," refers to the cluster of three *pu'u* that merge and collectively make up the summit of Mauna Kea. The second property, "Waiau," refers to the small lake and adjacent *pu'u* situated southwest of the summit and within the Natural Area Reserve. The third property, "Lilinoe," refers to a *pu'u* situated southeast of the summit and within the Science Reserve.

To be considered eligible for inclusion in the National Register of Historic Places, a potential property, such as the proposed Mauna Kea Summit Region Historic District, must demonstrate its historical significance by meeting the "National Register Criteria for Evaluation" contained within the Code of Federal Regulations, Title 36, Part 60 (CFR 1981). Generally speaking, this is accomplished through (a) association with an important historic context, and (b) retaining historic integrity of those aspects or elements needed to communicate significance. More specifically, to be found eligible for inclusion in the National Register of Historic Places, an entity of purported historical significance must satisfy a five-fold sequential test of (a) being one of a recognized category of tangible physical property, (b) being associated with an important historic context, (c) meeting one or more of the four basic National Register Criteria, (d) determining whether an otherwise ineligible property meets any of seven National Register Criteria Considerations which would make the property eligible, and (e) having integrity – the ability to convey significance. It is assumed that SHPD staff, in preparing the National Register nomination for the Mauna Kea Summit Region Historic District that is intended to be included in their Historic Preservation Plan for the Mauna Kea Science Reserve (DLNR In prep.) will adequately address all of these areas in making their argument for National Register eligibility

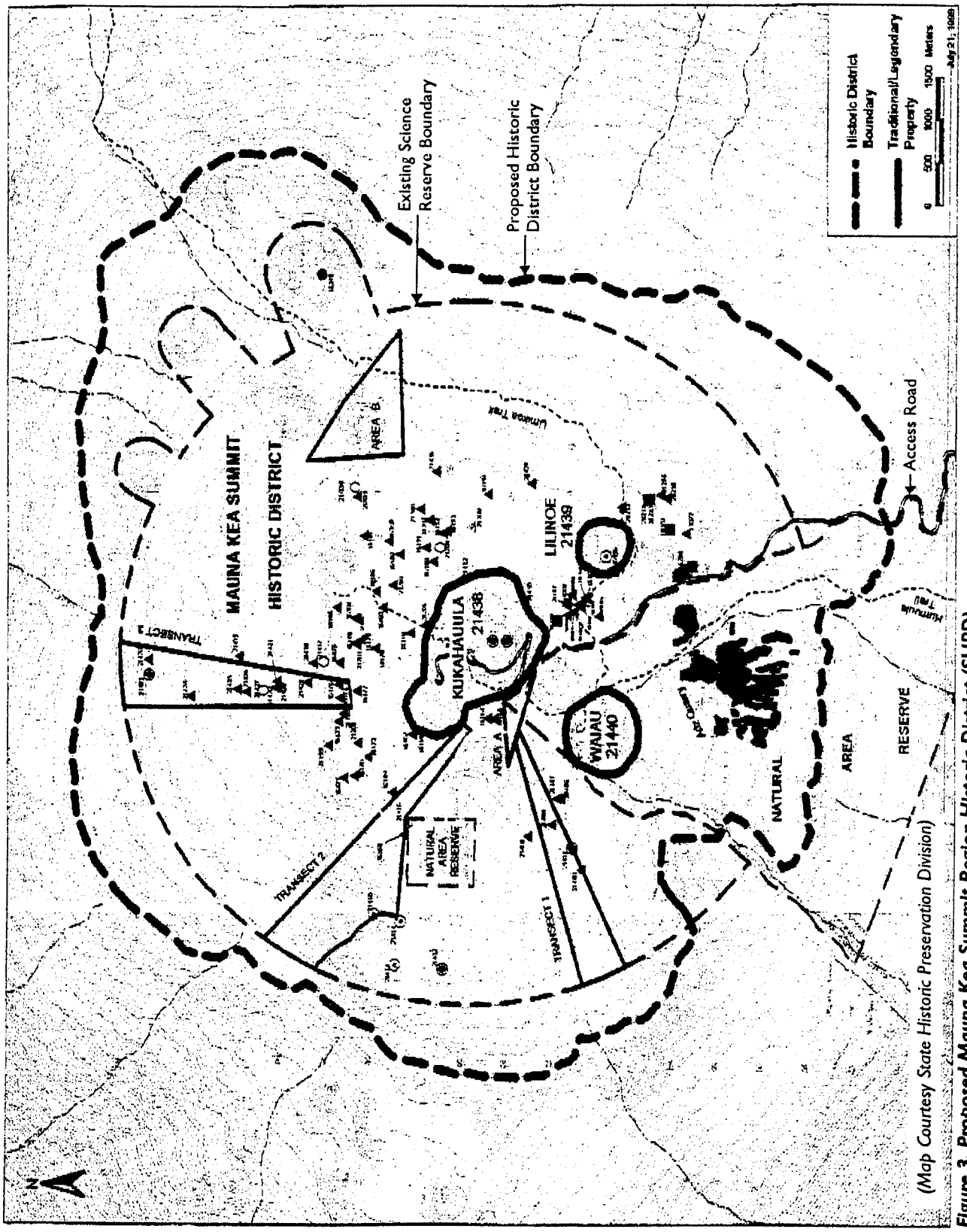


Figure 3. Proposed Mauna Kea Summit Region Historic District (SHPD)

(Map Courtesy State Historic Preservation Division)

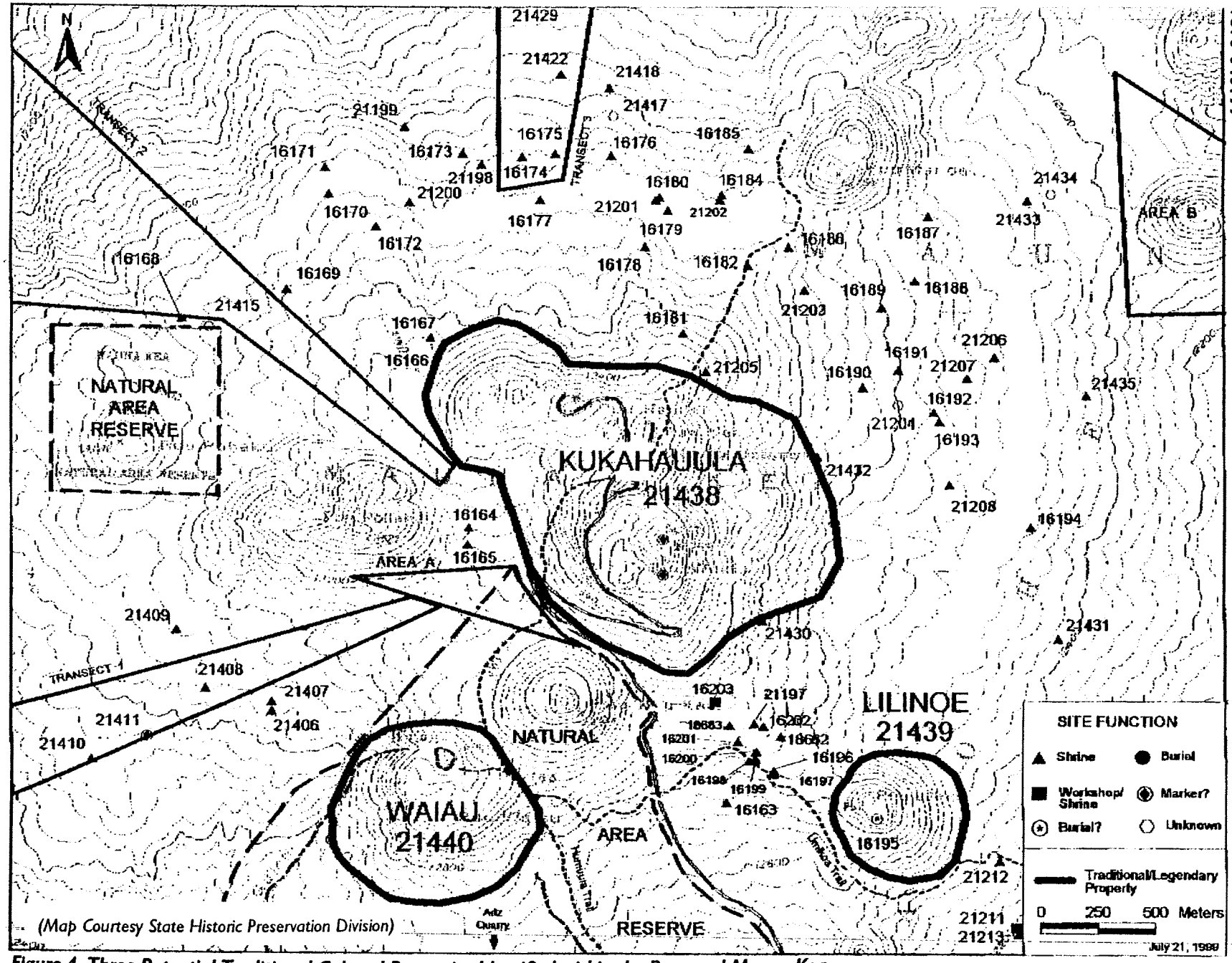


Figure 4. Three Potential Traditional Cultural Properties Identified within the Proposed Mauna Kea Summit Region Historic District (SHPD)

NATIVE HAWAIIAN CULTURAL PRACTICES, FEATURES, AND BELIEFS ASSOCIATED WITH THE UNIVERSITY OF HAWAII MAUNA KEA SCIENCE RESERVE MASTER PLAN PROJECT AREA

The principal source of information utilized by the present study for the identification of Native Hawaiian cultural practices, features, and beliefs associated with the Science Reserve Master Plan project area on Mauna Kea was the oral history and consultation study carried out by Kepā Maly (1999). Maly made extensive efforts to identify and contact individuals potentially knowledgeable of Mauna Kea with regard to traditional and customary cultural practices, traditional cultural properties, and contemporary cultural practices. He conducted a total of fifteen recorded interviews with twenty-two different informants, and in the process of carrying out his study consulted with more than 100 individuals, a great number of whom had knowledge about Mauna Kea and were able to provide information which supplemented that obtained during the recorded informant interviews.

In the course of his study, Maly documented on the basis of his recorded informant interviews and informal consultations a wide range of traditional and contemporary cultural practices, features, and beliefs associated with Mauna Kea. Taken together, these manifest a quality which Maly has referred to as the "cultural attachment" between Native Hawaiians and Mauna Kea:

> "Cultural Attachment" embodies the tangible and intangible values of a culture. It is how a people identify with and personify the environment (both natural and manmade) around them. Cultural attachment is demonstrated in the intimate relationship (developed over generations of experiences) that people of a particular cultural share with their landscape – for example, the geographic features, natural phenomena and resources, and traditional sites etc., that make up their surroundings. This attachment to environment bears direct relationship to beliefs, practices, cultural evolution, and identity of a people. In Hawai'i, cultural attachment is manifest in the very core of Hawaiian spirituality and attachment to landscape. The creative forces of nature which gave birth to the islands (e.g., Hawai'i), mountains (e.g., Mauna Kea) and all forms of nature, also gave birth to *na kanaka* (the people), thus in Hawaiian tradition, island and mankind share the same genealogy (Maly 1999:27).

In his study report, Maly summarized the traditional and contemporary cultural practices, features, and beliefs in terms of three different categories: traditional and customary cultural practice claims, traditional cultural property claims, and contemporary cultural practice claims (Maly 1999:27-33). Maly's summary is presented in *Table 2*, which includes the name or designation of practice or property, the sources of information relating to the practice or property, and general comments about the practice or property.

TRADITIONAL AND CUSTOMARY CULTURAL PRACTICES AND BELIEFS

A number of practices and beliefs were identified by Maly in the course of his study as being traditional and customary practices and beliefs associated with the Mauna Kea Science Reserve Master Plan project area *(see Table 2a)*. These include both those generally associated with the overall summit region of Mauna Kea, as well as those more directly associated with specific geographical locations within the Science Reserve project area *(see Table 2b)*. Identified practices and beliefs included the following:

Table 2. Summary of Identified Native Hawaiian Cultural Practics, Features, and Beliefs Associated with the Mauna Kea Science Reserve Master Plan Project Area *

a. Traditional and Customary Practices

Practice	*Source of Identification*	*Comments*
Prayer and ritual observances	Historical literature. Oral history interviews with – A. & A. Lancaster, A.K. Haa Sr. (& Jr.), H.K. Springer, P. Kanahele, I. Lindsey-Fergerstrom et al., Consultation records of: Ed Stevens, Iopa Mauna-kea, L. McCord, K. Pisciotta, L.K. Kimura, E. Kauhi, and AHCC.	See *Appendix D*. Several interviewees discuss past practices as learned from their elders, and others document that such observances remain important to their Hawaiian spirituality.
Collection of water from Waiau for ritual purposes	Historical literature. Oral history interviews with A & A Lancaster, A.K. Haa Sr. (& Jr.), L. Case, and P. Kanahele.	See *Appendix D*. Described as the most sacred of Kāne's waters in all the Hawaiian Islands.
Depositing of *piko* (umbilical cords) at Waiau and the summit peaks of Mauna Kea.	Oral history interviews with – K. Kalili, I. Lindsey-Fergerstrom et al., and P. Kanahele. Consultation records of – L.K. Kimura, and B. Robertson.	Members of the Lindsey-Fergerstrom family describe the practice as on-going. Barbara (Ka'apuni) Robertson, was told be her elders that it was a custom that was unique to people of the Waimea region, who shared a particularly close affinity with Mauna Kea.
Burial Practices: · Interment of remains –	Historical literature. Oral history interviews with – J. Ah San, T. Imoto, S. & D. Kaniho, A. Lancaster; A.K. Haa Sr. (& Jr.), L. Case, I. Lindsey-Fergerstrom et al. Consultation records of: Ed Stevens, Iopa Mauna-kea, L. McCord, K. Pisciotta, and AHCC.	(see *Appendix D*) Describing specific knowledge of ancient burial sites, and belief that burials occurring in the upper elevations are those of *ali'i* and other sacred personages – the ancestors of some interviewees.
· Releasing of ashes at the summit and other locations on Mauna Kea.	Oral history interviews with – T. Imoto, J. Ah San, T. Bell Sr., S. & D. Kaniho, Tita & JK Spielman, and P. Kanahele.	Described as a continuation of the traditional practice of taking loved ones remains to Mauna Kea.

**from Maly (1999)*

Table 2 b. Traditional Cultural Properties

Property	Source of Identification	Comments
Ka Mauna a Wākea or Mauna Kea, also referred to as "*Ka piko kaulana o ka 'āina*" (The famous summit or center of the land).	Historical literature.	See *Appendix D.*
	Oral history interviews with all Hawaiian interviewees (particularly – J.K. Lindsey, K.K. Phillips, A. & A. Lancaster, A.K. Haa Sr. & Jr., L. Case, and P. Kanahele).	Generally described as the mountain region from approximately the 6,000 foot elevation to summit. Described as a sacred landscape that is a physical and spiritual connection between one's ancestors, history, and the heavens.
	Consultation records of: Association of Hawaiian Civic Clubs (AHCC), Ed Stevens, Iopa Maunakea, L. McCord, K. Pisciotta, L.K. Kimura, E. Kauhi, L. Teves, and B. Robertson.	Many of the *pu'u* (hills) and other topographic features on Mauna Kea are named for Hawaiian gods and deities. Also, many of the *pu'u*, particularly those of the upper region, are believed to be burial sites of *ali'i* and other important ancestors.
	Interviews with Tita & JK Spielman, H.K. Springer, A.K. Haa Sr. (& Jr.), C. Hind, L. Case, and P. Kanahele; and consultation *Appendices B & C.*	Viewplain: The upper mountain region is described as a sacred landscape; for some interviewees ascending the mountain and viewing its features is important, for other families, the mountain is so scared that there is no desire to ascend it, but seeing it from afar–feeling its presence–is sufficient.
	Oral history interview with Lloyd Case.	Mountain landscape in navigational traditions: Hawaiian Navigational It is noted that while none of the archival-historical literature cited has made specific references to sites or features on Mauna Kea that were recorded as being associated with navigational practices and customs, the gods and deities associated with Mauna Kea have celestial body forms and some were evoked for navigational practices.
	Consultation records of K. Pisciotta and L. McCord.	Ms. Pisciotta was invited to provide the interviewer with a report she has prepared on the navigational-practices—to be included as an appendix under her name with the present study—but at the time of this writing, the report has not been received. (It is likely that Rubellite Kawena Johnson, Clay Bertlemann and Nainoa Thompson could provide the University with additional documentation on native practices and lore of Hawaiian navigation.)

Table 2 b. Traditional Cultural Properties (Continued)

Property	*Source of Identification*	*Comments*
Pu'u Kūkahau'ula – the summit peak of Mauna Kea.	Historical literature. Oral history interviews with all interviewees (particularly–I. Lindsey-Fergerstrom et al., A.K. Haa Sr., A. & A. Lancaster, L. Case, Tita Spielman et al., and P. Kanahele). Consultation records of: Ed Stevens, Iopa Mauna-kea, L. McCord, and K. Pisciotta.	See *Appendix D*. Generational repository of: *piko* (umbilical cords of children); ashes of individuals with strong attachment to Mauna Kea; and locations of an *ahu* (possibly more than one over time) associated with navigational practices and historic surveys.
Pu'u Poli'ahu	Historical literature. Oral history interviews with all Hawaiian inter-viewees (particularly – A. & A. Lancaster, L. Case, and P. Kanahele). Consultation records of: Ed Stevens, L. McCord, K. Pisciotta, and AHCC.	See *Appendix D*. As an important cultural-geographic feature, and for its association with the Hawaiian goddess and ancestress of some interviewees.
Pu'u Lilinoe	Historical literature and oral history interviews with all Hawaiian inter-viewees (particularly – A. & A. Lancaster, A.K. Haa Sr., and P. Kanahele). Consultation records of: Ed Stevens, L. McCord, K. Pisciotta, and AHCC.	See *Appendix D*. As an important cultural-geographic feature, and for its association with the Hawaiian goddess and ancestress of some interviewees.
Waiau	Historical literature. Oral history interviews with all Hawaiian inter-viewees (particularly – K. Kalili, J.K. Lindsey, K.K. Phillips, A. & A. Lancaster, A.K. Haa Sr., L. Case, P. Kanahele, and I. Lindsey Fergerstrom et al.). Consultation records of: Ed Stevens, L. McCord, K. Pisciotta, L.K. Kimura, B. Robertson, and AHCC.	See *Appendix D*. As an important cultural-geographic feature – a repository of *piko* of children; and a source of sacred water used for ceremonial and healing practices.

Table 2b. Traditional Cultural Properties (Continued)

Property	*Source of Identification*	*Comments*
	Historical literature.	See *Appendix D.*
Pu'u Mākanaka and Kaupō vicinity.	Oral history interviews – particularly J. Ah San, S. & D. Kaniho, and P. L'Orange.	Particularly noted as burial sites.
Trails —	Historical literature.	See *Appendix D.*
· Kūka'iau-'Umikoa to Mauna Kea Trail.	Oral history interviews: particularly – J. Ah San, T. Imoto, S. & D. Kaniho, T. Bell Sr., A. Lancaster,	Trail generally known to all interviewees, and remains in use by some who travel to Mauna Kea in present times.
There are also other trails which are potential Traditional Cultural Properties; documentation was recorded for the following trails:	A.K. Haa Sr. (& Jr.), M. Pence, L. Case, I. Lindsey Fergerstrom et al., and A.K. Haa Sr. (& Jr.).	A portion of the trail which connects with the lower Mānā-Laumai'a Trail (around the base of Mauna Kea) was also known as "Ioane's Trail" (Ioane was the great grandfather of A.K. Haa Sr.)
· Humu'ula to Mauna Kea Trail.	Oral history interviews: particularly – J. Ah San, T. Imoto, S. & D. Kaniho, T. Bell Sr., A. Lancaster, M. Pence, and P. L'Orange.	Trail generally known and traveled on by all individuals who went to Mauna Kea prior to opening of the summit road alignment in the 1960s.
· Laupāhoehoe-Waipunalei-Kanakaleonui to Mauna Kea Trail.	Oral history interviews: particularly – J. Ah San, & L. Case.	Trail generally known to individuals who traveled to Mauna Kea up to ca. 1930.
· Makahālau-Kemole to Waiau Trail. & · Waiki'i-Pu'u Lā'au to Waiau Trail.	Oral history interviews with: J.K. Lindsey, T. Bell Sr, and L. Case. Oral history interviews with: J.K. Lindsey, and Teddy Bell Sr.	These two trails are not generally known to most people who have traveled to the summit region of Mauna Kea. The two elder interviewees last traveled on them in the 1930s, Lloyd Case still travels the trails. In the interviews, it was also noted that most of the trails rising to the summit of Mauna Kea converge in the vicinity of Waiau, with a trail then rising to the summit peak.
———		
·10,000 ft. elevation trail/road around Mauna Kea.	Oral history interviews with: I. Lindsey Fergerstrom et al., and L. Case	Of particular interest to this trail/road feature at approximately the 10,000 ft. elevation are references to: (1) stone platforms and uprights that mark the contour of the trail (Mrs. Fergerstrom et al., associate them with the work on the alignment–there are burials and other features near by which they have personally seen); and (2) the walled enclosures in the region above Pu'u Lā'au.

Table 2c. Contemporary Cultural Practices

Practice	*Source of Identification*	*Comments*
Prayer and ritual observances – including construction of new *kūahu* (altars) as a part of ceremonial observances.	Consultation records of: K. Pisciotta and L. McCord.	See *Appendix C.*
Keanakāko'i – This complex of adze quarries, shrines and numerous associated features is already a property listed on the National Register of Historic Places.	Historical literature. Oral history interviews with all interviewees (particularly – J. Ah San, A. Lancaster, A.K. Haa Sr., H.K. Springer, P. Kanahele and I. Lindsey-Fergerstrom et al.). Consultation records of Wm. Akau.	See *Appendix D.* All interviewees had knowledge of the adze quarries and various caves associated with the practice of collection of stones for adzes, (only I. Fergerstrom et al.,–the result of years of traveling on Mauna Kea with Harry Fergerstrom who worked for the Territorial/State Forestry Div.) had knowledge of the platforms and uprights. None of the other interviewees could recall hearing of, or seeing the shrines in the vicinity of the quarry sites. There is also on-going contemporary practice of collection of stone from adze quarry sites for various purposes. While present-day collection of stone from traditional quarry sites compromises the integrity of the cultural resources, the practice is claimed as a traditional right. This is one of the important management issues which cultural practitioners, the Department of Land and Natural Resources, and the University will need to address. The interviews with J. Ah San, L. Case, H.K. Springer, and P. Kanahele include introductory discussions on protocols for collection of adze stones.
Subsistence and recreational hunting.	Oral history interviews with J. Ah San, and T. Imoto, M. Pence, S. & K. Kaniho, T. Bell Sr., I. Lindsey-Fergerstrom et al., and L. Case.	Described as important to the well-being of practitioner families, and important in maintaining a balance in an already disturbed environment on Mauna Kea.

1. Performance of prayer and ritual observances important for the reinforcement of an individual's Hawaiian spirituality;

2. Collection of water from Waiau for a variety of healing and other ritual uses;

3. Deposition of *piko* (umbilical cords) at Waiau and the summit peaks of Mauna Kea;

4. Use of the summit region as a repository for human burial remains, by means of interment, particularly on various *pu'u*, during earlier times, and more recently by means of releasing ashes from cremations;

5. Belief in the upper mountain region of Mauna Kea, from the Saddle area up to the summit, as a sacred landscape – as the personification of the spiritual and physical connection between one's ancestors, history, and the heavens; and

6. Association of unspecified traditional navigation practices and customs with the summit area.

TRADITIONAL CULTURAL PROPERTIES

In the course of his study, Maly identified a number of potential traditional cultural properties within the Mauna Kea Science Reserve Master Plan project area. These are historic properties that are of importance to Native Hawaiians because they possess traditional cultural significance derived from associated cultural practices and beliefs *(see Table 2b)*. (See also Figure 2 in Maly 1999 for a map indicating the locations of identified properties.) Potential traditional cultural properties identified to Maly by knowledgeable informants and cultural practitioners as being present within the Science Reserve Master Plan project area included the following:

1. The entire mountain region of Mauna Kea, from approximately the 6,000 foot elevation (the Saddle area) to the summit;

2. Pu'u Kukahau'ula – a cinder cone that is the summit peak of Mauna Kea (sometimes also referred to by the modern name of Pu'u Wekiu);

3. Pu'u Poli'ahu – a prominent summit region cinder cone situated to the west of Pu'u Kukahau'ula;

4. Pu'u Lilinoe – a prominent summit region cinder cone situated to the southeast of Pu'u Kukahau'ula;

5. Waiau – a shallow lake and its adjacent cinder cone situated in the summit region to the southwest of Pu'u Kukahau'ula;

6. Pu'u Makanaka and Kaupo vicinity – a cluster of two prominent cinder cones situated near the edge of the summit region to the northeast of Pu'u Kukahau'ula;

7. Mauna Kea-'Umikoa Trail – a foot and horse trail extending between Kuka'iau in Hāmākua to immediately south of the summit area;

8. Mauna Kea-Humu'ula Trail – a foot and horse trail extending from the Humu'ula Sheep Station up to the summit area; and

9. A number of lesser foot and horse trails – including the Mauna Kea-Laupahoehoe-Waipunalei-Kanakaleonui Trail, the Mauna Kea-Makahalau-Kemole Trail, and the Waiau-Waiki'i-Pu'u La'au Trail.

CONTEMPORARY CULTURAL PRACTICES

Contemporary cultural practices and beliefs would be those of cultural practitioners for which no clear specific basis in traditional culture can be clearly established or demonstrated for example, the conducting of ritual ceremonies at sites or features for which no such prior traditional use and associated beliefs can be demonstrated. In some cases, however, it may be possible to demonstrate the reasonable evolutionary development of a contemporary practice from an earlier traditional practice.

In the course of his study, Maly identified several contemporary cultural practices and beliefs associated with the Mauna Kea Science Reserve Master Plan project area *(see Table 2c)*. The following were related to Maly by knowledgeable informants and cultural practitioners:

1. Prayer and ritual observances – including construction of new *kuahu* (altars) in connection with ceremonial activities;

2. Collection of raw material stone from quarry sites within the Mauna Kea Adze Quarry Complex; and

3. Subsistence and recreation hunting.

CURRENT NATIVE HAWAIIAN PERSPECTIVES ON MASTER PLAN PROJECT

As a consequence of conducting his recorded interviews and informal consultations with knowledgeable informants and cultural practitioners, Maly was able to formulate a series of general recommendations and comments that reflected current Native Hawaiian perspectives on the Science Reserve Master Plan project (Maly 1999:34-5). The most substantial of these may be summarized as follows:

1. The great majority of individuals expressed the desire that no further development of astronomy facilities on Mauna Kea. Visual impacts and physical impacts upon the *pu'u* were often mentioned as important concerns;

2. Protection of the general landscape and view planes, especially among the *pu'u* and other cultural resources, was regarded as very important;

3. The present lessee should appreciate the past opportunity for the use of Mauna Kea, honor prior commitments, complete studies and work that were called for by the original complex development plan, and establish and comply with its own guidelines and requirements for the use of Mauna Kea;

4. In terms of management planning, the Native Hawaiian model of *ahupua'a* management, which incorporates and integrates all aspects of the physical, cultural, and spiritual environments, should be utilized;

5. All users of Mauna Kea should enter into a sustainable partnership, with the Native Hawaiian and other components of the local community, that would provide for the future stewardship of Mauna Kea; and

6. Plans need to be formulated, in consultation with cultural practitioners and families having genealogical ties to Mauna Kea, for access to and use of traditional sites and resources.

CONCLUSION

The basic purpose of this concluding section is to assess the findings of the present cultural impact assessment study to determine if any of the Native Hawaiian cultural practices, beliefs, or features identified as being associated with the University of Hawai'i Science Reserve Master Plan project area represent traditional and customary practices or places which might potentially be affected by future development of any astronomy facilities or related uses. The specific objectives of this conclusion include the following:

1. Summarize the nature and variety of identified Native Hawaiian cultural practices, beliefs, and features;

2. Evaluate the significance of identified Native Hawaiian cultural practices, beliefs, and features;

3. Assess the potential effects that any further development or use of the Science Reserve might have upon identified Native Hawaiian cultural practices, beliefs, and features; and

4. Make recommendations for measures that might (a) mitigate any potentially adverse effects of future development or use upon identified Native Hawaiian cultural practices, beliefs, and features, or (b) be otherwise appropriate.

NATIVE HAWAIIAN CULTURAL PRACTICES AND PROPERTIES ASSOCIATED WITH THE UNIVERSITY OF HAWAI'I MAUNA KEA SCIENCE RESERVE MASTER PLAN PROJECT AREA

The number and variety of individuals and groups contacted and consulted by Maly during the present study, as evidenced by the twenty-two knowledgeable informants and cultural practitioners *(see Table 1)* who provided information in the form of fifteen tape recorded and transcribed interviews, and the more than 100 individuals and groups that provided additional information through more informal consultations (Maly 1999:Appendix B), demonstrates an adequate, appropriate, and reasonable good-faith effort to identify the full range of Native Hawaiian cultural practices, features, and beliefs currently associated with the Science Reserve Master Plan project area on Mauna Kea. This documented effort indicates it likely that the full range of current cultural practices, features, and beliefs associated with the Science Reserve Master Plan project area has been identified, even though in many instances only the general nature of these practices, features, and beliefs has been determined but not documented in any great detail.

An overview of the cultural practices – including the component behaviors, features, beliefs, and values – summarized in the preceding section of the present report, and presented more fully and in richer detail in Maly's oral history and consultation study (1999) illustrates a pervasive general theme which flows throughout native Hawaiian culture and binds it together. To Native Hawaiians, the natural elements of the physical environment – the land, sea, water, winds, rains, plants, and animals, and their various embodied spiritual aspects – comprise the very foundation of all cultural life and activity – subsistence, social, and ceremonial; to Native Hawaiians, the relationship with these natural elements is one of family and kinship.

The Native Hawaiian cultural practices identified as currently associated with the University of Hawaii Mauna Kea Science Reserve Master Plan project area can be categorized as two general types: (a) practices with active behaviors involving both observable activities with material results and their inherent values or beliefs; and (b) practices with more passive behaviors which seek to produce nonmaterial results. The former type of behaviors involves such activities as the gathering and collecting of natural resources for various

purposes, the deposition of *piko*, and the funerary release of cremated human remains. Uses such as these generally have associated beliefs and values, as indicated in the preceding section *(see Table 2)*. The latter type of behaviors involves more experiential activities focused on "becoming one" with natural setting; that is, behaviors relating to spiritual communication and interaction that reaffirm and reinforce familial and kinship relationships with the natural environment.

Several potential traditional cultural properties were identified within the Science Reserve Master Plan project area. These included the entire mountain region of Mauna Kea, several of the distinctive *pu'u* that dominate the summit region, the shallow lake, and several foot and horse trails which access the summit region from the lower slopes of the mountain. Several of these properties comprise physical manifestations which reinforce cultural mythologies and relationships.

EVALUATION OF IDENTIFIED NATIVE HAWAIIAN CULTURAL PRACTICES AND PROPERTIES

Traditional and Customary Practices

For purposes of evaluating the significance of the Native Hawaiian cultural practices, features, and beliefs identified in association with the Science Reserve Master Plan project area, it would be useful to consider them in terms of the three types of informant claims that were defined earlier in the Introduction section of the present report. Information obtained by Maly in his oral history and consultation study (1999) suggests that several of the identified practices and beliefs would appear to fall within the category of traditional and customary practice claims. These would be claims which would lie within the purview of Article XII, Section 7, of the Hawaii State Constitution ("Traditional and Customary Rights"), particularly as reaffirmed in 1995 by the Hawaii State Supreme Court in the decision commonly referred to as the "PASH decision," and further clarified in the 1998 decision in "State v. Hanapi," and which would include various cultural practices and beliefs associated with the general geographical area of the summit region, rather than a clearly definable property or site. While certain other practices, such as prayer and ritual observances involving the construction of new *kuahu* (altars), or the releasing of cremated human remains rather than interment on *pu'u*, might seem to be contemporary cultural practices, they may as well be considered to be reasonable cultural developments evolving from earlier traditional practices.

A general familiarity with the content of traditional Hawaiian culture – both in its tangible material aspects and, perhaps to a somewhat lesser degree, its immaterial and behavioral aspects, indicated nothing unusual among the identified practices. While the geographical setting of the Mauna Kea, and especially the distinctive landscape of the summit region, may not be matched elsewhere within the Hawaiian Islands, none of the identified cultural practices would appear to be particularly unique to the Science Reserve Master Plan project area; similar practices traditionally took place in other settings throughout the islands.

Traditional Cultural Properties

Several potential traditional cultural properties were identified within the Science Reserve Master Plan project area, including the entire mountain region of Mauna Kea, several of the distinctive *pu'u* which dominate the summit region, the shallow lake, and several foot and horse trails which access the summit region from the lower slopes of the mountain. As defined earlier, traditional cultural property claims are the only ones strictly falling within the purview of the historic preservation process. Such claims would involve traditional practices and beliefs of Native Hawaiian informants and cultural practitioners that (a) are associated with a definable physical property (an entity such as a site), (b) are founded in the history of the local community, (c) contribute to the maintenance of the cultural identity of the community, and (d) demonstrate a historical continuity of practice or belief up to the present. Additionally, a potential traditional cultural property must be able to

demonstrate its historical significance in terms of established evaluation criteria, such as those of the National Register of Historic Places (CFR 1981) and/or the Hawaii Register of Historic Places, to qualify as a legitimate traditional cultural property within the historic preservation context.

The claims for several of the summit region *pu'u* – specifically for Kekahau'ula, Lilinoe, and Makanaka, and for the shallow lake and adjacent *pu'u* collectively known as Waiau, certainly would seem likely to qualify them as a traditional cultural properties which meet the National Register test for historical significance because the entities (a) are tangible physical properties, (b) appear to have sufficient integrity – that is, the ability to convey their significance, and (c) meet one or more of the four basic National Register criteria. As sites, all four have clearly recognizable and definable physical boundaries. While knowledgeable informants and cultural practitioners acknowledge that several of the *pu'u* have been damaged by past construction activities, they also appear to believe that the *pu'u* have not been so substantially damaged as to destroy their integrity. And finally, by reason of their association with a significant figures in Hawaiian cultural mythology (Kukahau'ula, Lilinoe), and as acknowledged traditional areas for burials (Makanaka) and ritual practices (Waiau), these four properties would seem to satisfy at least one or two of the four basic National Register Criteria: Criterion (A) by association with events that have made a significant contribution to the broad patterns of Hawaiian history, and Criterion (B) by association with the lives of persons significant in the Hawaiian past.

To satisfy Criterion (A), the direct association of a specific site with a significant event, or pattern of events, in Hawaiian history (either written documentary or oral traditional history) would have to be established. All four properties – Kukahau'ula, Lilinoe, Waiau, and Makanaka – would appear to satisfy this criterion because of associated traditional cultural practices and/or the cultural values they represent, as indicated by information provided by many of the knowledgeable informants and cultural practitioners.

To satisfy Criterion (B), the direct association of a specific site with a person significant in Hawaiian history (either written documentary or oral traditional history) would have to be established. National Register Bulletin No. 38 notes that the terms "persons" can mean both "persons whose tangible, human existence in the past can be inferred on the basis of historical, ethnographic, or other research," as well as legendary and mythological "persons" who exist only in the cultural traditions of a group (Parker and King 1991:11). As the personification of important characters in local traditional Hawaiian mythological history, both Kukahau'ula and Lilinoe certainly would seem to meet the requirement of specific persons of significance in traditional Hawaiian legend and myth.

It should be noted that this evaluation of Kukahau'ula, Lilinoe, and Waiau as traditional cultural properties concurs with a preliminary determination of the SHPD staff *(see Figures 3 and 4, and related discussion)* that the three features, with the definition of Kukahau'ula expanded to incorporate the cluster of three *pu'u* which form the summit of Mauna Kea, are believed to qualify as traditional cultural properties on the basis of traditional Native Hawaiian cultural practices and beliefs associated with them. SHPD staff concurrence should also be noted with regard to another *pu'u*, Poli'ahu, that had been identified in the Maly study as a potential traditional cultural property. While the current name of the latter feature might seem to indicate association with a significant mythological personage, it has been pointed out that while Poli'ahu as manifest by snow has long been traditionally associated with the upper slopes of Mauna Kea, the named assignment to a specific *pu'u* was a relatively recent historic period designation made in 1892 by W.D. Alexander during the mapping of Mauna Kea (McEldowney 1982:A-21), and not an earlier Native Hawaiian designation. Thus the feature would not seem to meet the criteria for definition as a traditional cultural property.

Finally, with regard to the various named foot and horse trails that ascended to the summit region and which were identified in the Maly study (1999) as potential traditional cultural properties, it seems likely that they are primarily historic period routes and not specific features of Native Hawaiian tradition; rather than following specific established routes up the slopes of Mauna Kea, travelers in earlier times were apparently guided by distinctive features of the landscape such as *pu'u* and ridgelines (McEldowney 1982:A-15,16).

Contemporary Cultural Practices

With regard to the current practices identified by Maly (1999) as contemporary cultural practices, it would seem that they all bear close enough relationships to earlier traditional cultural practices associated with the upper slopes and summit region of Mauna Kea so that no purpose would be served by distinguishing them as something different. Furthermore, as has been pointed out previously, it is likely that they represent reasonable cultural evolution from earlier traditional practices.

Concluding General Evaluation

Based on an evaluation of the findings of the present cultural impact assessment study made in reference to (a) the known content of traditional Hawaiian culture and (b) the National Register Criteria as clarified by National Register Bulletin No. 38, it is believed that with the exceptions noted above, most of the Native Hawaiian cultural practices, features, and beliefs identified as being currently associated with the Mauna Kea Science Reserve Master Plan project area can be considered to be culturally and historically significant. Most, if not all, of the identified practices and beliefs would seem to qualify as traditional and customary cultural practices within the meaning of the Hawaii State Constitution, while the principal *pu'u* and the shallow lake with adjacent *pu'u* would seem to satisfy the criteria for being regarded as a legitimate traditional cultural property. Finally, none of the identified practices and beliefs would seem to represent strictly contemporary cultural practices or beliefs lacking some measure of traditional connection.

Mauna Kea Summit Region as a Cultural Landscape

As was discussed earlier, SHPD staff have recently indicated that they will be proposing a historic district designation for the summit region of Mauna Kea which they believe will meet the eligibility criteria for inclusion in both the Hawaii State and the National Register of Historic Places. A historic district is defined as a historic property that "...possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development" (NPS 1990:5).

The approximate boundary of the proposed historic district, provisionally referred to as the "Mauna Kea Summit Region," incorporates the virtually the entire Science Research summit area, extending beyond limits of the reserve, and also includes portions of the Natural Area Reserve. The proposed district includes the total of 93 archaeological sites identified within the Science Reserve, three landscape features within the reserve believed to qualify as traditional cultural properties, and the Mauna Kea Adze Quarry Complex situated within the Natural Area Reserve.

Consideration of the properties included within this proposed historic district, and their associated practices and beliefs, suggests it to represent a type of historic property best referred to as a cultural landscape. A cultural landscape is a geographical definable area that clearly reflects patterns of occupation and land use over a long time period, as well as the cultural values and attitudes which guide and regulate human interaction with the physical environment. Based on the Native Hawaiian traditional cultural practices and beliefs associate with Mauna Kea, as documented in the Maly (1999) oral history and consultation study, the proposed historic district could perhaps even more appropriately be considered to be a special type of cultural landscape referred to by the National Park Service as ethnographic landscapes: "those landscapes imbued with such intangible meanings that they continue to be deemed significant or even sacred by contemporary people who have continuous ties to the site or area". Such an ethnographic landscape would seem to be embodied in the concept of "cultural attachment" used by Maly (1999:27) to describe the connection of many Native Hawaiians to Mauna Kea.

ASSESSMENT OF POTENTIAL PROJECT EFFECTS

The assessment of potential project effects upon the Native Hawaiian cultural practices, features, and beliefs, and potential traditional cultural properties identified as associated with the Mauna Kea Science Reserve Master Plan project area has been done in general accordance with the guidance documents cited in the earlier "Study Methodology" section of the present study. Of particular relevance were Part 800.9 ("Criteria of effect and adverse effect") of the federal regulations of the Advisory Council on Historic Preservation for the "Protection of Historic Properties" (CFR 1986), and Section 13-275-7 ("Determining effects to significant historic properties") of the DLNR draft administrative "Rules Governing Procedures for Historic Preservation Review" (DLNR 1998).

Discussion

The University of Hawaii Science Reserve Master Plan project focuses on the formulation of planning and management strategies to guide and regulate any proposed future development and use of the project area. The plan does not involve specific development projects with definable impacts, therefore discussion of potential effects and measures for the mitigation of potentially adverse effects must involve consideration of a range of possible effects and mitigation measures.

Direct effects are those caused by an action and which occur at the same time and place, while indirect effects are those caused by an action and are further removed in time and/or distance, but can still be reasonably foreseen. Cumulative effects are those which result from the incremental effect of actions which, taken together with similarly minor past, present, and future effects, over time become significant.

There are two principal types of actions the direct effects of which have potential to adversely effect the Native Hawaiian cultural practices, features, and beliefs associated with the Science Reserve Master Plan project area: (a) maintenance programs and routine operations, and (b) planned development and construction projects. Both types of actions could result in long-term effects that could damage, reduce, or destroy the integrity of the traditional cultural resources.

Planned development and construction projects are also the principal type of actions the indirect effects of which have potential to adversely effect the Native Hawaiian cultural practices, features, and beliefs associated with the Science Reserve Master Plan project area. This could potentially occur as the result of increased access to and use of the Mauna Kea summit region by the public for various recreation activities, and would also constitute long-term effects.

The integrity of the spiritual and sacred quality of the landscape of Mauna Kea's summit, and astronomy's relationship to the cultural landscape, appears to be a crucial issue with the future activities in the Science Reserve. Given the viewpoints expressed in the informant interviews, and research on the mountain's cultural importance, a common concern is the perceived lack of respect on astronomy's part for the Native Hawaiian cultural practices, features and beliefs. At Mauna Kea, however, a potential bridge may exist between the current study of astronomy and the Hawaiian cultural beliefs. Although the specific functions of the shrines clustered around the summit have not been identified through the interviews of knowledgeable informants, it is believed that they represent symbols of spiritual or heavenly worship offered by individuals or families closely linked to the mountain. It is known that the Polynesian voyagers studied and used the constellations as a navigational guide. A validation of Mauna Kea's astronomical and spritual importance was a recent visit to the summit shrine complex by some crew of the Hokuleia voyaging canoe, prior to their leaving for the South Pacific. Astronomers also share a deep respect for the natural elements and the heavens, but need to better understand the Native Hawaiian people's deep beliefs

tied to the physical landscape, its signs and meanings. The Master Plan and Management Plan propose to bring together the knowledge and values of the traditional culture to appropriately direct the future management of the Science Reserve, with ongoing involvement and wisdom of a kahu/kupuna council to be jointly involved in advising the management of the mountain.

The existence of both the shrine complexes and Keanakakoi Adze Quarry on the summit plateau region reiterates a fundamental aspect of Native Hawaiian culture; the integration of the spiritual and religious aspects of life with secular activities of daily living. The adze quarry is essentially a tool making activity, an equivalent of manufacturing or industry involving changing the landscape for functional purposes. That this activity co-existed side by side with what seem to be worship shrines indicates that all activities are imbued with spirituality and that issues of compatibility was resolved through the attitude and protocol with which activities were pursued. A protocol that includes requesting permission from the *aina, kupuna and akua*, expresses appreciation for the generosity and bounty of nature and follows practices of stewardship is the key to appropriateness. The basic conceptual difference between this indigenous use of the mountain's sacred summit area for a lithic industry, and the modern day use of the summit for the study of the stars by astronomers is the issue of appropriate protocol and respect. The Master Plan demonstrates respect for the resources of land, ecology, and culture, while the Management Plan can provide a new start for cooperative stewardship of the mountain's resources with the Native Hawaiian people.

Concluding Assessment

Based on an evaluation of the Native Hawaiian cultural practices, features, and beliefs identified as currently associated with the Mauna Kea Science Reserve Master Plan project area, and a general consideration of the potentially adverse direct and indirect effects that might result from future development and use of the summit region, it is obvious that a comprehensive plan for both the short-term and long-term management of the Science Reserve Master Plan project area is vital for the protection and preservation of significant traditional cultural resources. The Master Plan minimizes potential direct and indirect impacts to cultural practices, features and beliefs through the careful limits set upon future development within the proposed Astronomy Precinct and restrictive design guidelines. The Management Plan proposes specific necessary actions to protect the cultural resources and traditional cultural access rights and uses.

POTENTIAL MITIGATION MEASURES

SHPD Historic Preservation Plan

As mentioned earlier in the Introduction section of the present report, the staff of the SHPD are currently preparing for the University of Hawaii a Historic Preservation Plan for the Mauna Kea Science Reserve Master Plan project area. As presently conceived, this plan will consist of two major essential components: (a) an information component which described the significant historic properties of Mauna Kea and the Mauna Kea Science Reserve, and (b) a management component which identified potential impacts of proposed development and appropriate measures through which potentially adverse effects could be avoided or mitigated.

The management component of the preservation plan will deal two principal topics: (a) plans for specific development projects and related activities, and (b) plans for the long-term management of historic properties within the Science Reserve Master Plan project area. The former topic will address in detail the direct and indirect adverse effects that might potentially result from specific development projects and related activities, and propose a range of mitigation measures to avoid or minimize adverse effects. The latter topic will address in detail long-term management plans for interpretive development, monitoring,

routine consultation with Native Hawaiian organizations and individuals, cultural uses, and continued inventory of historic properties.

Potential Mitigation Measures

One general mitigation measure of value would be the preparation of an appropriate programmatic agreement which would provide a mechanism by which interested parties could reach a mutual understanding on what historic preservation review and compliance measures would be applicable to defined classes of development and use actions within the Science Reserve Master Plan project area. A vital component of any such agreement would close and meaningful consultation with the Native Hawaiian community, especially cultural practitioners who utilize the summit region for various purposes.

With regard to planned development and construction projects, procedures essentially the same as those presently contained in the draft SHPD administrative rules should be followed to assure that sufficient effort is given to the identification and evaluation of traditional cultural resources that might be effected by any specific proposed project. The procedures contained in the draft SHPD administrative rules generally parallel the federal historic preservation review process usually referred to as the "Section 106 Review." Basic elements of this review process would include the following: (a) inventory survey to identify all cultural resources within a specified project area; (b) evaluation of the significance of all identified cultural resources; (c) assessment of the potential effects of a project upon significant cultural resources; (d) determination of appropriate mitigation measures to avoid or minimize potentially adverse effects upon significant cultural resources; (e) identification and treatment of potential burial sites; (f) consultation with Native Hawaiian individuals and organizations; and (g) preparation of written agreements to project-specific preservation and management issues.

Perhaps the single most significant mitigation measure that could be implemented would be the restriction of virtually all future planned development and construction projects to the proposed 525-acre Astronomy Precinct. This area represents less than five percent of the entire Science Reserve. The Astronomy Precinct area has been carefully situated to exclude undeveloped *pu'u* and the concentrations of shrine features near the summit, so as to greatly minimize potential adverse direct effects upon the cultural resources of the summit region. All of the undeveloped *pu'u* in the Science Reserve are protected from future astronomy development, reflecting the stated wishes of many Native Hawaiians interviewed in the oral history process, that these culturally significant landforms be preserved. Further, only three shrines are located within the Astronomy Precinct, and these will not be directly affected by construction activities with a proposed minimum buffers of 200 feet from any proposed observatory locations. Importantly, the proposed siting for new observatories avoids interference with visual connections between the shrines and the significant *pu'u* cultural landforms.

With regard to the long-term management of cultural resources within the Mauna Kea Science Reserve Master Plan project area, a series of specific management plans could be formulated to address a wide range of issues. As with any other planning activities, close and meaningful consultation with Native Hawaiian individuals and organizations should be undertaken. Specific management plans could include the following:

1. Monitoring plan involving systematic strategies to monitor the condition of cultural resources to determine what activities and uses within the project area are effecting cultural resources, the nature and intensity of such effects, and appropriate mitigation measures to avoid or minimize any adverse effects;

2. Plan to complete the identification and documentation of cultural resources within the project area;

3. Burial treatment plan for the protection of known and suspected burials sites, and for the treatment of any burials inadvertently discovered during planned development

and construction projects. Preparation of a burial treatment plan should involve consultation with the Hawai'i Island Burial Council;

4. Cultural use plan to provide for access to and use of traditional cultural properties and other culturally significant areas by Native Hawaiian practitioners;

5. Interpretation plan that would designate sites and areas appropriate for public access for purposes of education and recreation, and could include such elements as self-guided and guided tours, informational signage, brochures, and displays; and

6. Enforcement plan to provide for protection of natural and cultural resources and systematic enforcement of all rules and regulations governing access to and use of the Science Reserve Master Plan project area.

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CULTURE

The First Arrivals: Native Hawaiian Uses

In Hawaiian culture, natural and cultural resources are one and the same. Native traditions describe the formation of the Hawaiian Islands and the presence of life on and around them. All forms of the natural environment, from the skies and mountain peaks, to the valleys and plains, and to the shoreline and ocean depth are the embodiments of Hawaiian gods and deities. One Hawaiian genealogical account records that Wākea (the expanse of the sky) and Papa-hāna-moku (Papa – Earth mother who gave birth to the islands) and various gods and creative forces of nature gave birth to the islands. Hawai'i, the largest of the islands, was the first-born of these island children. The account continues that the same god-beings were also the parents of the first man (Hāloa), and from this ancestor, all Hawaiian people are descended. In some genealogical chants, Mauna Kea is referred to as "Ka Mauna a Kea" (Wākea's Mountain), and it is likened to the first-born of the Island of Hawai'i. (Maly, 1999)

"Cultural attachment is demonstrated in the intimate relationship (developed over generations of experiences) that a people of a particular culture share with their landscape – for example, the geographic features, natural phenomena and resources, and traditional sites, etc., that make up their surroundings. This attachment to environment bears direct relationship to the beliefs, practices, cultural evolution, and identity of a people. In Hawai'i, cultural attachment is manifest in the very core of Hawaiian spirituality and attachment to landscape. The creative forces of nature which gave birth to the islands (e.g., Hawai'i), mountains (e.g. Mauna Kea) and all forms of nature, also gave birth to *nā kānaka* (the people), thus in Hawaiian tradition, island and humankind share the same genealogy." (Maly, 1999, p. 27)

According to Kanahele and Kanahele (1997), the first Hawaiians landed on the island's shores between 25 BCE and 125 CE. Many more Polynesians voyaged to Hawai'i and settled over the next thousand years. During this settlement period, the early Hawaiians developed stable water and food sources and adapted to their new environment. (Kanahele and Kanahele, 1997) Hawaiians first settled near the shore where there was ready access to the ocean's plentiful resources. The forests provided plants and animals for food, tools, and shelter. Flightless birds, knowing no predators before, became easy prey for Hawaiian hunters. The mountain tops, the highest points of the land, were considered sacred. Mauna Kea is among the most sacred of these high points.

As early as AD 1100, adze makers came in reverence to the Mauna Kea adze quarry, Keanakāko'i (most of which is located in the Mauna Kea Ice Age Natural Area Reserve), to craft tools from the unique dense basalt found here. As part of the ritual associated with quarrying, craftsman erected shrines to their gods. Adze makers came to the mountain for short periods of time to work on the basalt that formed from molten lava which erupted under the glacial ice cap. They chipped out chunks of basalt and then

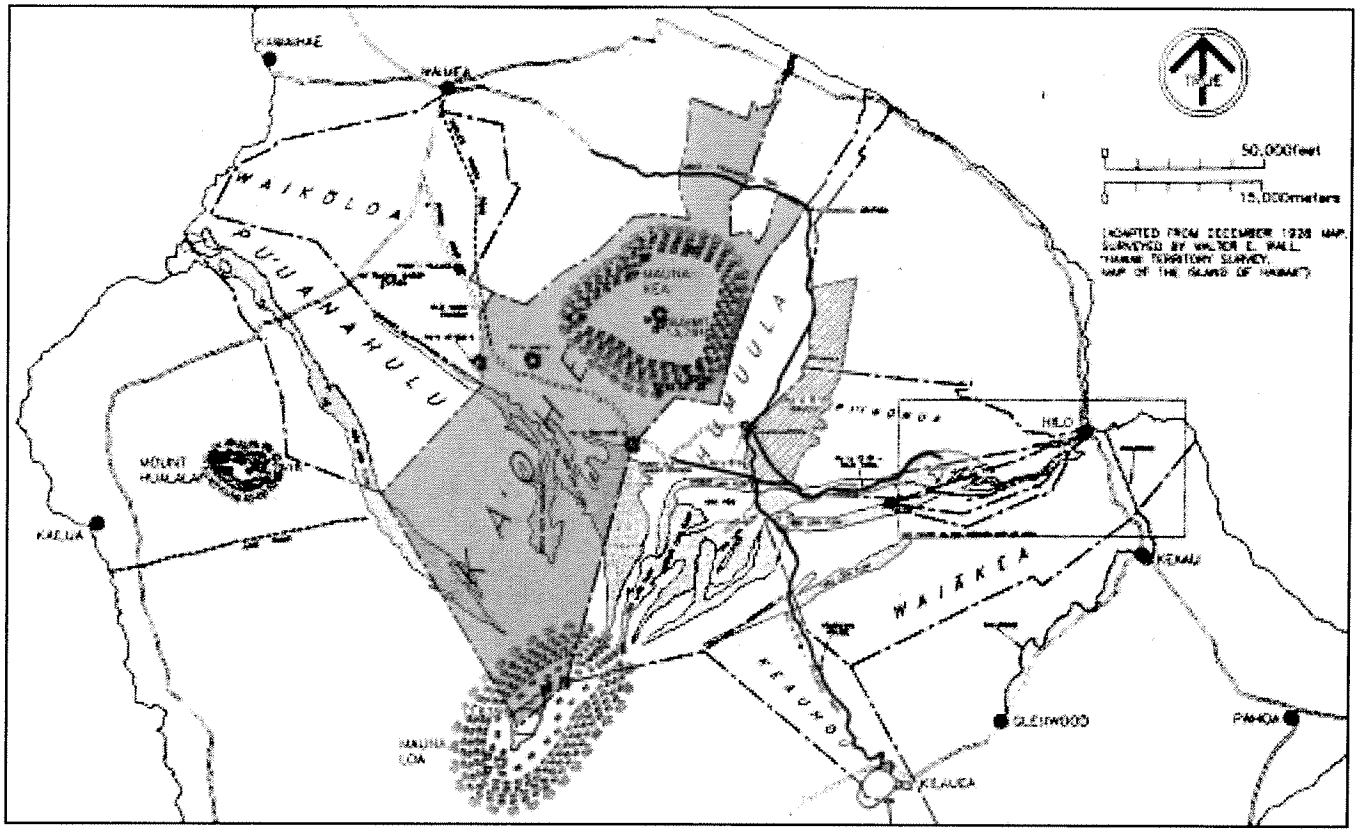
worked the stone to form refined tools in shelters and workshops they had built. Different areas were designated for chipping, rough-finishing, and fine-finishing. *Māmane* wood was preferred for adze handles. In addition to the quarrying of adze basalt, craftsmen also collected volcanic glass and dunnite/gabbro for cutting tools and octopus fishing gear sinkers (McCoy, various and Maly, 1999). Further down the mountain, near a spring, the adze makers erected shelters from which they would gather water, wood, and food to sustain them as they worked in the quarry. (PHRI, 1997) Remnants of shelters, shrines, adze manufacturing, food and offerings remain today to tell of these early craftsmen. The adze makers are thought to have come from neighboring areas and the adzes they crafted were widely used. Keanakāko'i was an active place for hundreds of years, with intensive use after AD 1400 and eventual decline prior to Western contact.

Following the long period of initial settlement, an era of high culture ensued. The Hawaiian society advanced in all areas from the 1200s until the late 1700s. During this time political powers exerted their might and the structure of communities was refined. (Kanahele and Kanahele, 1997)

In the beginning of the 1600s, during the time of Umi, the Hawaiian Islands were divided into political regions. The larger islands (*mokupuni*) were divided into districts (*moku*). The *moku* were divided into *ahupua'a* and large *ahupua'a* were divided into *'ili*. *Ahupua'a* were often entire valleys spanning from the top of the mountain ridge to the ocean. The *konohiki* managed the day-to-day operations of the *ahupua'a* with the aid of *luna* who were experts in various fields such as planting and fishing. Each *ahupua'a* contained nearly all of the resources Hawaiians required for survival from fresh water, plants, and a variety of animals, and was managed so that these resources could be sustained over time. (The Ahupua'a, 1994)

The *ahupua'a* of Ka'ohe spans the summit of Mauna Kea and includes the Mauna Kea Science Reserve (Figure V-1). The lower slopes of Mauna Kea reach into the *ahupua'a* of Humu'ula and Ka'ohe. Hawaiians hunted and gathered in Mauna Kea's *māmane* forests which were rich with vegetation and native birds including the *'ua'u* (dark-rumped petrel), *nēnē*, and *palila*. So prized were the plump young *'ua'u* that they could be eaten only by the *ali'i*. Hawaiians came to the *koa* and *'ōhi'a* forest on the mountain's lower slopes to gather wood for canoe-making and to collect bird feathers. Above the *koa* forests was the open *māmane* forest where they may have hunted *'ua'u* and *nēnē*.

All aspects of Hawaiian life were steeped in ritual. For the Hawaiian people, spiritual beliefs, cultural practices and all facets of daily life were intricately bound to the natural landscape of the islands. The lake, Wai'au, was believed to contain pure water associated with the god Kāne and was used in healing and worship practices. Archaeologist Pat McCoy suggests that shrines located at the edge of the summit plateau may mark the transition to a spiritual zone associated with the summit of Mauna Kea (McCoy and McEldowney, 1982). The shrines may be associated with the snow line and thus



Source : PHRI, 1997, Archaeological Inventory Survey and Historic Traditional Cultural Assessment for the Hawai'i Defense Access Road A-AD-6(1) and Saddle Road (SR 200) project

represent shrines to Poli'ahu and/or other deities. Hawaiians also buried the bones of their dead on the slopes of Mauna Kea.

Archaeology and Ethnographic Research

What we know today of Mauna Kea's ancient use and meaning we have learned from the physical clues left behind on the mountain. Ethnographic research explores more recent human activity and the traditions that have been handed down within families over time.

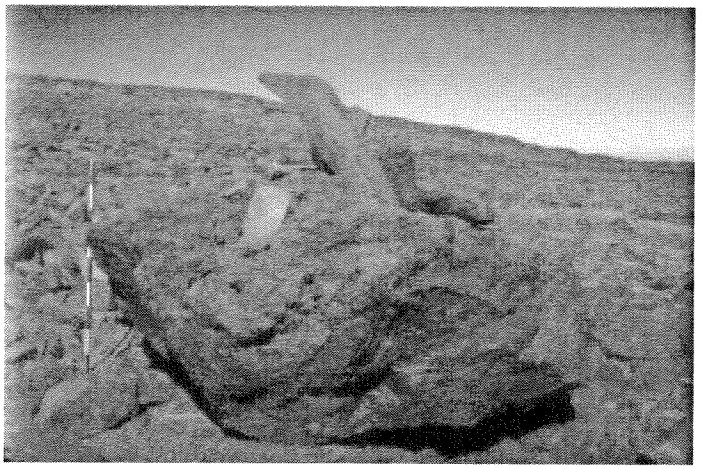
For the past two decades archaeologists have conducted extensive field work on the slopes of Mauna Kea, with access made much easier with the construction of a road to summit area. Approximately 3,000 acres, or 27 percent, of the Science Reserve has been surveyed to date (McCoy, 1999). Much of this archaeological work has been undertaken by Dr. Patrick McCoy, currently with the State Historic Preservation Division. McCoy and colleague Dr. Holly McEldowney have prepared an Historic Preservation Management Plan for Mauna Kea. As part of this plan, McCoy has inventoried and summarized the archaeological sites that provide a wealth of knowledge of past use of the mountain (McCoy, 1999) (Figures V-2 and V-3).

In addition to the archaeological field work, several individuals have recently conducted ethnographic studies concerning Mauna Kea. Their research is summarized here.

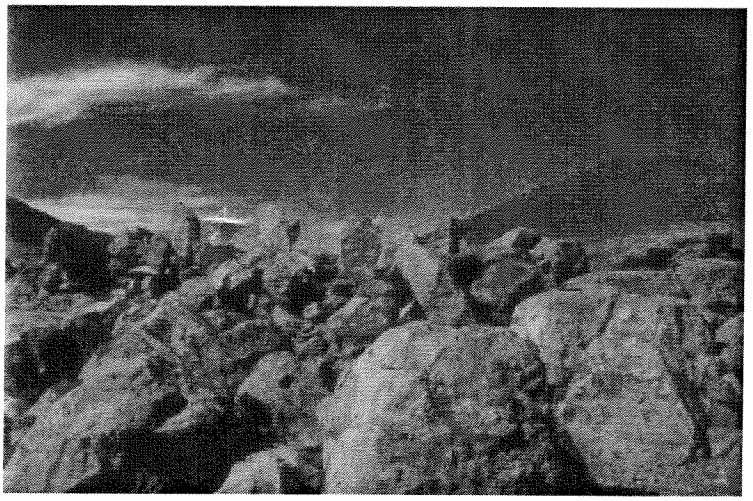
Dr. Charles Langlas of the University of Hawai'i-Hilo worked with Paul H. Rosendahl, Ph.D., Inc. to prepare an Archaeological Inventory Survey and Historic and Traditional Cultural Assessment for the Hawai'i Defense Access Road A-AD-6(1) and Saddle Road (SR 200) Project (1997). Pualani and Edward Kanahele prepared a Social Impact Assessment of Indigenous Hawaiian Cultural Values for this same project (1997).

In association with the preparation of this Master Plan, cultural specialist Kepā Maly conducted an oral history interview and archival research effort in the later part of 1998 to compile the thoughts and memories that those living today have of Mauna Kea (Maly, 1999). Maly interviewed 22 individuals and structured his research into broad groupings that are helpful in organizing the often generalized feelings that individuals have toward Mauna Kea.

McCoy summarizes the most recent archaeological work within the Mauna Kea Science Reserve. Based on field work undertaken between 1975 and 1997, a total of 93 archaeological sites have been identified in surveys covering approximately 3,000 acres within the larger Science Reserve, including the immediate summit ridge areas. These sites tell us much about the history of man's association with Mauna Kea. Of the 93 sites, 76 are shrines, four are adze manufacturing workshops, and three are markers. One burial has been positively identified and four other possible burial sites exist. The function of five of the 93 sites is unknown. (McCoy 1999)

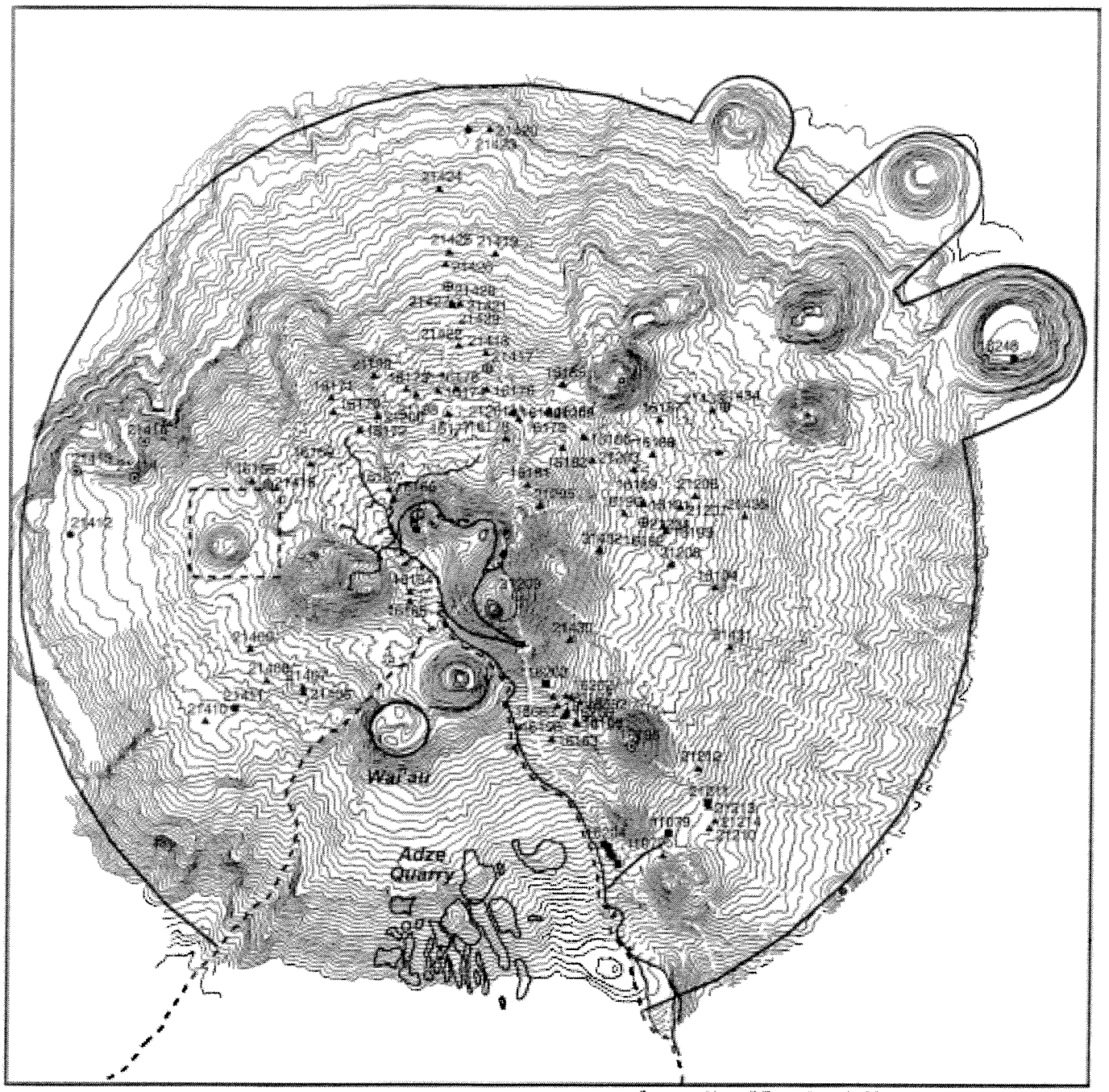






Archaeological Site Examples

Photos: Pat McCoy



Source: Hawaii Department of Land and Natural Resources
Historic Preservation Division, February 1999

- Shrines
- Marker
- Unknown
- Workshop
- 25' Contour Intervals
- Natural Area Reserve

0' 2000' 4000' 8000'

NORTH

Archaeology Sites Map - Science Reserve

Mauna Kea Science Reserve
Master Plan

Figure V - 3
Page V - 6

Shrines

The term 'shrine' is used by McCoy to describe all of the religious structures that exist in the summit region of Mauna Kea. The most common of the archaeological features on Mauna Kea, shrines are characterized by the presence of one or more upright stones. The shrines at Mauna Kea range from single uprights to more sophisticated complexes with pavements and prepared courts.

The majority of shrines on Mauna Kea are located conspicuously on ridgetops or at breaks in the slope. It is not surprising that shrines were placed in prominent locations with commanding views of the landscape. Shrines have not been found on the tops of cinder cones.

McCoy suggests that each upright on a shrine may have stood for a separate god. The majority of uprights were made of angular slabs found in the glaciated area of Mauna Kea. These select stones were unmodified by their human gatherers and provided a place for the gods to inhabit when they were needed. Based on ethnographic information McCoy suggests that the pointed uprights might represent male gods and the flat-topped uprights, female gods.

Stone uprights were typically set in a crack in the bedrock and braced with a few stones. In other shrines, most notably those in the north and east slopes, uprights were set on the top of a boulder. In shrines dispersed throughout the summit area, stone uprights were set into low rubble heaps or piles of stones. In only a few cases, cairns were built to support the stone upright. Platforms were also built to support one or more uprights.

McCoy suggests that the shrines on Mauna Kea were erected for one of two, and possibly more, functions. Though they are not distinguished from each other by physical characteristics, the shrines can be classified as occupational or non-occupational in function. The eight occupational shrines are identified by the remains of specialized workshops and adze manufacturing byproducts.

The non-occupational shrines range in complexity from simple features with a small number of uprights to more complex structures with courts and larger numbers of uprights. Most of the shrines found on Mauna Kea have just 1 to 3 uprights, however, some have as many as 24 or 25 stone uprights. McCoy speculates that the simple shrines were built and used by small family groups and the larger, more complex structures were built and maintained by a priesthood. McCoy reasons that the larger number of uprights indicate a larger number of gods than most Hawaiians would probably have known. In addition, many of these more complex sites are isolated from the main areas of worship.

McCoy has interpreted the shrine complex in the summit region as evidence of an historically undocumented pattern of pilgrimage to worship the snow goddess, Poli'ahu, and other mountain gods and goddesses.

Adze Quarrying and Manufacturing

The main adze quarry, Keanakāko'i, is located within the Mauna Kea Ice Age Natural Area Reserve. The majority of the workshops and shrines associated with adze manufacturing are located near the main quarry. Four additional adze manufacturing workshops have been found in the Science Reserve across the Summit Access Road from the adze quarry. However, these workshops are of a different kind than those found in the adze quarry. Manufacturing byproducts such as flakes, cores, adze rejects, and hammerstones have been found at these workshops, however, no stone-tool quality raw material is found. Thus it is likely that adzes were flaked elsewhere and transported to these localities at a later stage of the manufacturing process. Each workshop has one or more shrines upon which adze byproducts were offered to the tutelary gods of adze making. McCoy has identified one of these workshops as the location of initiation rites for apprentice adze makers. (McCoy 1999)

Several of those interviewed by Maly have heard of or visited the adze quarry areas on Mauna Kea.

> Coco Hind recalls, "I went up once [to Mauna Kea], a long time ago, we went up to Lake Waiau. I remember feeling kind of weak when we got up there, and it was the thin air. I wasn't that old. We went up to Humu'ula and then we took horses. We rode horses up to Wai'au. I was with my father, my mother didn't go. My mother was afraid of horses, she wouldn't go near a horse."... "... we went up and dad showed us this...there were other people with us too, my uncle Allan and his son, and others. He showed us this place where there were *'ōpihi* shells all over and it was where daddy said that they used to rough cut the adzes and then bring them down and finish them up, down below..." (Florence La'i-ke-aloha-o- Kamālu "Coco" Vrendenburg-Hind, p. A-118 in Maly, 1999)

Trails and Access

In pre-contact times, it is suspected that travel to Mauna Kea was guided by individual knowledge of the landscape rather than by any distinct trails. It is possible that ridges were followed or that sources of water were known and visited along the way. Individuals going up the mountain likely visited the shrines erected by their family members to their gods. No evidence of pre-contact trails has been documented. (McEldowney, 1999)

Maly reports that by the later nineteenth and early twentieth centuries, trails were created and often traveled on horseback. The trails of Mauna Kea linked communities and cultural and natural resources together. To reach the summit, people left the near-shore and plains lands and traveled the mountain slopes to the summit. The trails ascend the slopes of Mauna Kea from nearly all of the major, and many of the smaller *ahupua'a* which lie upon Mauna Kea's slopes. Traditions pertaining to journeys on the mountain trails, and knowledge of Mauna Kea are still retained as important family history today. Mauna Kea's trails, as told of in the oral and written histories, are depicted on the

annotated interview map (Figure V-4). Significantly, many of these trails converge at Wai'au, in the Natural Area Reserve.

Interviewees told Maly of their elders travelling to Mauna Kea to worship in the summit region, gather water from Wai'au for healing practices, procure stone for adze making, and take individuals' ash remains to the summit area or to Wai'au for their return to the Earth. Teddy Bell describes one of the mountain trails to Wai'au.

> "And then we also went from Waiki'i" . . ."You go so far from Pu'u Lā'au . . . There used to be one pine tree forest. And from that reserve, there's a clump of pine trees. That's where they've got a lot of cones. From that pine trees, you look at Mauna Kea, the two sides, it's almost like a *pali* but wide. And then you right up through that hollow there, and you come up to Lake Waiau. Almost to the end of the *pali* on Mauna Kea." (Theodore "Teddy" Bell, Sr., p. A-128 in Maly, 1999) (This trail is indicated in Figure V-4 as K Waiki'i-Waiau trail.)

During the historic period, people have traveled the mountain for Territorial Forestry operations, ranching, hunting, and recreational activities. Lloyd Case describes game trails on the mountain.

> "You know one of the most amazing things, and I don't know if some of the old timers told you this. But a lot of these Hawaiian trails, a lot of them were used by the sheep, they became game trails after a while. The sheep would use some of these trails. Some of these trails we walked 'em, on the Kemole side, Pu'u Mali side. But a lot of them, they are still there, but you have to have a good trained eye to find 'em." (p. A-348 in Maly, 1999)

Burials

As was mentioned earlier, no shrines have been identified on top of cinder cones in the Mauna Kea Science Reserve. McCoy believes that these high and remote places were reserved for burying the dead. Although there are references to human burials on Mauna Kea in oral histories, only one burial site has been positively identified in the mountain summit area.

"To date the only positively identified human remains found in the Science Reserve are located at Site 16248 on the summit of Pu'u Makanaka (Fig. 1). Jerome Kilmartin, a surveyor with the United States Geological Survey, noted the presence of human remains on this prominent cinder cone in 1925." (McCoy 1999)

Four other sites within the Science Reserve have been identified as possible burials by McCoy.

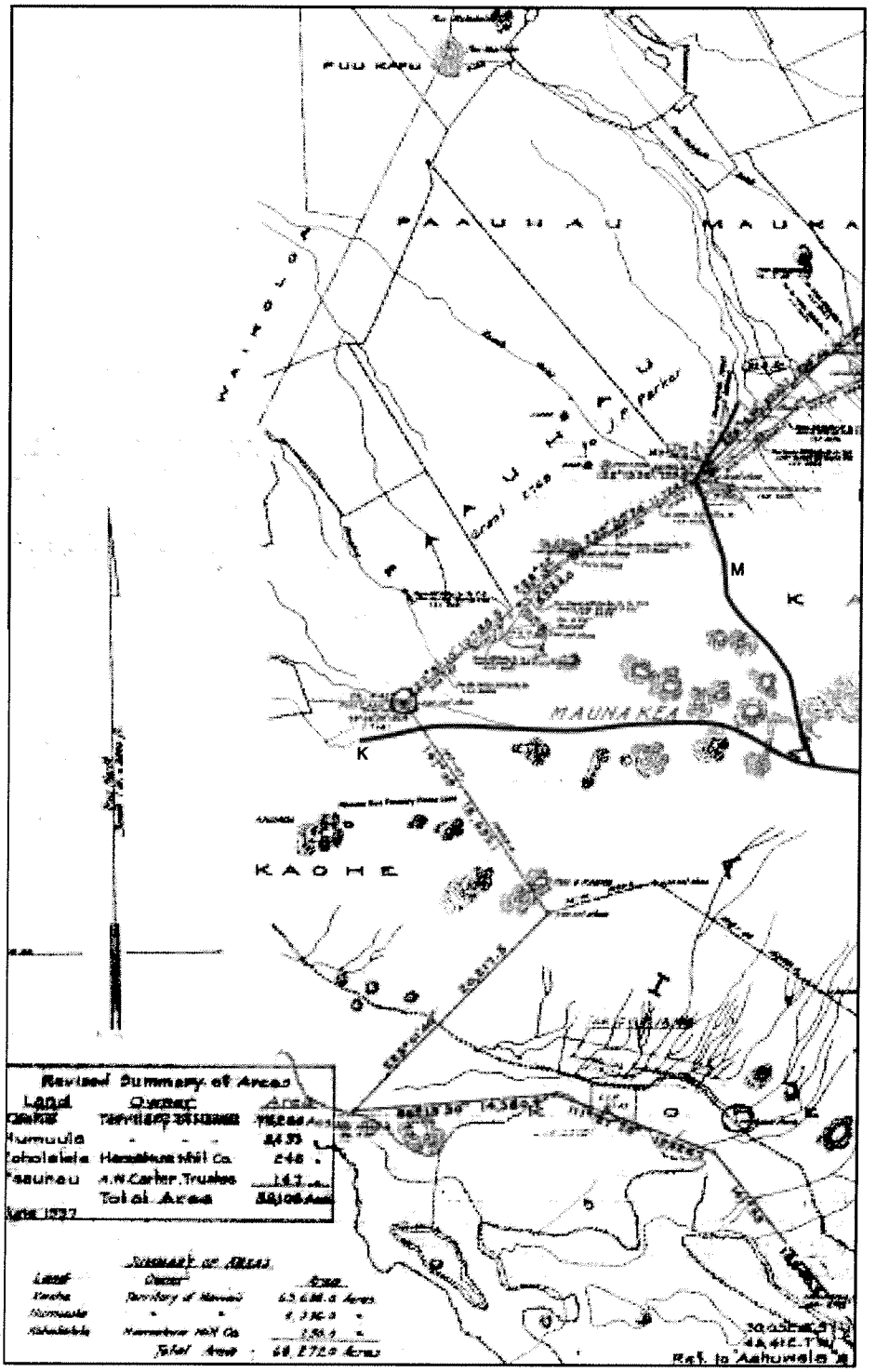


Figure 3. HFS Plat 613; March 1938 (State Survey Division) Annotated as Interview Map Showing Approximate Locations of Selected Sites Referenced During Oral History Interviews

Kumu Pono Associates Report No. HMMR-21 (925 PP)

Key to Sites Identified on Map
(Source = Mauna Kea Oral History Interviews):

A – Mauna Kea "Ka Mauna a Wākea" (the Mountain of Wākea), "Ka piko kaulana a ka 'āina" (The famous summit of the island); a sacred landscape.

B – Pu'u Kūlakahau'ula. The summit peak, a sacred landscape. Site of an adze, repository of piko, and site where ashes of deceased are returned.

C – Pu'u Poli'ahu. A sacred landscape.

D – Pu'u Līlīnoe. A sacred landscape.

E – Waiau. A sacred landscape, source of water used for ceremonial and healing rituals, and repository of piko.

F – Site of an adz site or cairn on which a piko was placed, and in which gourds with the names of early visitors to Mauna Kea were placed.

G – Monumental plaques commemorating the life of Elwin Low (placed in January 1994 – later removed by unknown individuals).

H – Mauna Kea-Humu'ula Trail.

I – Mauna Kea-Waiau Trail.

J – Keonehehe'e' (Kahuahaihai'i). A specific adze quarry site, and some outstanding mineral relics with associated quarries, caves and platform features.

K – Waikī-Waiau Trail (shown at approximate route).

L – Pepeiaholoholo. A sacred Landscape.

M – Waikahalulu-Komolo-Waiau Trail (shown at approximate route).

N – Pu'u Hākeakea and Kaupō. A sacred landscape.

O – Pu'u Kanahaunaua. A sacred landscape.

P – Pu'u Lua. A sacred landscape.

Other pu'u and natural features noted on map.

Sacred landscape indicates that a location is associated with one or more attributes, for example: (1) a Hawaiian god or goddess; (2) prayer and/or ritual observances; (3) traditional practices; and/or (4) interment of remains.

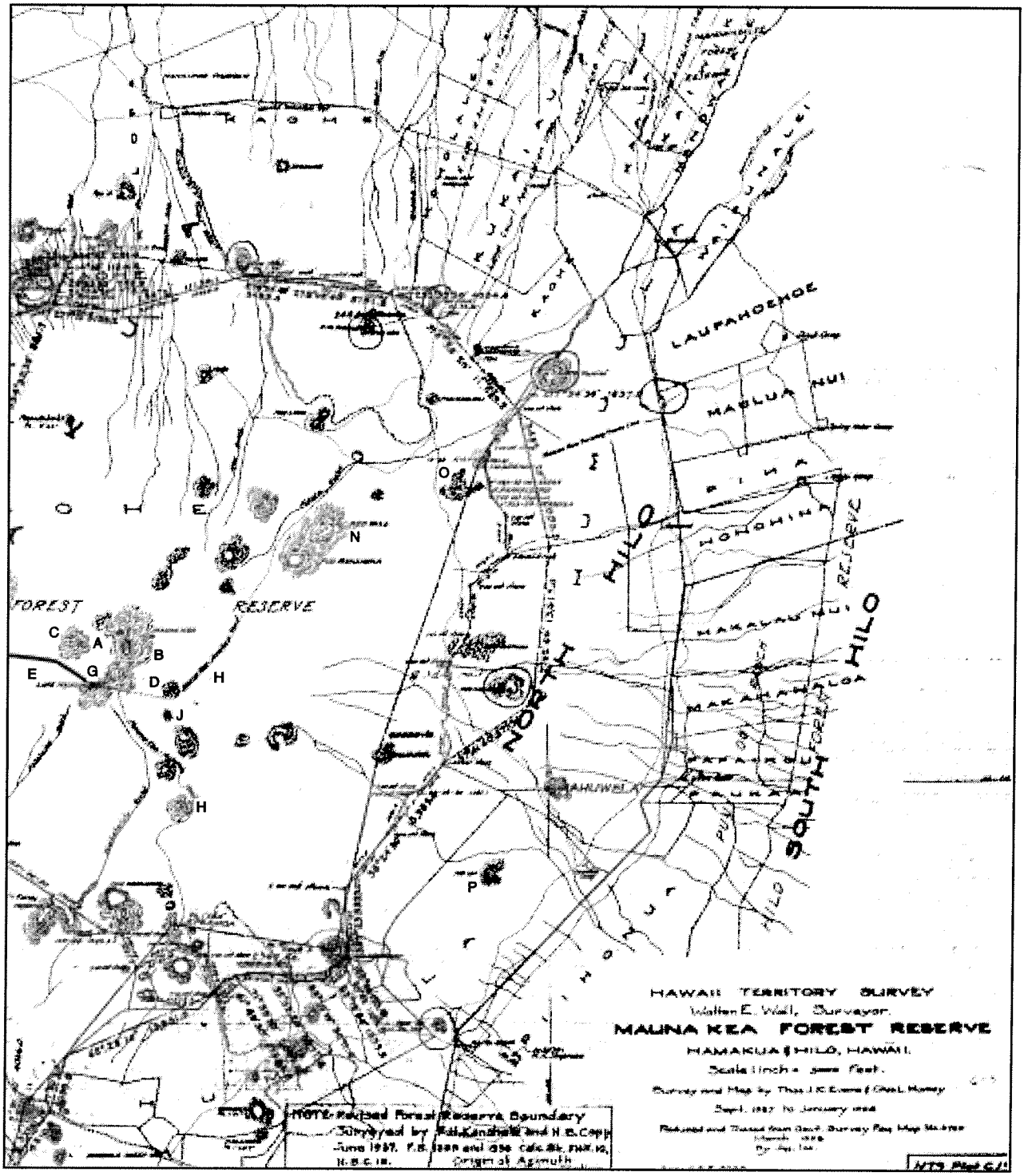


Figure V-4
Page V-11

> "There are four other sites in the surveyed areas of the Science Reserve that have been identified as possible burials (Sites 16195, 21413, 21414, and 21416). In each case there are compelling reasons to believe that the site is indeed a burial, but because human remains were not seen at the time the site was recorded it has been called a possible burial."

Of these four possible burial sites one consists of two adjacent cairns located on the eastern rim of Pu'u Līlīnoe. The other three are located on the southern and eastern rim of a large unnamed cinder cone on the northwestern edge of the Science Reserve. (McCoy 1999)

McCoy notes that archaeological sites have been found in all areas that have been surveyed to date but the distribution and density of the various types of sites follows certain patterns. The one burial and four possible burials have been found only on the tops of cinder cones and never with shrines.

While none of the individuals interviewed by Maly reported knowing of specific locations of burials in the immediate area of the Mauna Kea summit, many spoke of *ilina* (burial sites) in cinder cones, and other natural features in the region extending from about the 12,000 down to the 7,000 foot elevation. In modern times several family members or close friends of interviewees have had their cremated remains taken to the summit of Mauna Kea for release.

Summit Area

A significant pattern is the virtual absence of archaeological sites at the very top of the mountain. McCoy states that the "top of the mountain was clearly a sacred precinct that must, moreover, have been under a *kapu* and accessible to only the highest chiefs or priests."

Most of the shrines in the Science Reserve are found on the northern and eastern slopes just above and below the 13,000 foot elevation. This pattern suggest that most of those who journeyed to the summit area came from the Hāmākua and Hilo sides of the mountain. Discussing the scarcity of sites on the western and southwestern slopes, McCoy makes the following observations:

> "While the small number of shrines on this side of the mountain suggest the possibility of people coming from the Kona and South Kohala districts, the number would appear to have never been high. The implications are quite interesting. It suggests that while the mountain may have been viewed from a distance by people from everywhere on the island as a sacred mountain, in practice those who made the journey and worshipped there did not represent an even cross-section of the island populace. The implication is that access to the summit region was under the political control of the east Hawaii chiefdoms, a conclusion that is consistent with all of the other data." (McCoy 1999)

All of those interviewed by Maly attributed spirituality and healing qualities to being on Mauna Kea; and several recorded that they still go to Mauna Kea for prayer and restoration. One described Mauna Kea as a sanctuary in ancient times. The area above the forest line was so sacred that once in the upper region, your enemies could not pursue you. (Maly 1999)

In addition to the sites identified within the Science Reserve, a wealth of physical evidence can be found in the Mauna Kea Ice Age Natural Area Reserve, outside of the Science Reserve. Within the Natural Area Reserve, the main adze quarry and numerous sites at Wai'au tell of the activity in this geologically and culturally unique area. Many of these sites have been inventoried but have yet to be fully analyzed and related to the other sites found on the mountain.

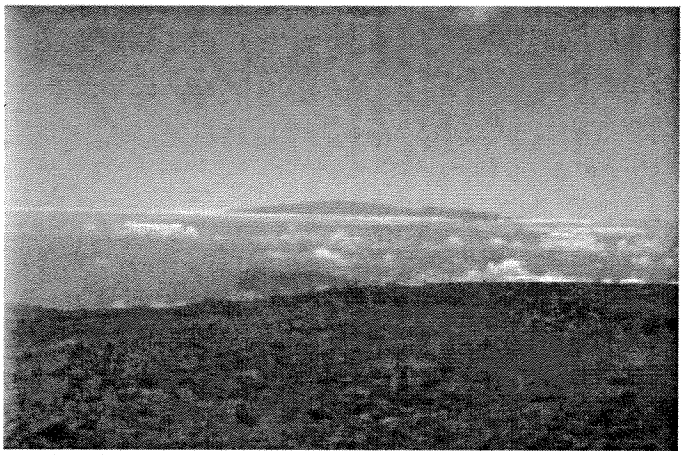
Cultural Landscape

The summit of Mauna Kea has been referred to as *wao akua* (region of the gods). The most common understanding of *wao akua* is that it was a remote desolate location where spirits, benevolent or malevolent, lived and people did not live. Usually these places were deep interior regions, inhospitable places such as high mountains, deserts and deep jungles. These areas were not necessarily *kapu* but were places generally avoided out of fear or respect. Different people and family had different protocols when they traveled through these remote regions. (George Atta personal communication with Holly McEldowney and Pat McCoy, June 2, 1999)

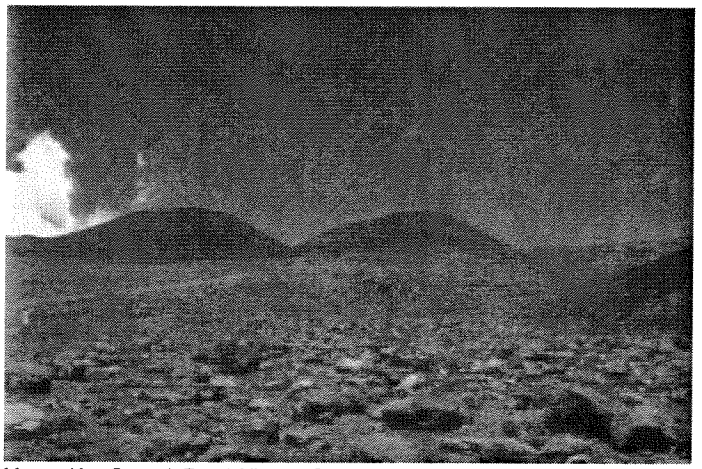
"Perhaps as a result of its prominence, isolation, and extreme environmental conditions, Mauna Kea's place in the culture and history of the Hawaiian people is significant. This 'cultural significance' extends beyond a physical siting, sites or particular features which have been previously identified in archaeological site studies. Mauna Kea is a prominent feature on the cultural landscape of Hawai'i which has been and continues to be, viewed from afar, and to which spiritual and cultural significance is attributed." (Maly, 1999, p. 3)

The ancient saying "Mauna Kea kuahiwi ku ha'o i ka mālie" (Mauna Kea is the astonishing mountain that stands in the calm) (Pukui 1983: No. 2147), expresses the feeling that Mauna Kea is a source of awe and inspiration for the Hawaiian people. The mountain is a respected elder, a spiritual connection to one's gods. Thus, the landscape can be interpreted as a significant facet of a Hawaiian's identify. Mauna Kea is the focal point of numerous traditional and historical Hawaiian practices and narratives recorded by both native Hawaiians and foreign visitors. Views of the mountain landscape are presented in Figure V-5.

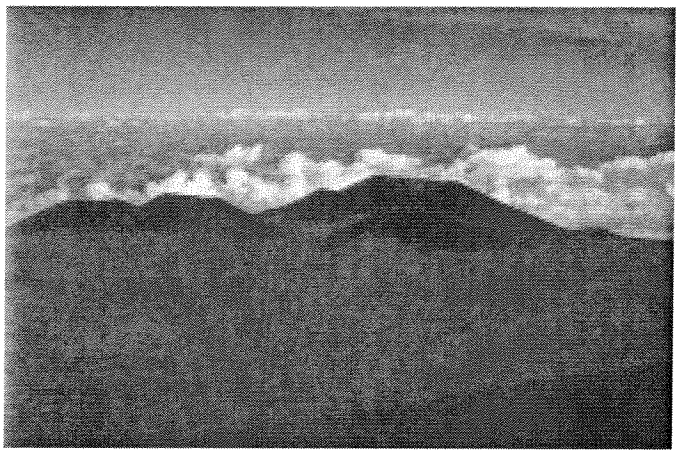
"A number of place names recorded for this mountain landscape are associated with Hawaiian gods. Other place names are descriptive of natural features and resources, or document events that occurred on the mountain." (Maly, 1999) "Native families also



View from SMA Road, Haleakalā in background (Photo: Group 70)



Mauna Kea Summit Road, View to Summit Area (Photo: Group 70)



Summit Plateau Cinder Cones (Photo: Pat McCoy)

retain names such as Maunakea, Poli'ahu, Lilinoe, and Wai'au, which in some cases are directly tied to the mountain landscape." (Maly, 1999)

The Kanaheles (1997) tell of Mauna Kea as the *piko* or origin point for the island of Hawai'i, and specifically the northern half of the island. Mauna Kea is, therefore, a place of great *mana*. Kanahele has also said that the three *pu'u*, Poli'ahu, Līlīnoe, and Wai'au are named for three sister goddesses who are female forms of water. Poli'ahu is embodied in the snow, Līlīnoe in mist, and Wai'au in the lake. These *pu'u* are where the goddesses manifest themselves. Of these three landforms two, Poli'ahu and Līlīnoe, are located in the Science Reserve. Wai'au is located in the Natural Area Reserve (Figure V-6).

Many of those interviewed by Kepā Maly expressed the significance Mauna Kea holds for them as Hawaiians and as individuals.

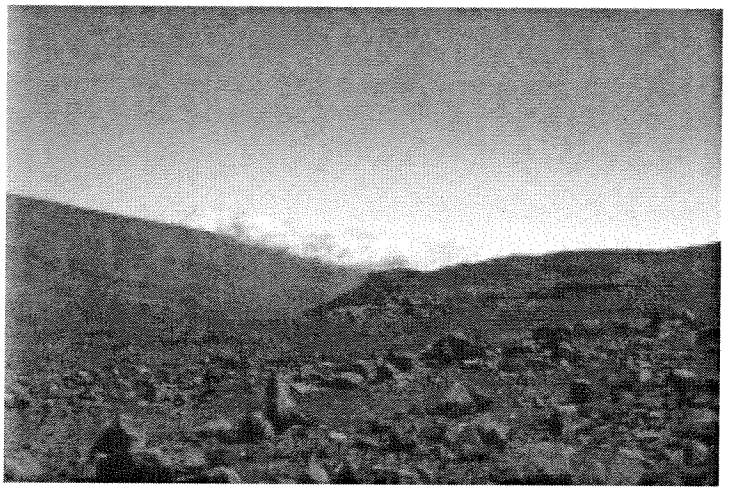
John Speilman and Pualani Kanahele describe Mauna Kea in the context of the entire Island of Hawai'i and in Hawaiian ancestral history.

> "And I think too, what is important to understand and for people to realize is that it is all connected. Although we are talking about Mauna Kea, Mauna Kea and Paniau are connected. When you go fishing from Paniau, you look up to Mauna Kea and you check out the weather. You look to the mountain and see what the weather patterns are doing. The Kohala mountains. So the fishermen use the mountains as visual aids to help them in their fishing. And perhaps, I don't this as much, but from the mountain side down, but I would imagine that the farmers and the people that lived higher, would look down to the ocean to see if the weather was changing, the cloud patterns on the ocean. It's all connected. It is not separate. But Mauna Kea, I think, is the focal point of this island. It is the *piko*, the breath . . ." (John K. Spielman, p. A-282 in Maly, 1999)

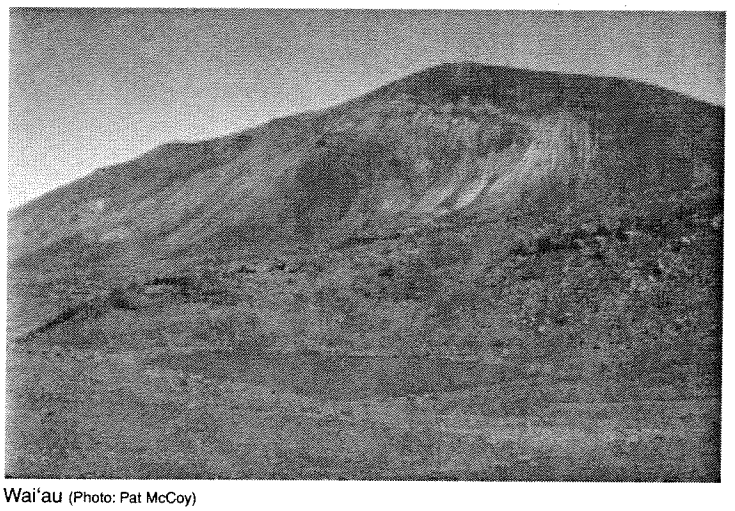
> "Mauna Kea was always *kupuna* [an elder, ancestor] to us. Mauna Kea and Mauna Loa, the tips, they were always *kūpuna* [elders, ancestors]. and there was no wanting to go on top. You know, just to know that they were there was just satisfying to us. And so it was kind of a hallowed place that you know is there, and you don't need to go there. You don't need to bother it. But it is there, and it exists. And it was always reassuring because it was the foundation for our island." (Pualani Kanaka'ole Kanahele, p. A-366 in Maly, 1999)



Adze Quarry (Photo: Group 70)



Adze Quarry (Photo: Group 70)



Wai'au (Photo: Pat McCoy)

Alexander Lancaster and Tita Spielman relay the significance of Mauna Kea to each of their families.

> "Yes, my grandmother Alice. Her Hawaiian name is Kamahalo – she was named after her grandmother, my great, great, great grandmother. She said " When you go up there, you going feel the spirit." And you do feel the spirit." (Alexander Kanani'alika Lancaster, p. A-234 in Maly, 1999)

> Regarding her family's relationship to Mauna Kea, Spielman explains, "Well, it was through my mother, because of course, she grew up in Kohala and spent a lot of time there. And at Pu'u Wa'awa'a and Kiholo, and always loved Mauna Kea. She used to say 'That's my mountain.' And so we got to know it and love it as we do." ("Tita" Elizabeth Kauikeōlani Ruddle-Spielman, p. A-265 in Maly, 1999)

Teddy Bell and Lloyd Case relay their own personal feelings about Mauna Kea.

> "On the slopes of Mauna Kea, there is a ridge there called Pu'u Nānā. Pu'u Nānā, if it's a clear day, you can see all of this Waimea. So that's where I want my ashes to be scattered." Theodore "Teddy" Bell Sr., p. A-139 in Maly, 1999)

> "Because the one thing I loved about it was just going up there and sitting down under the tree and looking out at space. Looking at everything. That is the most rewarding thing that I ever can say happens to me. When I go up there, it just heals me. That is a place for healing . I come back a different person." (Lloyd Case, p. A-353 in Maly, 1999)

A gentleman interviewed by Langlas was taught by his great-grandparents that there were two sites of ritual importance on Mauna Kea, the summit peak and the lake and surrounding *pu'u* Wai'au. According to this individual, the summit peak was a place to go and pray to the gods for *mana*, to cleanse the person and give him health.

Wai'au is a place of tradition and a source of inspiration. Located outside the Science Reserve in the Natural Area Reserve, Wai'au is a focal point for many visitors to the mountain. Many of the individuals interviewed by Kepā Maly discussed their own visits or visits by family members to Wai'au.

> "It [Mauna Kea] brings back memories, you know. But way back, people never used to go up there. They never did go to Mauna Kea except on horse back, and that was very few. And right at Lake Waiau, had a bottle there. Whoever went up, would write their name and the date, and put it in the bottle." . . ." Yeah. So, I don't know what happened to that bottle. My first trip to Mauna Kea was in 1934. And there were a few peoples

> names in that bottle already." (Theodore "Teddy" Bell Sr., p. A-123 in Maly, 1999)
>
> Kepā Maly, "And you mentioned that Waiau was a favorite place [of your grandfather Eben Low]." Tita Spielman, "A very favorite place. Yes, and that's why his plaque was put there. Because that was one of his favorite places. Although, his ashes were scattered at the top, the plaque was put at Waiau." ("Tita" Elizabeth Kauikeōlani Ruddle-Spielman p. A-270 in Maly, 1999)

In addition to feelings of *aloha* expressed for the place, numerous oral traditions of the importance of Wai'au have been handed down through families.

> Kepā Maly, "So he [your father] would go *mauka* to Waiau and gather water there?" Anita Lancaster, "And he would bring it, and he had my mom and I drink that water. And if we had it for a week, it never went into the refrigerator, it stayed on the counter, but it was always cold. And that was the sweetest water. It was so pure. I thought nothing of it because I was so young. But as I grew older, I would always remember it because my dad always had this gallon hanging, you know when he didn't go hunt, the gallon was always hanging in the house. In fact, the last time I saw it was just before he died, and then I don't know what happened to the gallon..." (Anita Leilani (Kamaka'ala) Landcaster, p. 245 in Maly, 1999)
>
> "The water they used...the *lā'au lapa'au*, the healers went to this particular place, and another place in the Kohala mountains, there is another spring up there which Papa Auwae uses." . . . "So, I've heard of the old ones getting water from Waiau to use for healing. (Lloyd Case, p. A-353 in Maly, 1999)
>
> "And so here, within the Mauna a Wākea, sits this *'apu wai* [water container] which is Waiau. What they are calling Lake Waiau. And as it hasn't had a chance to come down to the rest of us, then it is sacred water, like the water that is in the piko of *lau kalo* [taro leaf], and the water that is found in the *'ohe* [bamboo – interpreted as the meaning of the *ahupua'a* name Ka'ohe, within which the summit of Mauna Kea and Waiau are situated]. And the water that is found also in the *niu* [coconut]. So you have all of these different, sacred waters, but to me, that water, Waiau, is the most sacred because it isn't the water that has been spilled, it is still up there in the realm of Wākea.". . . "The most sacred of all the waters." (Pualani Kanaka'ole Kanahele p. A-368 in Maly, 1999)

In ca. 1881, Dowager Queen Emma ascended Mauna Kea on a journey of spiritual and physical well-being. At the time, Queen Emma was in competition with David Kalākaua

for the position of ruling chief for the Kingdom of Hawai'i. Each of the two embarked on journeys to prove their connection to the senior line and connect back to a *wahi pana* (a sacred physical place). Emma went to the top of Mauna Kea to bathe in the waters of Wai'au, and cleanse herself in the *piko* of the island. (Kanahele and Kanahele, 1997)

For some, Wai'au has a special family tie. "...Hawaiian members of the Lindsey family have a tradition of taking the *piko* of their children to Wai'au and the summit of Mauna Kea.". "Other interviewees who had not heard of the practice of taking *piko* to Mauna Kea all felt that it was likely to have occurred, and they shared similar stories from their own families of the custom at various localities." (Maly, 1999)

Kanahele explains the importance of this tradition of taking the *piko* to a particular place.

> "I don't personally know any families [who took the *piko* to Waiau]. I know that people took *piko* there, I just don't know who." . . . Well, the *piko* is that part of the child that connected the child back to the past. Connected the child back to the mama. And the mama's *piko* is connected to her mama, and so on. So it takes it back, not only to the *wā kahiko* [ancient times], but all the way to *Kumu Lipo*." . . . "So, it's not only the *piko*, but it is the extension of the whole family that is taken and put up in a particular place, that again connects to the whole family line. And it not only gives *mana* or life to the *piko* and that child, but life again to the whole family." (Pualani Kanaka'ole Kanahele p. A-368 in Maly, 1999)

The Physical Planning Guide (Section IX) incorporates the information gained from interviews, ethnographic, research, and archaeology studies to determine areas recommended for preservation. The Management Plan (Section X) uses this same information in making recommendations for the establishment and operation of a local management authority.

The First European Contact to the Islands

As evidenced by the archaeological evidence and though oral histories, Hawaiian adze-making and worship at Mauna Kea continued through the 1700s.

In 1778, the first foreigner arrived in Hawai'i. In the decades that followed, life in Hawai'i changed dramatically with the introduction of new technologies, religion, diseases, animals, and industry. The population of Hawaiians was decimated by the effects of diseases that had never been seen before in the islands. Port towns such as Kailua, Kealakekua and Hilo developed into commercial centers accommodating Western ships. Adze quarrying on Mauna Kea ceased to exist as stone adzes were soon replaced by metal tools after European contact.

In the late 1700s and through the 1800s several Europeans led expeditions to Mauna Kea. The names Goodrich, Baldwin and Alexander are well-known to students of the

mountain. Their maps and documents are the earliest written descriptions of Mauna Kea. Early in the 20th Century, the Board of Agriculture and Forestry designated the Mauna Kea Forest Reserve.

In 1793 the first cattle were brought to Hawai'i and offered by Captain George Vancouver to King Kamehameha. By the early 1800s more cattle had arrived and escaped to forested areas where, in the absence of natural predators, their populations multiplied (Juvik and Juvik, 1984). In addition to wild cattle, sheep and goats thrived on the mountain. In 1809, John Palmer Parker settled in Hawai'i and became friends with King Kamehameha I. The king placed Parker in charge of the wild cattle. With a land grant from King Kamehameha III in 1845, Parker established a ranch, Parker Ranch, which has been in continuous operation until the present. Other ranches also operated in the mid-1800s, however, much of the cattle and sheep continued to run free on the mountain's slopes destroying the native vegetation. By this time, hunting had become a vital lifestyle for many island residents. Hunters continued to pursue the animals for their hides and meat which were consumed locally and bartered for goods from visiting ships.

After the decline in adze making on Mauna Kea, there was limited human activity on the mountain. On the lower portions of the mountain animals grazed and hunters pursued them. On the higher slopes a few Western explorers conducted expeditions up to the summit region. The next major phase of activity began in the early 1960s with the exploration of Mauna Kea as a potential site for astronomy observations.

The travel journals of the first Westerners to explore the mountain's summit region highlight some of the first information on the physical evidence of past activity. McCoy (1999) shares some of these earliest observations. The first documented trip to the summit of Mauna Kea was that of Reverend Joseph Goodrich in 1823. Later writings of this trip record some of the observations and thoughts about the summit region:

> "Rev. Joseph Goodrich, who, on this occasion, was unfortunately laid up with mountain sickness, had on 26th August, 1823, reached the summit of Mauna Kea. This is the first recorded instance of the ascent of this mountain, although Mr. Goodrich mentions that on reaching the top of one of the terminal cones that encircle the main plateau of Mauna Kea, he discovered a heap of stones, probably erected by some former visitor. Who this former visitor was is unknown, but he was probably one of the white men that in the early years of the nineteenth century got a living by shooting wild bullocks that roved on the side of Mauna Kea. It is very unlikely that any native had reached the top of the terminal cones on the summit, owing to being unprovided with warm clothing to resist the great cold and also to the fact that the natives had a superstitious dread of the mountain spirits or gods." (Macrae 1922)

An account of Alexander's journey in 1892 mentions the presence of a cairn at the top of a cinder cone:

> "Messrs. Muir and Alexander ascended the second highest peak on the northwest, overlooking Waimea, 13,645 height to continue their survey. In the cairn on the summit a tin can was found, which contains brief records of the visits of five different parties from 1870 to the present time, to which we added our own." (Alexander 1892)

Reflecting this notion, Ellis (1979) looked back to the travels of Goodrich and Blatchely, who ascended the peak about six months after Goodrich, and provided this description of Hawaiians' view of Mauna Kea.

> "The snow on the summit of the mountain, in all probability, induced the natives to call it Mouna-Kea (mountain white), or, as we should say, white mountain. They have numerous fabulous tales relative to its being the abode of the gods, and none ever approach the summit – as, they say, some who have gone there have been turned to stone. We do not know that any have been frozen to death; but neither Mr. Goodrich, nor Dr. Blatchely and his companion, could persuade the natives, whom they engaged as guides up the side of the mountain, to go near its summit." (Ellis 1979)

The early exploration of the summit region and the subsequent development of the astronomy industry on the mountain is detailed further in the Education and Research section of this report.

Cultural Practice Today

In their ethnographic work Maly, Langlas, and Kanahele and Kanahele describe some of the practices that individuals and families conduct on Mauna Kea today. Several of the individuals interviewed by Maly stated that "they still go to Mauna Kea for prayer and restoration". All interviewees attributed spirituality and healing qualities to being on Mauna Kea. (Maly, 1999)

Dr. Langlas interviewed a woman of the Poli'ahu line, meaning that Poli'ahu is one of her family's *'aumakua*. This family has designated an individual as their *kahu* for worship of Poli'ahu. This individual has constructed a shrine on Mauna Kea to worship Poli'ahu and has incorporated a stone given to her by the family. She considers the whole mountain to be sacred and feels that it is appropriate to worship anyplace on the mountain if one is spiritually guided there. Thus, worship should not be limited to traditional sites. The shrine placed by this *kahu* is not located in a traditional site but rather in a place that she was guided to.

Maly's interviewees also report of the practice of taking ash remains to the summit of Mauna Kea for release. Two of the individuals interviewed by Maly have instructed that upon their deaths, their ashes are to be taken to specific places on the slopes of Mauna Kea.

While the ethnographic research provides few accounts of actual cultural practices on the mountain, other individuals and groups may visit the mountain for worship on special occasions or on a regular basis. Many more carry with them an esteem and respect for Mauna Kea.

"In both its genealogical associations and its physical presence on the island landscape, Mauna Kea is a source of awe and inspiration for the Hawaiian people. In Hawaiian practice elders are revered – they are the connection to one's past – and they are looked to for spiritual guidance. Because of its place in the Hawaiian genealogies, Mauna Kea, the landscape itself is a sacred ancestor." (Maly, 1999, p. D-25) This is the spirit with which many view the mountain today.

Appendix F. Mauna Kea-Ka Piko Kaulana o ka ʻĀina (Mauna Kea—The Famous Summit of the Land)

Kumu Pono Associates LLC, 2005. Mauna Kea-Ka Piko Kaulana o ka ʻĀina (Mauna Kea—The Famous Summit of the Land); A collection of Native Traditions, Historical Accounts, and Oral History Interviews for: Mauna Kea, the Lands of Kaʻohe, Humuʻula and the ʻĀina Mauna on the Island of Hawaiʻi. Prepared for the Office of Mauna Kea Management. March 30, 2005.

"MAUNA KEA– KA PIKO KAULANA O KA 'ĀINA"

(MAUNA KEA–THE FAMOUS SUMMIT OF THE LAND)

A Collection of Native Traditions, Historical Accounts, and Oral History Interviews for: Mauna Kea, the Lands of Ka'ohe, Humu'ula and the 'Āina Mauna on the Island of Hawai'i

By

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&
Onaona Maly • Researcher

Prepared for

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March 30, 2005-b

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Kumu Pono Associates LLC
Historical & Archival Documentary Research · Oral History Interview Studies · Researching and Preparing Studies from Hawaiian Language Documents · Māhele 'Āina, Boundary Commission, & Land History Records · Integrated Cultural Resources Management Planning · Preservation & Interpretive Program Development

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Cover Photos

Portion of HTS Plat Map 701, depicting Mauna Kea and the ʻĀina Mauna.

No. 511. Kohatek (20 min 1-20-74). Courtesy of UH-Intitute for Astronomy.

Aerial View, Summit of Mauna Kea (1939). Photo No. 37382 A.C., in Collection of National Archives and Records Administration.

KPA-931. The Kalaiʻeha-Waiau Trail, through Keanakākoʻi.

KPA-3746. Altar at Keanakākoʻi, Mauna Kea.

KPA-4224. Naʻenaʻe (Raillardia) of Ka-houpo-a-Kāne, Mauna Kea.

KPA-2567. Mauna Kea in the Morning, View from the Waiākea-Piʻihonua uplands to the Summit.

KPA-3733. Ka-wai-hū-a-Kāne and Waiau, Mauna Kea.

KPA-S076. Mauna Kea viewed from the Mauna Loa Shrine on Puʻu Alaula.

Cowboys atop Summit of Mauna Kea, 1938. Courtesy of Rally Greenwell.

ACKNOWLEDGEMENTS

We wish to acknowledge here, the kindness of the *kūpuna* and *kama'āina* who graciously allowed us to record some of their histories that present and following generations may understand the paths that have been traveled to the present-day. The voices of these people help give life to the landscape. They remind us of our past, and give us clues as to how to behave and care for the *'āina mauna*.

The interviewees, a number of whom have since passed on, include:

John AhSan, Teddy Bell, Stephen Bowles, Howard Ellis, Rally and Pat Greenwell, Helen Hale, Jess Hannah, F.L. Coco and Robby Hind, Toshi Imoto, Kinoulu Kahananui, Pualani Kanaka'ole-Kanahele, Sonny and Daniel Kaniho, Elisabeth and Hisao Kimura, Rolf Peter Kudritzki, Pete L'Orange, AhFat and Barbara Lee, Kamaki Lindsey, Irene Lindsey-Fergerstrom (and family), Eva Lindsey-Kealamakia (and family), Martin Pence, Barbara Dorothy Phillips-Nishie, Phillips-Robertson, Elisabeth and J.K. Spielman, Walter Steiger, David and Leiana Woodside (with Ulalia Woodside), and Jiro and Marc Yamaguchi.

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John Cloud, Richard Cole, Bob Hansen, and Albert "Skip" Theberge of the National Oceanic and Atmospheric Administration General Library.

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M. Kanani Reppun of the Hawaiian Mission Children's Society Library.

Barbara Dunn of the Hawaiian Historical Society.

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EXECUTIVE SUMMARY

At the request of Stephanie Nagata, on behalf of the University of Hawai'i-Office of Mauna Kea Management, *Kumu Pono Associates LLC* undertook research, compiled a detailed collection of archival-historical records, and conducted oral history interviews with *kūpuna* and elder *kama'āina*, pertaining to the *ahupua'a* (native land divisions) of Ka'ohe, Humu'ula and neighboring *'āina mauna* (mountain lands) of Mauna Kea, on the island of Hawai'i. This work was undertaken as a part of on-going archival and oral historical research conducted by *Kumu Pono Associates LLC*, since 1996, and builds upon the accounts published by Maly in 1997, 1999, 2002, and 2003. The study is multifaceted, and includes detailed verbatim accounts and descriptions of Mauna Kea, the larger Humu'ula-Ka'ohe lands, and *'āina mauna*, covering the periods of Hawaiian antiquity and traditions, to first-hand accounts of travel on and around Mauna Kea, dating from the early 1820s to the 1960s.

One of the primary goals of this study has been to bring a significant collection of historical resource material, describing—native Hawaiian traditions, traditional and customary practices and beliefs; early descriptions of the landscape, land use, and access; changes in the environment; efforts at conservation of the mountain landscape; and the events leading to development of observatories on Mauna Kea—into one manuscript. Such a manuscript will provide readers with access to the diverse, and at times, difficult to locate, historical narratives that document the cultural landscape, and history of land use on Mauna Kea. It being believed that this information may in turn serve as a platform for informed discussions—in the field of cultural and historical resources—in planning for the future well-being of Mauna Kea as a cultural, natural, and scientific resource.

Because of the nature of the Hawaiian system of beliefs and land management, this study looks not only at the upper regions of Mauna Kea, but also at the lands which lie upon the slopes of Mauna Kea. In the traditional and historical setting, the people living on the lands which rested upon, or even viewed Mauna Kea, shared ties to the upper mountain regions as well. The historical records—including oral testimonies of elder *kama'āina* of the mountain lands—provide readers with detailed descriptions of traditional and customary practices; the nature of land use, and the types of features found on the mountain landscape; and early efforts in conservation on Mauna Kea and the adjoining *'āina mauna.* The descriptions of land use and subsistence practices range from antiquity to the 1970s, and represent the knowledge of generations of life upon the land.

It is important to note that in the summit region of Mauna Kea (from approximately 11,000 feet and above) and on the lower mountain slopes are found several features named for, or associated with Hawaiian gods and deity. These associations are indicators of Mauna Kea's place in the culture and history of Hawai'i as a scared landscape. With each part contributing to the integrity of the whole cultural, historical, and spiritual setting.

Through the collection of historical-archival texts and oral history interviews, we have found that a wide range of traditional knowledge and practices, including, but not limited to the following, are described for Mauna Kea and the adjoining *'āina mauna*:

- ***Mauna Kea***—though simply translated as "White Mountain" since at least 1823, the name, Mauna Kea is also known in native traditions and prayers as Mauna a Wākea (Kea), "The Mountain of Wākea." It is the first-born mountain son of Wākea and Papa, who were also progenitors of the Hawaiian race. Mauna Kea is symbolic of the *piko* (umbilical cord) of the island-child, Hawai'i, and that which connects the land to the heavens.

- ***Pu'u o Kūkahau'ula***[*], named for a form of the god Kū, where the *piko* of new-born children were taken to insure long life and safety. This practice is still participated in at the present time.
- ***Waiau***, named for the mountain goddess, Waiau (Ka piko o Waiau), and home of the *mo'o* (water-form) goddess Mo'o-i-nanea. Place where *piko* of newborn children were taken to ensure long life; and from which *"ka wai kapu o Kāne"* (the sacred water of Kāne) was collected. These practices are still participated in at the present time.
- ***Pu'u Poli'ahu***[**] and ***Pu'u Lilinoe***, named for, and the abode of goddesses of Mauna Kea.
- In 1823, the first missionary party to visit the summit of Mauna Kea learned from the natives that it was "the abode of the gods," and none could be induced to travel to the summit (Goodrich in Ellis, 1963:292).
- *Heiau* and *'ahu*—ceremonial sites, shrines, and places where *mele* (chants) and offerings were presented.
- *'Ahu*—stone mounds as land markers.
- *Ana* and *lua kā ko'i* (caves and quarries from which stone was harvested for making tools).
- *Ilina* (burial features) extending from the summit to the lowlands. Specific mention is made in several important historical accounts—recorded by both native witnesses and non-Hawaiians—of the presence of burials in the *pu'u* and summit plateau of Mauna Kea. The remains of individuals who share ties to Mauna Kea are still taken to the various *pu'u* on Mauna Kea for interment.
- Native trails—portions of which, on the ascent to the summit, and around the base of Mauna Kea, are overlaid by modern routes of access.
- Shelters and habitation caves.
- Resource collection sites.
- Later features, dating from the middle 1800s, including pens—such as ***Kulaka***, on Humu'ula above Pu'u 'Ō'ō; and ***Aiakala***, in Ka'ohe, above the Pu'u Nanahu section of the mountain—walls and fence lines.
- Stone and wooden houses.
- Water collection and storage facilities;
- Bird hunting blinds—in the form of single, double or tri-sided stone walls; former garden plots; and other ranch "support" features.

Another facet of this study, was a review of native lore associated with traditional knowledge of the heavens. While we have uncovered no specific archival references to native astronomy on Mauna Kea, the association of the gods and deities whose forms are seen in the heavens and whose names are commemorated at locations on Mauna Kea is significant. We have found, that as is the case in all areas of Hawaiian life, the traditions, customs and practices associated with the *'oihana kilokilo* (astronomy) and *kilo hōkū* (observing and discerning the nature of the stars) were deeply tied to the spiritual beliefs of the Hawaiian people. The stars are physical manifestations of the gods who created the heavens, earth, and humankind, or are body-forms granted to select individuals or beings of nature (Malo, 1951 and Beckwith, 1951). The combined writings of native and foreign historians on this subject—recorded between the 1830s to 1935—provide us with a list of more than 270 Hawaiian names for stars (not including alignments of stars which marked the heavens and pathways of traditional navigators).

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[*] The name Pu'u o Kūkahau'ula is the traditional name of the summit cluster of cones on Mauna Kea, appearing in native accounts and cartographic resources until ca. 1932. The recent names, Pu'u Wekiu, Pu'u Hau'oki and Pu'u Haukea, have, unfortunately been used since the 1960s (since the development of astronomy on Mauna Kea), and have displaced the significant spiritual and cultural values and sense of place associated with the traditional name, Pu'u o Kūkahau'ula.

[**] The place name Poli'ahu, was recorded in native texts (cf. Kamakau, 1961 in this study), and as a part of Boundary Commission proceedings in 1873 (in this study); it was also widely documented as the name of the primary goddess of Mauna Kea. The specific usage of the place name "Puu Poliahu" (also referred to as Peak A), was apparently given to the present-day location in 1892, by W.D. Alexander, commemorating the goddess, Poli'ahu, (cf. Alexander and Preston, 1892-1893, in this study).

Also, of importance in discussions regarding modern astronomy on Mauna Kea, the narratives cited in this collection provide readers with first-hand accounts—from archival documents and oral history interviews—of the early days of astronomy on the mountain, including the thoughts and recommendations of the pioneer scientists, responsible agencies, and community members on the island of Hawai'i, in regards to use and limitations of Mauna Kea. An example of the kind of information recorded by the early scientists and community on the island of Hawai'i, between 1964 to 1980, was that development of telescope facilities on Mauna Kea should be carefully limited—by 1980, the recommended number being six observatories.

Historical Land Use on the Mountain Lands

As early as the 1820s, introduced cattle, sheep, goats, and wild dogs had made their way up to the mountain lands, and were bothersome to those who traveled the *'āina mauna.* In 1834, Scottish naturalist, David Douglas was killed by a wild bullock at Keahua-ai (now called Douglas Pit or Kaluakauka), near the boundary of Humu'ula and Laupāhoehoe. By 1850, the natural-cultural landscape of the *'āina mauna* was being significantly altered by the roving herds of wild bullocks, sheep and other ungulates, and ranching interests were being formalized in the region. In 1857, the Crown and Government mountain lands of Humu'ula and Ka'ohe—including the summit of Mauna Kea—were leased to Francis Spencer and the Waimea Grazing and Agricultural Company, which established ranching stations and operations around the mountain lands. Portions of the land of Pi'ihonua were leased to native bird hunters in the middle 1860s, and subsequently to native and foreign bullock hunters. As a result, Humu'ula and the larger *'āina mauna* have been intensively ranched for more than 150 years.

Because hunting, and subsequently ranching of bullocks, cattle and sheep were the primary historic activities on the mountain lands, areas once forested soon became open pasture land. While the first formal lease of Humu'ula and Ka'ohe was issued in 1857 (Keoni Ana to F. Spencer), it was Samuel Parker and Parker Ranch that held the longest lease on the Humu'ula and Ka'ohe mountain lands. In between 1900 to 2002, their leases extended around Mauna Kea to the Pu'u Huluhulu vicinity, and for a period, the leases also included portions of the 'Āina Hou lands. The Parker Ranch interests initially focused on sheep ranching in the Humu'ula-Kalai'eha section, but in 1964, the ranch terminated it's sheep program. Cattle operations were maintained till the end of the Parker lease in August, 2002.

Today, limited ranching of cattle is continued on the lands extending from Humu'ula to Hānaipoe, Pā'auhau, and the Parker Ranch lands—the Humu'ula section being worked under a permit by the Department of Hawaiian Home Lands, and leases from the State of Hawai'i. While the Humu'ula section is still partially grazed, some 6,000 acres between the Pu'u 'Ō'ō and Pu'uloa, have succumb to an infestation of the introduced gorse (first recorded on the land in 1892), which has had little maintenance since ca. 1980.

As early as 1831, portions of the land of Pi'ihonua Uka and neighboring forest lands were being worked by Daniel Castle, and later, by the Castle and Hitchcock brothers for lumber milling and bullock hunting operations. Subsequently by the 1860s, native lessees were granted the right of hunting in the Pi'ihonua uplands. Then in 1887, the *ahupua'a* of Pi'ihonua (everything from above Hilo Town to the upland boundary with Humu'ula) was leased to John Timoteo Baker, who undertook ranching operations in Pi'ihonua in the 1890s.

Prior to Baker's lease, the Puu Oo Ranch Station had been established, with its buildings developed as a part of the Humuula Sheep Station Company; this due to an error in locating the boundary between Humu'ula and Pi'ihonua. In 1896, the boundary matter was settled, and Baker maintained cattle and livestock ranching operations in the area. Baker sold his lease to W.H. Shipman in 1899, which was followed by the sale of a 40 acre parcel—the Pu'u Oo Ranch headquarters—in Patent Grant No. 8970, to W.H. Shipman. In 1902, Shipman secured leases on the lands of Pāpa'ikou, Makahanaloa and other Hilo District lands, which were incorporated into the Pu'u Oo ranching

operation. W.H. Shipman, Limited, sold its interest in the Pu'u 'Ō'ō parcel in the 1970s, and it remains in private ownership to the present day.

Early leases of the Ka'ohe mountain lands date back to 1857 (Keoni Ana to F. Spencer), and the operations of Francis Spencer's Waimea Grazing and Agricultural Company. The lease took in all of the mountain lands (to the summit of Mauna Kea), across Ka'ohe to its' Mauna Loa boundary. Activities were all tied to sheep and cattle ranching. Subsequently, in 1870, the lease was acquired by Parker Ranch, which held most of the Ka'ohe mountain lands until their removal in 1905 for the Mauna Kea Forest Reserve, and later withdrawals as a part of the Pōhakuloa Military installation in 1956 (Governor's Executive Order No. 1719; and Presidential Executive Order No. 1167). Portions of the land of Ka'ohe, generally those on the northern (Waimea) side of Mauna Kea, are still grazed by Parker Ranch. The land of Ka'ohe IV (the Pōhakuloa section), were turned over to the United States Army, and have been used for military training operations since that time.

The summit of Mauna Kea, situated in the *ahupua'a* of Ka'ohe, was noted as a site of importance for modern astronomical observations by the Pendulum Party of 1892. In 1964, the first modern observatory was built on top of Pu'u Poli'ahu. By 1965, the National Aeronautics and Space Administration (NASA) and the University of Hawaii initiated their program "*to exploit the exciting potentialities of the Mauna Kea site for astronomical purposes*" (cf. Newell to Hiatt, Feb. 16, 1965, in this study). In 1967, the University of Hawaii Institute for Astronomy was founded, and in 1968, the Board of Land and Natural Resources leased the entire summit of Mauna Kea to the University by Lease No. S-4191. While the practice and activities associated with astronomy on Mauna Kea represent the shortest of the periods of history and land use described in this study, its forty-one years (at the time of this writing) in the summit region of Mauna Kea, also represent the period of most significant changes in the natural and cultural landscapes on the mountain.

Archival Resources of the Present Study

Records cited—many as verbatim transcripts, allowing readers to understand the full context of the accounts as meant by the original authors—include native accounts translated from Hawaiian language sources; the records of Kingdom and Government agencies; journals of historic visitors; records of the lessees and ranching operations on the mountain lands; and narratives from scientific expeditions to Mauna Kea through the 1960s. There are also cited, a number of the early letters by participants in the development of astronomy on Mauna Kea, dating from 1963 to 1980.

Archival-historical resources were located in the collections of the Hawai'i State Archives, Survey Division, Land Management Division, and Bureau of Conveyances; the Bishop Museum Archives; the Hawaiian Historical Society; University of Hawai'i-Hilo Mo'okini Library; private family collections; the Parker Ranch & *Paniolo Preservation Society* (PPS) collections; the National Archives and Records Administration, and NOAA Central Library; the Houghton Library-Harvard; the USGS Central Library, Denver; the Hawaiian Historical Society; the Hawaiian Mission Children's Society Library; the Hilo Public Library; the Archives of the Institute for Astronomy; and in the collection of *Kumu Pono Associates LLC*. The oral history interviews cited in this study represent selected interviews conducted by Maly between 1999 to 2005, and reflect the recollections of elder native Hawaiians and *kama'āina* of lands of the *'āina mauna*. The interviewees ranged in age from their 60s to 90s, and in their stories they describe life upon the land, practices associated with travel and work on the mountain lands, and the early days of astronomy on Mauna Kea.

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INTRODUCTION

Background

At the request of Stephanie Nagata, on behalf of the Office of Mauna Kea Management, *Kumu Pono Associates LLC*[1] conducted research, compiled a detailed collection ofarchival-historical records, and conducted oral history interviews with *kūpuna* and elder *kama'āina*, pertaining to the *ahupua'a* (native land divisions) of Ka'ohe, Humu'ula and neighboring *'āina mauna* (mountain lands[2]) of Mauna Kea, on the island of Hawai'i (*Figure 1*). This work was undertaken as a part of on-going archival and oral historical research being conducted by *Kumu Pono Associates LLC*, since 1996, and builds upon detailed accounts published by Maly in 1997, 1999, 2002a & 2002b, and 2003. The study is multifaceted, and includes detailed verbatim accounts and descriptions of Mauna Kea, the larger Humu'ula-Ka'ohe lands, and *'āina mauna*, covering the period of Hawaiian traditions to first-hand accounts of travel on the *'āina mauna* and Mauna Kea, dating from the early 1820s, to the 1970s.

Through the detailed and extensive narratives, we seek to provide the University of Hawai'i; Native Hawaiians and other community members; planners; land and resource managers; and those interested in future plans and activities on Mauna Kea, and the larger *'āina mauna*, with access to a significant collection of documentation pertaining to the traditional, cultural, historical and natural assets of Mauna Kea and the *'āina mauna*. Many of the records reported herein, have not been previously known, or made available in their entirety. While future researchers will likely find more information, and be able to answer further questions about the traditions and history of Mauna Kea, we have sought to ensure that through this collection, readers and parties with responsibility for Mauna Kea, will have a solid foundation of traditional and historical knowledge to speak and work from.

Archival-Historical Research and Oral History Interviews

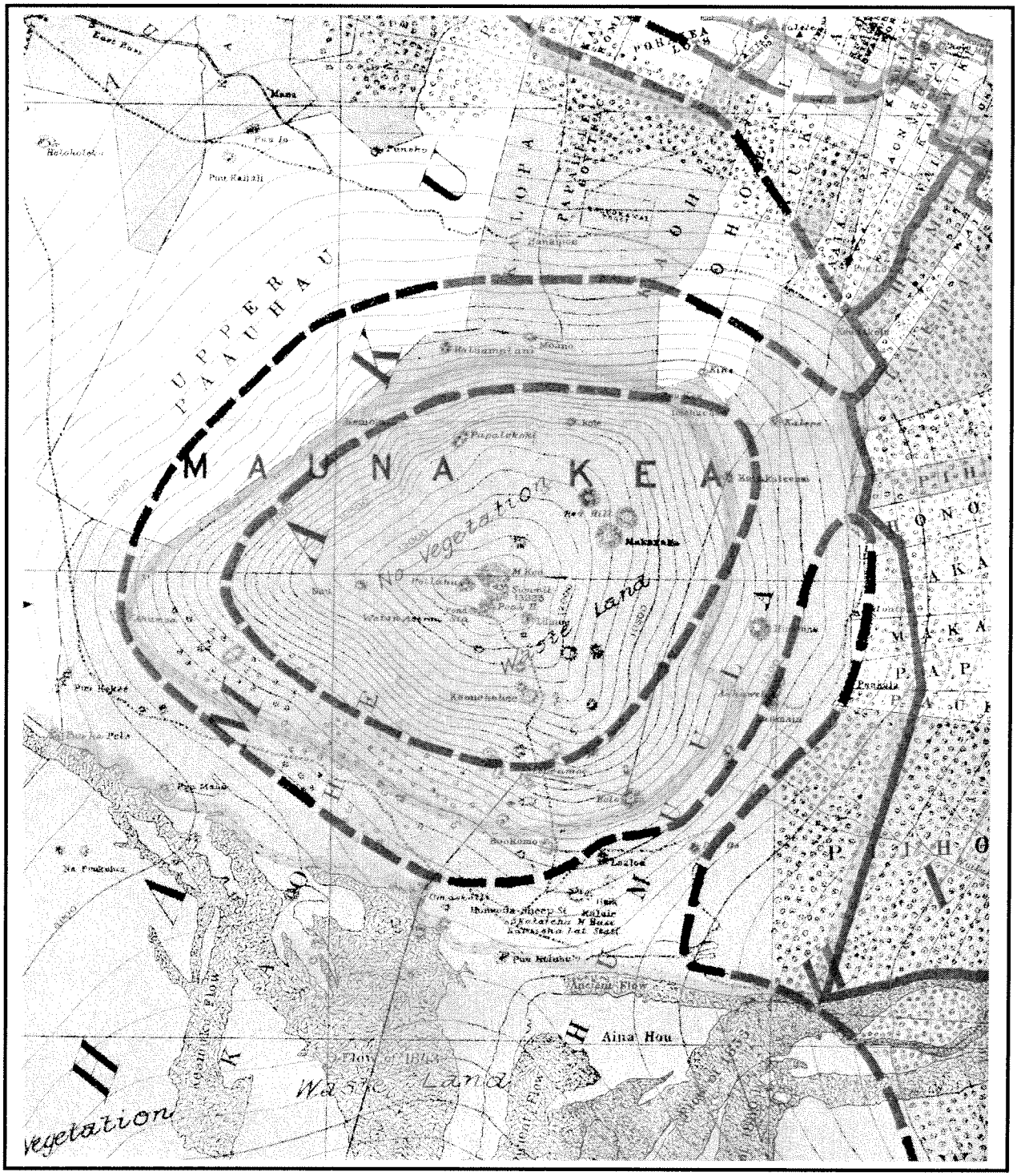
The archival-historical research conducted as a part of past studies and the present study, was performed in a manner consistent with Federal and State laws and guidelines for such studies. Among the pertinent laws and guidelines are the National Historic Preservation Act (NHPA) of 1966, as amended in 1992 (36 CFR Part 800); the Advisory Council on Historic Preservation's "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP 1985); National Register Bulletin 38, "Guidelines for Evaluating and Documenting Traditional Cultural Properties" (Parker and King 1990); the Hawai'i State Historic Preservation Statue (Chapter 6E), which affords protection to historic sites, including traditional cultural properties of on-going cultural significance; the criteria, standards, and guidelines currently utilized by the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) for the evaluation and documentation of cultural sites (cf. Title 13, Sub-Title 13:275-8; 276:5 – 2003); and the November 1997 guidelines for cultural impact assessment studies, adopted by the Office of Environmental Quality Control (which also facilitate the standardized approach to compliance with Act 50 amending HRS Chapter 343; April 26, 2000).

Maly and Maly have conducted detailed research in archival-historical literature, referencing both native Hawaiian language and English texts; conducted field visits with elder *kama'āina*; and conducted oral history interviews with individuals known to be knowledgeable about the history, residency and land use on the *'āina mauna*.

---

1 Kepā Maly, Cultural Historian-Resource Specialist & Onaona Maly, Researcher.

2 The native term *'āina mauna*, was used affectionately by elder Hawaiians, to describe all of the mountain lands surrounding, and including Mauna Kea. It is used in this text, in the same manner.


MAUNA KEA
UPPER PAAUHAU
No vegetation
Waste Land
vegetation
Waste Land
Aina Hou
Lava Flow of 1859
Makanaka
Pupalekeni
Kalepa
Kalair
Pua Kea
Pua Kalili
Pua Mako
Na Pualeleo
Laalaa
Pua Kilohau
Ahuma
Kaumahina
Kamakahoe
Kalepa
Kiha
Hanaipoe
Mana
Pua Io
Pukeko
Halulaloa
East Boundary
Pahoehoe Flow
Aa Flow
Kaumahina Flow
Kalepa Flow
Kiha Flow
Kamakahoe Flow
Pahoehoe Flow
Aa Flow
Aa Flow
Pahoehoe Flow
Aa Flow
Pahoehoe Flow
Aa Flow
Pahoehoe

While conducting the research, primary references included, but were not limited to—land use records, including the Hawaiian Land Commission Awards (L.C.A.) records from the *Māhele 'Āina* (Land Division) of 1848; the Boundary Commission Testimonies and Survey records of the Kingdom and Territory of Hawai'i; and historical texts authored or compiled by—D. Malo (1951); S.N. Haleole (1862-1863); J.P. I'i (1959); Kupahu (1865); S. M. Kamakau (1961, 1964, 1976, and 1991); Wm. Ellis (1963); records of the American Board of Commissioners of Foreign Missions (A.B.C.F.M.) (1820-1860); Chas. Wilkes (1845); Alexander & Preston (1892-1894); A. Fornander (1916-1919 and 1996); Isabella Bird (1964); G. Bowser (1880); and many other native and foreign writers. The study also includes several native accounts from Hawaiian language newspapers (compiled and translated from Hawaiian to English, by Maly), and historical records authored by nineteenth century visitors, and residents of the region.

Archival-historical resources were located in the collections of the Hawai'i State Archives, Survey Division, Land Management Division, and Bureau of Conveyances; the Bishop Museum Library and Archives; the Hawaiian Historical Society and the Hawaiian Mission Children's Society Library; University of Hawai'i-Hilo Mo'okini Library; the National Archives and Records Administration (NARA), Maryland; the Library of Congress (LoC), Washington D.C.; the National Oceanic and Atmospheric Administration (NOAA) Library, Maryland; the Smithsonian Institution Natural History and National Anthropological Archives libraries, Washington D.C.; the Houghton Library at Harvard; the United States Geological Survey Library, Denver; the *Paniolo Preservation Society* (PPS) and Parker Ranch collections; private family collections; and in the collection of *Kumu Pono Associates LLC.* This information is generally cited in categories by chronological order of the period depicted in the narratives.

The oral history interviews cited in this study (Appendix A) represent selections from interviews conducted by Maly between 1998 to 2005, and reflect the recollections of elder native Hawaiians and *kama'āina* residents of the *'āina mauna.* The interviewees ranged in age from their 60s to 90s, and in their stories they describe life upon the land, and practices of their families, and changes observed over the years in the condition of the landscape.

The recorded interviews were transcribed and returned (with the recordings) to each of the interviewees. Follow up discussions were then conducted to review each of the typed draft-transcripts. The latter process resulted in the recording of additional narratives with several interviewees. Following completion of the interview process, all of the participants in the tape recorded oral history interviews gave their permission for inclusion of portions of their transcripts in historical studies of the *'āina mauna.* Because of the review and follow-up discussions with interviewees, the final transcripts cited in this study at times differ from the original recorded interview. The final released transcripts supersede the original documentation.

The historical records—including oral testimonies of elder *kama'āina* of the mountain lands—provide readers with detailed descriptions of traditional and customary practices, the nature of land use, and the types of features to be expected on the landscape, and early efforts in conservation on Mauna Kea and the adjoining *'āina mauna.* The descriptions of land use and subsistence practices range from antiquity to the middle 1950s, and represent the knowledge of generations of life upon the land. Importantly, in the discussion regarding astronomy on Mauna Kea, the narratives cited in this collection also provide readers with first-hand accounts—in archival literature and oral history interviews—of the early days of astronomy on the mountain, including the thoughts and recommendations of the pioneer scientists and community members on the island of Hawai'i, in regards to use and limitations of Mauna Kea.

A CULTURAL-HISTORICAL OVERVIEW OF THE 'ĀINA MAUNA OF HAWAI'I

This section of the study provides readers with a general overview of the cultural and natural[3] landscapes of Mauna Kea and the *'āina mauna*. The narratives include discussions on Hawaiian settlement, population expansion, evolution of the traditional land management practices, and attachment to place. We find that the ancient Hawaiian system of land management is rooted in the beliefs, practices, traditions and values of the people, and that these formed the basis of the sustainable relationship shared between the Hawaiian people and the land. As this system evolved, the *ahupua'a* of Ka'ohe and Humu'ula were established as the largest lands of the Mauna Kea region. There are also some 75 additional *ahupua'a* in the Hilo District; 82 *ahupua'a* in the Hāmākua District; and one *ahupua'a* with several large *'ili* divisions in the Kohala District, that rest upon the slopes of, and are enriched by the tangible and intangible resources of Mauna Kea. These traditional land divisions defined the rights of access of people to the resources necessary to life and culture; they were intricately tied to the lifeways of the people; and are reflected in the on-going cultural attachment[4] of Hawaiians to Mauna Kea.

"Kumulipo" Traditions of the Heavens, Gods, Land, Natural Resources, and People in the Hawaiian Cultural System

In the Hawaiian world view, natural and cultural resources were treated alike, the well-being of one depended upon the well-being of the other. We find that native traditions describe the formation of the heavens, the islands, and all forms of life and nature, in the context of a genealogy, and the birth of children.

The epic "*Kumulipo,*" a Hawaiian Creation Chant, was translated by Martha Warren Beckwith (1951). The "*pule*" (prayer) was given, in ca. 1700, at the dedication of the new-born chief, Ka-'Ī-i-mamao, also known as Lono-i-ka-Makahiki. Beckwith described the *pule* as:

> The Hawaiian *Kumulipo* is a genealogical prayer chant linking the royal family to which it belonged not only to primary gods belonging to the whole people and worshiped in common with allied Polynesian groups, not only to deified chiefs born into the living world, the Ao, within the family line, but *to the stars in the heavens* and the plants and animals useful to life on earth, who must also be named within the chain of birth and their representatives in the spirit world thus be brought into the service of their children who live to carry on the line in the world of mankind... [Beckwith 1951:8]

Beckwith's primary resources for the *Kumulipo*, came from the papers of King David Kalākaua, his sister, Queen Lili'uokalani, who published the Kumulipo in 1897; and papers of Prince Jonah Kūhiō Kalanaiana'ole.

In her introduction to the *Kumulipo*, Queen Lili'uokalani observed that the language was itself at times difficult to translate, "because the true signification has been lost." (Liliuokalani, 1897). Of Hawaiian

---

[3] In the Hawaiian mind, cultural and natural landscapes are one and the same. It was the nature of place that shaped the cultural and spiritual view of the Hawaiian people.

[4] "Cultural Attachment" embodies the tangible and intangible values of a culture—how a people identify with, and personify the environment around them. It is the intimate relationship (developed over generations of experiences) that people of a particular culture feel for the sites, features, phenomena, and natural resources etc., that surround them—their sense of place. This attachment is deeply rooted in the beliefs, practices, cultural evolution, and identity of a people. The significance of cultural attachment in a given culture is often overlooked by others whose beliefs and values evolved under a different set of circumstances (cf. James Kent, "Cultural Attachment: Assessment of Impacts to Living Culture." September, 1995).

practices of navigation, and knowledge of the and heavens, stars, and world around them, she also observed — "The ancient Hawaiians were astronomers, and the terms used appertained to the heavens, the stars, terrestrial science, and the gods." (Liliuokalani, 1897).

Ka-'Ī-i-mamao, also called Lono-i-ka-Makahiki, was the son of Keawe-i-kekahi-ali'i-o-ka-moku and Lono-ma-'Ī-kanaka. She noted that the Kumulipo was:

> "A prayer of dedication of a chief, A *Kumulipo* for Ka-'I-amamao and (passed on by him) to Alapai'i-wahine (woman)..." "An ancient prayer for the dedication of the high chief Lono-i-ka-makahiki to the gods soon after his birth..." [Beckwith 1951:8]
>
> This chant of Kumulipo is the chant recited by Pu'ou to Lono (Captain Cook) as he stood while a sacrifice of pork was offered to him at the *heiau* of Hikiau at Kealakekua.
>
> The priest had said at the time of Ka-'I-'i-mamao's death that Lono would come again, that is, Ka-'I-'i-mamao, and would return by sea on the canoes 'Auwa'alalua.
>
> That was why Captain Cook was called Lono... [Beckwith 1951:10]

The following excerpts of the "*He Pule Ho'ola'a Ali'i He Kumulipo, No Ka-'I-i-Mamao*" (A Dedication Prayer for the Chief, the Kumulipo, for Ka-'Ī-i-Mamao) are among those that address the relationship between the stars of the heavens, the chiefly line, and earth. The entire Kumulipo, is comprised of more than 2,100 lines, with narratives describing every facet of life and nature known in the Hawaiian system:

Ka Wa Akahi	The First Period
1. O ke au i kahuli wela ka honua	1. At the time when the earth became hot
2. O ke au i kahuli lole ka lani	At the time when the heavens turned about
3. O ke au i kuka'iaka ka la.	At the time when the sun was darkened
4. E ho'omalamalama i ka malama	To cause the moon to shine
5. O ke au o Makali'i ka po	5. The time of the rise of the Pleiades
6. O ka walewale ho'okumu honua ia	The slime, this was the source of the earth
7. O ke kumu o ka lipo, i lipo ai	The source of the darkness that made darkness
8. O ke kumu o ka Po, i po ai	The source of the night that made night
9. O ka lipolipo, o ka lipolipo	The intense darkness, the deep darkness
10. O ka lipo o ka la, o ka lipo o ka po	10. Darkness of the sun, darkness of the night
11. Po wale ho—'i	Nothing but night.
12. Hanau ka po	The night gave birth
13. Hanau Kumulipo i ka po, he kane	Born was *Kumulipo* in the night, a male
14. Hanau Po'ele i ka po, he wahine...	Born was *Po'ele* in the night, a female...
[page 187]	[page 59]
Ka Wa Umikumamaha	The Fourteenth Period
1846. Hanau o Paupaniakea	Born was *Pau-pani-a[wa]kea*
1847. O Wakea no ia, o Lehu'ula, o Makulukulukalani	This was *Wakea*; [born was] *Lehu'ula*; [born was] *Makulu-kulu*-the-chief
1848. O ko laua hope, o kanaka 'ope'ope nui	Their youngest, a man of great bundles
1849. Huihui a kau io Makali'i, pa—'a	Collected and placed with *Makali'i*; fixed fast
1850. Pa'a na hoku kau i ka lewa	1850. Fixed are the stars suspended in the sky

1851. Lewa Ka'awela, lewa Kupoilaniua	[There] swings[5] *Ka'awela* [Mercury], swings *Kupoilaniua*
1852. Lewa Ha'i aku, lewa Ha'i mai	*Ha'i* swings that way, *Ha'i* swings this way
1853. Lewa Kaha'i, lewa Kaha'iha'i	*Kaha'i* swings, swings *Kaha'iha'i* [in the Milky Way]
1854. Lewa Kaua, ka pu'uhoku Wahilaninui	Swings *Kaua*, the star cluster *Wahilaninui*
1855. Lewa ka pua o ka lani, Kaulua-i-ha'imohai	1855. Swings the flower of the heavens, *Kaulua-i-ha'imoha'i*
1856. Lewa Puanene, ka hoku ha'i haku	Puanene swings, the star that reveals a lord
1857. Lewa Nu'u, lewa Kaha'ilono	*Nu'u* swings, *Kaha'ilono* swings
1858. Lewa Wainaku, lewa Ikapa'a.	*Wainaku* [patron star of Hilo] swings, swings *Ikapa'a*
1859. Lewa Kiki'ula, lewa Keho'oea	Swings *Kiki'ula*, swings *Keho'oea*
1860. Lewa Pouhanu'u, lewa Ka'ili'ula	1860. *Pouhanu'u* swings, swings *Ka-ili-'ula*, The-red-skinned
1861. Lewa Kapakapaka, lewa Mananalo	Swings *Kapakapaka*, [and the morning star] *Mananalo* [Jupiter or Venus]
1862. Lewa Kona, lewa Wailea	Swings Kona, swings *Wailea* [patron star of Maui] [page 126]
1863. Lewa ke Auhaku, lewa Ka-maka-Unulau	Swings the *Auhaku*, swings the Eye-of-*Unulau*
1864. Lewa Hinalani, lewa Keoea	Swings Hina-of-the-heavens, *Hina-lani*, swings *Keoea*
1865. Lewa Ka'aka'a, lewa Polo'ula	1865. *Ka'aka'a* swings, swings *Polo'ula* [star of Oahu]
1866. Lewa Kanikania'ula, lewa Kauamea	*Kanikania'ula* swings, *Kauamea* swings
1867. Lewa Kalalani, lewa Kekepue	Swings *Kalalani* [of Lanai], swings [the astrologers' star] *Kekepue*
1868. Lewa Ka'alolo, lewa Kaulana-a-ka-la	Swings *Ka'alolo* [of Ni'ihau], swings the Resting-place-of-the-sun [*Kaulana-a-ka-la*]
1869. Lewa Hua, lewa 'Au'a	*Hua* swings, *'Au'a* [Betelgeuse] swings
1870. Lewa Lena, lewa Lanikuhana	1870. *Lena* swings, swings *Lanikuhana*
1871. Lewa Ho'oleia, lewa Makeaupe'a	Swings *Ho'oleia*, swings *Makeaupe'a*
1872. Lewa Kaniha'alilo, lewa 'U'u	Swings *Kaniha'alilo*, swings *'U'u*
1873. Lewa 'A'a, lewa 'Ololu	Swings *Aa* [Sirius], swings *'Ololu*
1874. Lewa Kamaio, lewa Kaulu[a]lena	*Kamaio* swings, swings *Kaulu[a]lena*
1875. Lewa o Ihu-ku, lewa o Ihu-moa	1875. Swings Peaked-nose, swings Chicken-nose
1876. Lewa o Pipa, lewa Ho'eu	Swings *Pipa*, swings *Ho'eu*
1877. Lewa Malana, lewa Kaka'e	Swings *Malana*, swings *Kaka'e*
1878. Lewa Mali'u, lewa Kaulua	Swings *Mali'u*, swings *Kaulua*
1879. Lewa Lanakamalama, lewa Naua	*Lanakamalama* swings, *Naua* swings
1880. Lewa Welo, lewa Ikiiki	1880. *Welo* swings, swings *Ikiiki*
1881. Lewa Ka'aona, lewa Hinaia'ele'ele [page 235]	*Ka'aona* swings, swings *Hinaia'ele'ele*
1882. Lewa Puanakau, lewa Le'ale'a	*Puanakau* [Rigel] swings, swings *Le'ale'a*
1883. Lewa Hikikauelia, lewa Ka'elo	Swings *Hikikauelia* [Sirius of navigators], swings *Ka'elo*

[5] In this context, Beckwith uniformly translated the word "*lewa*" as "swings," which is one translation for the word; while others, depending on context might include, the sky, firmament, afloat, dangling, etc. We suggest, that a more poetic translation might be that "Afloat is *Ka'awela*, afloat is *Kupoilaniua...*" and so on with each of the references to the named stars, which appear to float in the heavens (*lewa*).

1884. Lewa Kapawa, lewa Hikikaulonomeha	Swings Kapawa, swings Hikikaulonomeha [Sirius of astrologers]
1885. Lewa Hoku'ula, lewa Poloahilani	1885. Swings *Hoku'ula*, swings *Poloahilani*
1886. Lewa Ka'awela, lewa Hanakalanai	Swings *Ka'awela*, swings *Hanakalanai*
1887. Lewa Uliuli, lewa Melemele	*Uliuli* swings, *Melemele* swings [two lands of old]
1888. Lewa Makali'i, lewa Na-huihui	Swings the Pleiades, *Makali'i*, swings the Cluster, *na Huihui*
1889. Lewa Kokoiki, lewa Humu	Swings *Kokoiki* [Kamehameha's star], swings *Humu* [Altair]
1890. Lewa Moha'i, lewa Kauluokaoka	1890. *Moha'i* swings, swings *Kaulu[a]okaoka*
1891. Lewa Kukui, lewa Konamaukuku	*Kukui* swings, swings *Konamaukuku*
1892. Lewa Kamalie, lewa Kamalie-mua	Swings *Kamalie*, swings *Kamalie* the first
1893. Lewa Kamalie-hope	Swings *Kamalie* the last
1894. Lewa Hina-o-na-leilena	Swings Hina-of-the-yellow-skies, *Hina-o-na-Leilena.*
1895. Lewa na Hiku, lewa Hiku-kahi	1895. Swing the Seven, *na Hiku.* [Big Dipper], swings the first of the Seven
1896. Lewa Hiku-alua, lewa Hiku-kolu	The second of the Seven, the third of the Seven
1897. Lewa Hiku-aha, lewa Hiku-lima	The fourth of the Seven, the fifth of the Seven
1898. Lewa Hiku-ono, lewa Hiku-pau	The sixth of the Seven, the last of the Seven
1899. Lewa Mahapili, lewa ka Huihui	Swings *Mahapili*, swings the Cluster [page 127]
1900. Lewa Na Kao	1900. Swing the Darts [*Kao*] of Orion
1901. Lu ka 'ano'ano Makali'i, 'ano'ano ka lani	Sown was the seed of *Makali'i*, seed of the heavens
1902. Lu ka 'ano'ano akua, he akua ka la	Sown was the seed of the gods, the sun is a god
1903. Lu ka 'ano'ano a Hina, he walewale o Lonomuku [Beckwith, 1951:236]	Sown was the seed of Hina, an afterbirth of Lono-muku... [Beckwith, 1951:128]

In the *Kumulipo*, and other *mele* of creation, we find that all forms of the natural environment, from the skies and mountain peaks, to the watered valleys, plateau lands, and lava plains, and to the shoreline and ocean depths are believed to be *kinolau* (physical embodiments) of Hawaiian gods and deities.

Another Hawaiian genealogical account, records that *Wākea* (the expanse of the sky–the male) and *Papa-hānau-moku* (Papa, who gave birth to the islands–the female)—also called *Haumea-nui-hānau-wāwā* (Great Haumea, born time and time again)—and various gods and creative forces of nature, gave birth to the islands. Hawai'i, the largest of the islands, was the first-born of these island children. This birth of the islands is commemorated in various *mele ko'ihonua*, chants describing the forming of the earth. On such *mele* includes the following lines:

'O Wākea Kahikoluamea ea,	Wākea the son of Kahikoluamea,
'O Papa, Papa-nui-hānau-moku ka wahine;	Papa, Papa-nui-hānau-moku the wife
Hānau o Kahiki-kū, Kahiki-moe	Kahiki-kū and Kahiki-moe were born
Hānau ke 'āpapanu'u,	The upper stratum was born,
Hānau ke 'āpapalani,	The uppermost stratum was born,
Hānau Hawai'i i ka moku makahiapo,	Hawai'i was born, the first-born of the islands,
Ke keiki makahiapo a lāua...	The first born child of the two...
	(S.M. Kamakau 1991:126)

As the Hawaiian genealogical account continues, we find that these same god-beings, or creative forces of nature who gave birth to the islands, were also the parents of the first man (Hāloa), and from this ancestor all Hawaiian people are descended (cf. David Malo, 1951; Beckwith, 1951 &1970; Pukui and Korn, 1973). It was in this context of kinship, that the ancient Hawaiians addressed their environment, and it is the basis of the Hawaiian system of land use. Importantly, in these genealogical accounts, we find too, that Mauna Kea is referred to as "*Ka Mauna a Kea*" (Wākea's Mountain), and it is likened to the first-born of the island of Hawai'i (cf. Pukui and Korn 1973).

A *mele hānau* (birth chant) for Kauikeaouli (Kamehameha III), who was born in 1814, describes the chiefly lineage in the context of creation and genealogy spanning—the heavens; placing the sun above; the spirit realms and physical earth—land and ocean forms; the birth of the island of Hawai'i; and subsequent birth of Mauna Kea, as the son of Wākea. Excerpts from the *mele*, published in several issues of the *Nupepa Kuokoa*, in 1866, follow below:

Nupepa Kuokoa
March 24, 1866:4

No Kalani "Kauikeaouli Kamehameha III."	For the Chief, "Kauikeaouli Kamehameha III."
O hanau ka po ia luna,	Born was the night above,
Hanau ka po i luna nei,	Born was the night up here.
O lani hanee ka po o pinai ke ewe,	The heavens slid away into the night, swift came the afterbirth.
O pipili ka po o moe anaana le'a,	The nights came closer together,
O kohi ana le'a ka po o Mahinale'a,	stretching along until came a separation Making distinct the night of Mahinale'a
O huli e ka po o kaawale ka pili,	The night turned, closeness became separated.
O ke keiki po lani keia a "Kea," i hanau,	This is the royal offspring of night borne by Kea,
Keiki akahi a ka po keiki alua a ka po,	First child of the night, second child of the night,
Keiki akolu a ka po,	Third child of the night.
O ke kuakoko o ka po,	The night lay in travail,
E hanau mai auanei ka po,	To give birth to the night.
Oia hoi, o ka Po, hanau ka po,	He is in the night, the night newly born,
O ka po la hoi auanei ko luna nei la,	So it is the night that is there above,
Owai la hoi auanei ko lalo?	Who then is below?
Na Aua.	By Aua.
O hanau ka Moku a kupu,	Born was the island, it grew,
A lau, a loa, a ao, a muo a liko.	And sprouted, it flourished, rooted deeply, budded, formed tender leaves.
Ka moku ia luna o Hawaii.	That was the island over Hawaii.
O Hawaii nei no ka moku.	Hawaii itself was an island.
He pulewa ka aina he naka Hawaii,	The land was unstable, Hawaii quivered,
E lewa wale ana no i ka lani lewa.	Moving freely about in space.
Hanoa mai e Wakea pa hano ia.	Wakea recognized the island, recognized, it remained.
Malia ikea ka moku me ka honua,	Visible were island and earth,
Paa ia Lewaalani i ka lima akau o Wakea.	Held in heavenly space by the right hand of Wakea.
Paa Hawaii, a laa Hawaii la ikea he moku.	Hawaii was held, Hawaii was seen, an island.
O ka moku la hoi auanei kolalo nei la,	Down here shall be the island,

Owai la hoi auanei ko luna, owai la?	Who shall be above, who?
O ke Ao! Aia, aia hoi ha.	The cloud! That is who is shall be.
Na Hauna.	By Hauna.
O hanau ke Ao, o hiki ae.	The cloud was born, it rose and appeared.
O ohi ae ke ao o hiki ae	The cloud thrived, it rose and appeared.
O mokupawa ke ao o hiki ae,	The cloud came at dawn, it rose and appeared.
O aka ula ke ao o hiki ae,	The cloud flushed with a reddish tinge, it rose and appeared.
O moakaka ku ke ao mala'e,	The cloud rose and appeared in clearest configuration,
O opukupuku ke ao melemele,	Turned yellow and menacing.
O memele ka opua he la-i,	The horizon cloud hung yellow over a calm sea.
O opua nui, uli ka opua hiwahiwa,	A swelling cloud, a dark cloud,
O hiwahiwa ka opua lani ele,	A cloud whose deepening darkness
Eleele ka lani huhulu weo,	Turned to black, a sky already black
Lani ekaeka ha eleele,	In with feathery clouds of dusk,
	A sky heavy with blackness, rough, lowering,
Hakona, hakuma, hakumakuma.	A sky speaking in threat.
O ke ao nui mai hee ua keia,	A vast cloud foretelling the approach of rain.
E hoowiliwili mai ana e hanau,	The sky writhed in labor to give birth.
Oia hoi, o ke Ao, hanau ke ao,	He is the Cloud. Thus the cloud was born.
O ke ao la hoi auanei ko luna nei la,	A cloud shall be up there.
Owai la auanei ko lalo la?	Who shall be below?
Owai la, o ka Mauna aia, aia hoi ha.	Who, it shall be the Mountain there indeed.
Na Piopio.	By Piopio.
O hanau ka mauna a Kea,	Born of Kea was the mountain (mauna).
Opuu ae ka mauna a Kea.	The mauna of Kea budded forth.
O Wakea ke kane,	Wakea was the husband,
O Papa o Walinuu ka wahine,	Papa Walinuu was the wife.
Hanau Hoohoku he wahine,	Born was Hoohoku, a daughter,
Hanau Haloa he alii,	Born was Haloa, a chief,
Hanau ka mauna he keiki mauna na Kea,	Born was the mountain, a mountain-son of Kea.
O ka lili o Wakea o ka hai i ka hala.	Jealous was Wakea, he revealed his fault,
O ke ku kuku laau ana me Kane,	Told of his smiting Kane with a club,
I hoouka ai i iloko o Kahikiku,	In battle, fought at Kahikiku.
Hee Wakea kalewa kona ohua,	Wakea was routed, fled in confusion with his family.
Kuamu ia e Kane, kuawa ia e Kane,	None spoke to Wakea save in whispers, but Kane shouted.
Hoi mai Wakea a loko o lani momo-e,	Wakea returned to the sky seeking a wife.
Moe Wakea moe ia Papa,	Wakea mated with Papa,
Hanau ka la na Wakea,	The sun was born to Wakea,
He keiki kapu na Wakea,	A sacred off-shoot of Wakea,
O ka uluna o Wakea na Kea no,	The growth of Wakea was Wakea's own.
Hanau ka mauna he makahiapo kapu na Kea.	The mountain was born, the sacred first-born of Kea.

Oia hoi ha, o ka mauna. Hanau ka mauna,	So it is, the mountain. The mountain was born.
O ka mauna auanei ko lalo nei la,	The mountain shall be down here.
Owai la auanei ko luna la?	Who shall be above?
Owai la? O ka la, aia, aia hoi ha.	Who? The sun, that is who it is.
Na Hehena.	By Hehena. [cf. Pukui and Korn 1973:13-28]

Through such narratives as those above, we begin to perceive that in the traditional-cultural context, natural resources—such as the stars in the heavens, the *pu'u* (hills) and rock outcrops, a pool of water, the *mea kolokolo* (insects), the *hau* (snow and dew), a forest grove, the *moa uakea a Kāne* and *lilinoe* (white rains of *Kāne* and thick mists of *Lilinoe*), an ocean current, a mountain, and even the sunrise-tinted snows of Mauna Kea (Kūkahau'ula)—are valued as cultural properties by the Hawaiian people. It is this "cultural attachment" to the natural world and heavens above that defines and shapes the beliefs, traditional cultural properties, and cultural practices of Hawaiians.

Nā Wao–Traditional Regions and Elevational Zones on the Mountain Lands

Several early descriptions of the lands of Humu'ula and Ka'ohe, describe them as sharing the summit region of Mauna Kea (see Wiltse, Register Map No. 668, and Boundary Commission testimonies in this study). While final settlement of the boundaries of Humu'ula and Ka'ohe, in 1891, took Humu'ula down to around the 9,300 foot elevation, the land rests on Mauna Kea, and with Ka'ohe, extends to the summit of Mauna Loa. They are among the largest *ahupua'a* in the Hawaiian Islands.

In any discussion of Hawaiian land—*'āina*, that which sustains the people—and its place in culture, it is also appropriate to briefly discuss traditional Hawaiian land terms, as the terms demonstrate an intimate knowledge of the environment about them. We observe once again, that in the Hawaiian mind, all aspects of natural and cultural resources are interrelated. All are culturally significant. Thus, when speaking of Mauna Kea—the first born child of Hawai'i, abode of the gods—it's integrity and sense of place depends on the well-being of the whole entity, not only a part of it.

As introduced in the above narratives, and further recorded throughout this study in native testimonies and historical accounts, readers are provided with documentation of the detailed knowledge that Hawaiians had of the *'āina mauna.* Native accounts and other historical writings record that the vast regional land divisions of Humu'ula and Ka'ohe, and the smaller *ahupua'a* and *'ili* which adjoin them on the lower mountain slopes, included a wide range of named environmental zones (*wao*). Each of these *wao* were noted for resources—extending from the sea to the forested lands, and in some instances, to the summits of the two mountains. It was these resources that sustained Hawaiian life, culture and spirituality.

Hawaiian customs and practices demonstrate the belief that all portions of the land and environment are related. Indeed, just as place names tell us that areas are of cultural importance, so too, the occurrence of a Hawaiian nomenclature for the *wao* tells us that there was an intimate relationship between Hawaiians and their environment. Writing in 1869, in his history of Hawai'i, Samuel Kamakau described the various regions and divisions of land. Of the mountains Kamakau observed:

> ...Here are some other divisions of the islands, together with their descriptive names.
>
> Heights in the center or toward the side of a land, or island, are called *mauna*, mountains, or *kuahiwi*, "ridge backs." The highest places, which cover over with fog and have great "flanks" behind and in front (*kaha kua, kaha alo*)—like ***Mauna Kea***—are called *mauna*; the place below the summit, above where the forests grow is the *kuahiwi.* The peak of the mountain is called *pane po'o* or *piko*; if there is a sharp point on the peak it is called *pu'u*

pane po'o; if there is no hill, *pu'u*, and the peak of the mountain spreads out like the roof of a house, the mountain is described as a *kauhuhu mauna* (house ridgepole mountain); and if there is a precipitous descent, *kaolo* [from the peak] to the *kauhuhu mauna* below this is called a *kualo* ("block"). If there are deep ravines (*'alu ha'aha'a*) in the sides of the mountain it is called a *kihi po'ohiwi mauna* ("shoulder edge" mountain). A place that slopes down gradually (*hamo iho ana*) is called a *ho'oku'u* (a "letting down"); a sheer place is called a *pali lele koa'e* (cliff where *koa'e* birds soar), or a *holo* ("slide"), or a *waihi* (a "flowing down"). Rounded ridges that extend from the mountains or "ridge backs" or hills are called *lapa* or *kualapa* or *mo'o*—and, if they are large, *'olapalapa* or *'omo'omo'o.* Depressions between *lapa* or *mo'o* are *awawa*, valleys.

MOUNTAIN ZONES

Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi.* A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*'ano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and *makai* of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele. Makai* of this region the trees are tall, and this is the *wao lipo. Makai* of the *wao lipo* is the *wao 'eiwa*, and *makai* of that the *wao ma'ukele. Makai* of the *wao ma'ukele* is the *wao akua*, and *makai* of there the *wao kanaka*, the area that people cultivate. *Makai* of the *wao kanaka* is the *'ama'u*, fern belt, and *makai* of the *'ama'u* the *'apa'a*, grasslands.

A solitary group of trees is a *moku la'au* (a "stand" of trees) or an *ulu la'au*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa wa'a*) grow is a *wao koa* and *mauka* of there is a *wao la'au*, timber land. These are dry forest growths from the *'apa'a* up to the *kuahiwi.* The places that are "spongy" (*naele*) are found in the *wao ma'ukele*, the wet forest.

Makai of the *'apa'a* are the *pahe'e* [*pili* grass] and *'ilima* growths and *makai* of them the *kula*, open country, and the *'apoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *'ae kai*, the water's edge.

That is the way *ka po'e kahiko* named the land from mountain peak to sea. [S.M. Kamakau (in *Ke Au Okoa*, November 4-11, 1869; Kamakau, 1976:8-9]

The native tradition of Ka-Miki, penned by native historians, John Wise, Isaac Kihe and a group of their associates (in *Ka Hoku o Hawaii*, 1914-1917), provides readers with a detailed account of Hawaiian land divisions and environmental zones. While competing in a riddling contest at the court of the chief, Palikū-a-Kīko'oko'o, the hero, Ka-Miki sparred with Pīna'au, the foremost riddler of the district of Hilo Palikū (northern Hilo). The riddles covered topics describing regions from the mountain tips to the depths of the ocean, and descriptions of *kalo* (taro growth), the *ala loa* (trail systems), and *nā mea lawai'a* (fishing practices). As the contest unfolded, it was seen that each of the competitors were well matched. In one of the riddles, Ka-Miki described the various regions of the island of Hawai'i, extending from the mountain to the sea. Ka-Miki then told his opponent, that if he could rise to the challenge of answering the riddle, his knowledge could be compared to one who has ascended to the summit of Mauna Kea, described as the "***mauna o Poliahu***" (mountain of Poli'ahu) (in *Ka Hoku o Hawaii*, September 21, 1916).

Through one of the riddles, readers learn about the traditional *wao* of land, districts, and land divisions of the administrators who kept peace upon the land (diacritical marks and numbers have been added to these texts to facilitate correlation between Hawaiian and English narratives). The environmental zones include:

1–Ke kuahiwi; 2–Ke kualono; 3–Ke kuamauna; 4–Ke ku(a)hea; 5–Ke kaolo; 6–Kawao; 7–Ka wao ma'u kele; 8–Ka wao kele; 9–Ka wao akua; 10–Ka wao lā'au; 11–Ka wao kānaka; 12–Ka 'ama'u; 13–Ka 'āpa'a; 14–Ka pahe'e; 15–Ke kula; 16–Ka 'ilima; 17–Ka pu'eone; 18–Ka po'ina nalu; 19–Ke kai kohola; 20–Ke kai 'ele; 21–Ke kai uli; 22–Ke kai pualena; 23–Kai pōpolohua-a-Kāne-i-Tahiti.

1–The mountain; 2–The region near the mountain top; 3–The mountain top; 4–The misty ridge; 5–The trail ways; 6–The inland regions; 7 and 8– The rain belt regions; 9– The distant area inhabited by gods; 10–The forested region; 11–The region of people below; 12–The place of *'ama'u* [fern upland agricultural zone]; 13– The arid plains; 14–The place of wet land planting; 15–The plain or open country; 16–The place of *'ilima* growth [a seaward, and generally arid section of the *kula*]; 17–The dunes; 18–The place covered by waves [shoreline]; 19–The shallow sea [shoreline reef flats]; 20–The dark sea; 21–The deep blue-green sea; 22–The yellow [sun reflecting– sea on the horizon]; and 23–The deep purplish black sea of Kāne at Tahiti. (*Ka Hoku o Hawaii*, September 21, 1916; Maly, translator)

The *kuahiwi, kualono, kuamauna, kuahea, kaolo, kawao, wao ma'ukele, waokele, wao akua, wao lā'au*, and *wao kānaka*, are all considered part of Mauna Kea (*Figure 2*). These *wao* extend from the mountain peaks, down slope through the *wao akua*—the region were the clouds settle upon the mountain lands, concealing the presence of the gods—to the lower region frequented by mankind, and from where resources were regularly collected and tended.

Ahupua'a—Nā Kuleana a me nā Pono

In the generations that followed initial settlement, the Hawaiians developed a sophisticated system of land use and resource management. By the time 'Umi-a-Līloa rose to rule the island of Hawai'i in ca. 1525, the island (*moku-puni*) was divided into six districts or *moku-o-loko* (cf. Kamakau, 1961; and Fornander 1973–Vol. II:100-102). Hilo, extending from the sea to the mountain slopes of Mauna Kea, and on to the summit of Mauna Loa—through the land division of Humu'ula—is one of those six major districts. The land division of Ka'ohe in the district of Hāmākua, another of the six major districts on the island of Hawai'i, shares a common boundary with Humu'ula, running across Mauna Kea, and up to the summit of Mauna Loa.

The large districts (*moku-o-loko*) like Hilo, and sub-regions (*'okana* and *kalana*) were further divided into manageable units of land. These smaller divisions or units of land were tended to by the *maka'āinana* (people of the land) (see Malo 1951:63-67). Of all the land divisions, perhaps the most significant management unit throughout the islands was the *ahupua'a*. *Ahupua'a* are subdivisions of land that were usually marked by an altar with an image or representation of a pig placed upon it (thus the name *ahu-pua'a* or pig-altar). In their configuration, the *ahupua'a* may be compared to wedge-shaped pieces of land that radiate out from the center of the island, extending to the ocean fisheries fronting the land unit. Their boundaries are generally defined by topography and geological features such as *pu'u* (hills), ridges, gullies, valleys, craters, or areas of a particular vegetation growth (see Boundary Commission Testimonies, 1865-1891; and C. Lyons, 1875, in this study).

The *ahupua'a* were also divided into smaller manageable parcels of land—such as the *'ili, kō'ele, mahina 'ai, māla*, and *kīhāpai*—that generally run in a *mauka-makai* orientation, and are often marked by stone wall (boundary) alignments. In these smaller land parcels the native tenants cultivated crops necessary to sustain their families, and supplied the needs of the chiefly communities they were associated with. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people who lived in a given *ahupua'a* had access to most of the resources from mountain slopes to the ocean, needed to sustain life and culture. These access rights (*pono*) were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility (*kuleana*) for stewardship of the natural environment, and supplying the needs of ones' *ali'i* (see Malo 1951:63-67 and Kamakau 1961:372-377).



Figure 2. Nā Wao–Kuahiwi, Kualono, Kua Mauna, Kuahea o Mauna Kea (The Mountain Regions of Mauna Kea, with Waiau and the Head of Pōhakuloa Gulch in the Foreground), (National Archives and Records Administration, B-2897-11th Photo Section, January 26, 1925)

Entire *ahupua'a*, or portions of the land were generally under the jurisdiction of appointed *Konohiki* or subordinate chief-landlords, who answered to an *ali'i-'ai-ahupua'a* (chief who controlled the *ahupua'a* resources). The *ali'i-'ai-ahupua'a* in turn, answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua'a* resources supported not only the *maka'āinana* and *'ohana* who lived on the land, but also contributed to the support of the royal community of regional and island kingdoms. In the Hilo District, the primary chiefly center, extended from the lowlands of Pi'ihonua to the shore of Waiākea. In Hāmākua, the chiefly center was focused around Waipi'o, while in South Kohala, the center was in the Waimea section, the *'ili* of Pu'ukapu and Pu'ukalani.

In 1875, Curtis J. Lyons, son of Reverend Lorenzo Lyons, of Waimea, one of the foremost surveyors of the Hawaiian Kingdom, authored a paper on "Hawaiian Land Matters" (Lyons 1875). In his discussion, he provided readers with important references to the rights of native tenants on the *ahupua'a* of Humu'ula and Ka'ohe. He also discusses their relationship with the neighboring mountain lands on the slopes of Mauna Kea:

> The ordinary *ahupuaa* extends from half a mile to a mile into this [forest] belt. Then there are larger ahupuaas which are wider in the open country than others, and on entering the woods expand laterally so as to cut off all the smaller ones, and extend toward the mountain till they emerge to the open interior country; not however to converge to a point at the tops of the respective mountains. Only a rare few reach those elevations, sweeping

past the upper ends of all the others, and by virtue of some privilege in bird-catching, or some analogous right, taking the whole mountain to themselves... The whole main body of ***Mauna Kea*** belongs to one land from Hamakua, viz., ***Kaohe***, to whose owners belonged the sole privilege of capturing the *ua'u*, a mountain-inhabiting but sea-fishing bird. High up on its eastern flank, however, stretched the already mentioned land of ***Humuula***, whose upper limits coincide with those of the *mamane*, a valuable mountain *acasia*, and which starting from the shore near ***Laupahoehoe***, extends across the upper ends of all other Hilo lands to the crater of Mokuaweoweo... [Lyons 1875:111 (emphasis added)]

Sequence of Hawaiian Settlement

Archaeologists and historians describe the inhabiting of these islands in the context of settlement which resulted from voyages taken across the open ocean. For many years archaeologists have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawai'i were underway by AD 300, with long distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian population—the Hawaiian Kahiki—were the Marquesas and Society Islands (Emory in Tatar 1982:16-18).

For generations following initial settlement, communities were clustered along the watered, windward (*ko'olau*) shores of the Hawaiian Islands. Along the *ko'olau* shores, streams flowed, rainfall was abundant, and agricultural production became established. The *ko'olau* region also offered sheltered bays from which deep sea fisheries could be easily accessed. Also, near-shore fisheries, enriched by nutrients carried in the fresh water running from the mountain streams, could be maintained in fishponds and coastal fisheries. It was around these bays such as at Hilo, that clusters of houses where families lived could be found (see McEldowney 1979). In these early times, the residents generally engaged in subsistence practices in the forms of agriculture and fishing (Handy, Handy and Pukui, 1972:287).

Over a period of several centuries, areas with the richest natural resources became populated and perhaps crowded, and by ca. 900 to 1100 AD, the population began expanding to the Kona (leeward side) and more remote regions of the island (Cordy 2000:130). Kirch (1979) reported that by ca. AD 1200, there were small coastal settlements at various areas along the western shore line of Hawai'i (Kirch 1979:198). In this system of settlement and residency, the near-shore communities shared extended familial relations with those of the uplands.

By the 1400s, upland regions to around the 3,000 foot elevation were being developed into areas of residence and a system of agricultural fields. By the 1500s to 1600s, residency in the uplands was becoming permanent, and there was an increasing separation of royal class from commoners. During the latter part of this period, the population stabilized and a system of land management was established as a political and socio-economic factor (see Kamakau 1961; Ellis 1963; Handy, Handy & Pukui 1972; Tomonari-Tuggle 1985; and Cordy 2000).

The lowlands of Ka'ohe, Humu'ula and the other neighboring *ahupua'a*, extending from the shore to around the 3,000 foot elevation, supported residential, agricultural, and subsistence activities, spanning the centuries of Hawaiian residency. The upper mountain lands of the Ka'ohe-Humu'ula region were frequented by travelers, collectors of natural resources, and for a wide range of cultural practices (see Kamakau, 1961; and Boundary Commission Testimonies, 1865 to1891, in this study).

Traditions and historical records tell us that the deification and personification of the land and natural resources, and the practices of district subdividing and land use as described above, were integral to Hawaiian life, and were the product of strictly adhered to resource management planning. In this system, the people learned to live within the wealth and limitations of their natural environment, and were able to sustain themselves on the land and ocean. It is in this cultural system that we can understand the significance of the lands of Ka'ohe, Humu'ula and the neighboring *'āina mauna*.

Historical Overview of Land Use Practices and Travel on the 'Āina Mauna

The land of Humu'ula—extending from sea level to the 9,000 foot elevation on Mauna Kea, and above the 13,000 foot elevation on Mauna Loa—is apparently named for a type of stone (Red jasper stone) that was used in making *ko'i* (adze). The place name of Ka'ohe—a land area extending from sea level to the summits of Mauna Kea and Mauna Loa—may be literally translated as "The-bamboo" or named for a type of *kalo* (taro) that may have been common in the region (cf. Pukui, et al. 1974).

Native Hawaiian traditions and historical accounts describe the lands of Humu'ula and Ka'ohe—those areas extending from shore to around the 6,000 foot elevation—as having once been covered with dense forests, and frequented by native practitioners who gathered forest-plant resources, birds, and food. The larger *'āina mauna* were frequented by individuals who were traveling to the upper regions of Mauna Kea to worship, gather stone, bury family members, or deposit the *piko* (umbilical cords of new-born children) in sacred and safe areas; and by those who were crossing from one region of the island to another.

As early as the 1820s, introduced cattle, sheep, goats, and wild dogs had made their way up to the mountain lands, and were bothersome to those who traveled the *'āina mauna*. In 1834, Scottish naturalist, David Douglas was gored and killed by a wild bullock near the boundary of Humu'ula and Laupāhoehoe. By 1850, the natural-cultural landscape of the *'āina mauna* was being significantly altered by the roving herds of wild bullocks, sheep and other ungulates, and ranching interests were being formalized in the region. By 1857, the Crown and Government mountain lands—including Humu'ula and Ka'ohe—were leased to Francis Spencer and the Waimea Grazing and Agricultural Company, which established ranching stations and operations around the mountain lands. As a result, the *'āina mauna* have been intensively ranched for more than 150 years.

Humu'ula

Because hunting, and subsequently ranching of bullocks, cattle and sheep was the primary activity on the mountain lands of Humu'ula, areas once forested, soon became open pasture land. While the first formal lease of Humu'ula was issued in 1857 (Keoni Ana to F. Spencer), it was interests of the Parker Ranch that held the longest lease on the Humu'ula mountain lands. The lease, from 1900 to 2002, covered the area extending around Mauna Kea to the 'Āina Hou-Pu'u Huluhulu vicinity. The Parker Ranch interests initially focused on sheep ranching in the Humu'ula-Kalai'eha section, but in 1964, the ranch terminated it's sheep program. Cattle operations were maintained until the end of the Parker lease in August, 2002.

Today, limited ranching of cattle is continued on Humu'ula, under a permit by the Department of Hawaiian Home Lands, and leases from the State of Hawai'i. Also, some 6,000 acres between Pu'u 'Ō'ō and Pu'uloa, have succumb to an infestation of the introduced gorse (first recorded on the land in 1892), which has had little maintenance since ca. 1980.

Ka'ohe

Early leases of the Ka'ohe mountain lands date back to 1857 (Keoni Ana to F. Spencer), and the operations of Francis Spencer's Waimea Grazing and Agricultural Company. The lease took in all of the mountain lands, to the summit of Mauna Kea, across Ka'ohe to its Mauna Loa boundary. Activities were all tied to sheep and cattle ranching. Subsequently, in 1870, the lease was acquired by Parker Ranch, which held most of the Ka'ohe mountain lands until their removal from the lease in 1905 for the Mauna Kea Forest Reserve, and later withdrawals as a part of the Pōhakuloa Military installation in 1956 (Governor's Executive Order No. 1719; and Presidential Executive Order No. 1167). Portions of the land of Ka'ohe, generally those on the northern (Waimea) side of Mauna Kea, are still grazed by Parker Ranch. The lands of Ka'ohe V (the Pōhakuloa section), were turned over to the United States Army, and have been used for military training operations since that time.

The summit of Mauna Kea, situated in the *ahupua'a* of Ka'ohe, was noted as a site of importance for modern astronomical observations by the Pendulum Party of 1892. In 1964, the first modern observatory was built on top of Pu'u Poli'ahu. By 1968, the scientific community recognized the value of Mauna Kea as a setting for development of multiple observatories, and in 1967, the University of Hawaii Institute for Astronomy was founded. In 1968, the Board of Land and Natural Resources leased the entire summit of Mauna Kea to the Institute by Lease No. S-4191.

Na 'Āina e pili 'ana iā Mauna Kea

All other lands lying on the slopes of Mauna Kea—those belonging to the districts of Hilo, Hāmākua and Kohala—generally extended through the forests, where they are cut off by the traditional boundaries of Ka'ohe and Humu'ula. From the middle 1800s, those lands such as Waiākea, Pi'ihonua, Pāpa'ikou, Laupāhoehoe, 'O'ōkala, Ka'ala, Kūka'iau, Pā'auhau, and Waikōloa, were either held in fee-simple interest or leased out by the Crown and Government, for development of lumber collection, bullock hunting, cattle and sheep grazing, and in the elevations below approximately the 2,000 foot level, to development of sugar plantations.

In the early 1900s, forest lands below Humu'ula and Ka'ohe, and the Mauna Kea mountain lands from approximately the 9,000 foot elevation to the summit, were turned over to preservation in the form of forest reserves. The primary interest in the development of the reserves was the protection of water sheds to ensure that plantations would have access to water, necessary for the cultivation, harvesting, and processing of sugar. Interest in, and the value of Hawaiian forests and watersheds has since evolved as a greater awareness of the unique and fragile ecosystems of the Hawaiian mountain lands has been developed.

Na Ala Hele o ka 'Āina Mauna

Travel across the *'āina mauna* is documented in native traditions, which describe *ala hele* (trails) passing from the coastal lowlands through the forest lands; along the edge of the forests; across the plateau lands of the Pōhakuloa-Ka'ohe region, and to the summit of Mauna Kea. These *ala hele* approached Mauna Kea from Hilo, Hāmākua, Kohala, Kona, and Ka'ū, five of the major districts on the island. Only Puna, which is cut off from direct access to the mountain lands, apparently did not have a direct trail to the *'āina mauna*. Thus, people traveling to Mauna Kea from Puna traveled through the lands of Waiākea, Hilo or Keauhou, Ka'ū to reach Humu'ula and the slopes of Mauna Kea.

By the early 1820s, foreign visitors, in the company of native guides, began making trips across the *'āina mauna* and to the summit of Mauna Kea. Based on their accounts, travel in the region through the middle 1800s basically followed the old trails, or cut across new areas—a result of dense forest growth, and new lava flows covering older routes. By the 1850s, the Kingdom of Hawai'i entered into a program of improving ancient trails and identifying new routes, by which to improve travel between various locations and facilitate commerce. The earliest recorded improvements, describing work government on a trail around Mauna Kea, document work on the Waimea-Kula'imano trail (cutting across the lands of Ka'ohe, Hāmākua and Hilo), running above the forest line and to the coast of Hilo, date from 1854, when the Waimea-Kula'imano route was improved to accommodate wagon travel.

In the later 1850s, as leases were given out for the lands of Humu'ula and Ka'ohe, and the sheep and bullock hunting interests grew, the 1854 route was maintained, and the upper trail between Kula'imano-Makahanaloa, was improved to the Kalai'eha vicinity. In 1862, the Kingdom again initiated a program to improve the government roads across the *'āina mauna*. Two routes were proposed, one between Hilo and Waimea via Kalai'eha, and the second to improve on the trail from Kalai'eha towards Kula'imano-Makahanaloa, and around through Hanaipoe-Mānā and Waimea. These trails, termed *Alanui Aupuni*, were appropriated and work completed by the late 1860s. The routes appear on island maps through 1901, with subsequent designations as trails on later maps.

Several ancient trails approached the summit of Mauna Kea, and were used by *maka'āinana* through the 1920s. Most of these trails were accessed via the improved government roads around the

mountain. Primary approaches included, but were not limited to the Kalai'eha-Waiau Trail, the 'Umikoa-Ka'ula Trail, and the Kemole-Pu'u Nanahu Trail. Historical accounts and oral history interviews record that these trails provided travelers with access to various sites, including areas where rituals and practices were observed, and that the trails converged at Waiau. At Waiau, travelers found a sheltered area and water for their use while on the mountain. Those who were traveling to the summit of Mauna Kea, or to other locations in the summit region then followed smaller trails that provided them with the access necessary for their purposes.

By the early 1870s, the ancient trail between Kalai'eha and the summit of Mauna Kea, was improved into a horse trail by the Spencers, lessees of the Mauna Kea mountain lands. Other routes, accessing outlying ranching stations, such as at Pu'u 'Ō'ō and Puakala (Pua'ākala), Lahohinu, and Hānaipoe had also been improved by lessees, with routes running around the mountain, and down to Hilo or out to Waimea. In the leases of the Crown Lands and Government Lands, it was specified that improvements, including trails, reverted to the Crown or Government upon termination of the leases. Until the late 1940s, early 1950s, these trails and government roads were primarily used by lessees for transportation of goods—and cared for by the lessees. There are also numerous accounts by visitors to the *'āina mauna* document travel in the region. By the late 1890s, the Kohala road supervisor, reported that while the mountain roads belonged to the government, they were all but private by the nature of their use.

Between the 1930s to 1940s, improvements were made to the Kalai'eha-Waipunalei section of the road to Waimea as a part of the Civilian Conservation Corps (CCC) and Territorial Forestry programs, with work also being done by the Parker Ranch. Likewise, the Kalai'eha-Waiki'i route was maintained by the ranch, and improved by the United States Army-U.S.E.D., in 1942.

Apparently little work was done on the Kalai'eha-Hilo section of the road (trail), after the 1870s. The trail was accessed by ranchers, with routes diverging to Kalai'eha and Pu'u 'Ō'ō, as described in survey records, journals, and *kama'āina* testimonies. It was also periodically used by visitors to the mountain lands, usually those who were traveling to view Mauna Loa lava flows, or to make the ascent of Mauna Kea. It was not until 1942, that the route was modified as a vehicular road in what became the Saddle Road, following in areas, the native trail and historic route, while also cutting across new lands in other locations. The "Saddle Road" was formally turned over to the Territory in 1947, following which time the general public was then given an opportunity to travel to the mountain lands unhindered.

In 1963, interest in Mauna Kea as a site for a telescope, manifested itself. Hawai'i based scientists, Walter Steiger (with the University of Hawai'i) and Howard Ellis (with the National Weather Service's Mauna Loa Weather Station) facilitated trips by Dr. Gerard Kuiper and Alika Herring (both, associated with the University of Arizona and NASA) to the summits of Mauna Loa and Mauna Kea. The Mauna Kea route basically followed the old foot trail from Kalai'eha, past Kalepeamoa, Keonehe'ehe'e, and up to the summit. Over the years, the old trail was modified for horses and pack animals, and after World War II, for the occasional four-wheel drive vehicles that ascended the mountain. In 1964, Pu'u Poli'ahu on Mauna Kea had been chosen as the site for the first telescope, and state funds were released for grading a road to Pu'u Poli'ahu, to facilitate construction and access by the scientists. Since 1964, the primary route of access up the mountain slopes has remained generally the same, though as additional development in the summit region has occurred, new accesses and realignments of the earlier route have occurred.

Historical accounts cited in various sections of this study, provide readers with detailed descriptions of the histories summarized above.

NATIVE HAWAIIAN TRADITIONS AND HISTORICAL NARRATIVES OF KA'OHE, HUMU'ULA AND THE 'ĀINA MAUNA

In Hawaiian *mo'olelo* (traditions and historical narratives) are found expressions of native beliefs, customs, practices, and history. Indeed, in Hawai'i the very landscape is storied (*wahi pana*). Each place name is associated with a tradition—names might describe the presence and interactions of the gods with people, or document events, or the characteristics of a given place. Unfortunately, today, many of those *mo'olelo* have been lost, though some still remain, and from them we are able to glimpse into the history of the lands and people of the *'āina mauna*.

This section of the study presents readers with a collection of narratives written by native Hawaiian authors and nineteenth century historians, recording history, the occurrence of events and travel, and traditions of place names, that have survived the passing of time. Several of the *mo'olelo* were translated here from the original Hawaiian by Maly; selected place names and events are emphasized by use of bold face (as in place names), and by italics. The accounts date back to the period of antiquity to the first hand accounts of those who traveled the *'āina mauna* in historic times, and were found in accounts written between 1794 to 1940. The narratives are presented in four sections — I. *Mo'olelo 'Āina*: Native Traditions of the Land; II. *Ka 'Oihana Kilokilo Hōkū*: Native Knowledge of the Stars and Navigation; III. Historical Accounts of the *'Āina Mauna* Recorded by Visitors and Foreign Residents (1778-1899); and IV. Historical Accounts of the *'Āina Mauna* Recorded After 1900.

I. Mo'olelo 'Āina: Native Traditions of the Land

Among the most significant sources of native *mo'olelo* are the Hawaiian language newspapers which were printed between 1838 to 1948, and the early writings of foreign visitors and residents. Most of the accounts that were submitted to the papers were penned by native residents of areas being described and noted native historians. Over the last 30 years, the author has reviewed and compiled an extensive index of articles published in the Hawaiian language newspapers, with particular emphasis on those narratives pertaining to lands, customs, and traditions. Several traditions naming places on Humu'ula, Ka'ohe, and the neighboring mountain lands, have been located in these early writings. Those accounts describe native practices, the nature of land use at specific locations, and native lore. Thus, we are given a means of understanding how people related to their environment and sustained themselves on the land.

Kai-a-ka-Hinalii: An Account of the Ocean Flood of Ka-Hina-Li'i and Mauna Kea

In 1823, British missionary William Ellis, documented the earliest penned tradition of Mauna Kea (Mouna-Kea). Following a sermon in Hilo, in which Ellis had mentioned the biblical account of the Great Flood and Noah's Ark, several Hawaiians approached him with questions and recalled a tradition of Mauna Kea that they had learned. Ellis reported that the natives were:

> ...informed by their fathers, that all the land had once been overflowed by the sea, except a small peak on the top of Mouna-Kea, where two human beings were preserved from the destruction that overtook the rest, but they said they had never before heard of a ship, or of Noah, having always been accustomed to call it the kai a Kahinarii (sea of Kahinarii)... (Ellis 1963:321).

Adze Quarries, a Wooden Image, and Artifacts Found Near the Summit of Mauna Kea (1862)

The *Pacific Commercial Advertiser* of Honolulu, reported on October 23, 1862, that Dr. William Hillebrand, who was the director of the Queen's Hospital and personal physician to the royal family.

Hillebrand, who also was an avid botanist, traveled around the Hawaiian Islands collecting plant specimens. In October 1862, he conducted a tour of the island of Hawai'i, which also included a trip to the summit of Mauna Kea. The article is of particular importance as it described the adze quarries; the presence of cultural remains, documenting extensive visitation to the summit region of Mauna Kea by ancient Hawaiians; and that he found a carved wooden image at the front of a cave in an adze quarry workshop. We also learn that artifactual materials were removed from the cave including the wooden image by Dr. Hillebrand.

Under the "Notes of the Week," the Pacific Commercial Advertiser reported:

> Hawaiian Antiquities. — On a a recent tour around Hawaii, Dr. Wm. Hillebrand ascended to the summit of Mauna Kea, in company with Charles Hall and Capt. Cumings. About 1500 feet below the top, on a side of the mountain seldom visited by either foreigners or natives, they discovered an ancient manufactory of stone implements. It consists of a cave, in front of which was a pile of stone chips 25 feet high, which had evidently accumulated from the manufacture of stone adzes, *maika* balls, &c. &c., which lay scattered about in an unfinished state. In front of the cave was found a wooden idol, in good preservation, which with the pedestal attached to it, measures nearly five feet high. In form the image very much resembles that picture in Jarves' History, page 27. Bones of pigs and dogs, *kapa*, pieces of cocoa-nut shells, fragments of hewn wooden implements, sea shells, and many other curiosities were also found. The Party loaded their guide and themselves with as many of these curiosities as they could carry, and returned to Waimea. On reaching Rev. Mr. Lyons' residence, the discovery soon became noised abroad among the natives, who flocked to the mission premises to learn the truth of the report.
>
> On inquiry among them, no person appears ever to have heard of the existence of the manufactory, — even the oldest natives were ignorant of it. From this it is inferred that its antiquity must date back beyond the present generation. On reaching Kona, Dr. H. learned from Capt. Cumings that an old native was living there, who in his younger days had heard the place spoken of by his fathers, but nothing definite can be learned regarding it. The discovery forms an interesting incident in Hawaiian History, and may lead to further searches and perhaps discoveries regarding the ancient customs of this people. [Pacific Commercial Advertiser, October 23, 1862:2]

While the above article implies that almost no one knew of the adze quarries, native witnesses, hailing from the Humu'ula region, testified before the Boundary Commission in 1873, that they had traveled to the quarries, and that their elders had previously worked in the quarries (see testimonies of the Boundary Commission in this study).

Two days later, on October 25th, the native language newspaper *Kuokoa* carried news of Hillebrand's "discovery" to readers in it's columns, reporting:

> *KOENA O KA WA KAHIKO. Eia Kauka Hilebarana (Hillebrand) i hele aku nei i ke Kaapuni ma ka mokupuni o Hawaii, ua loaa ia ia ma Maunakea, he kii o ka wa kahiko, a me kekahi paila pahoa e waiho ana mawaho iho o ka waha o kekahi ana. He elima kapuai ka loihi o ua kii'la. He nui no paha na mea o ia ano e waiho huna mai nei iloko o ko kakou mau awaawa uliuli a me na kuahiwi no hoi a pau.*
>
> *REMNANT OF ANCIENT TIMES. Doctor Hillebrand went around the island of Hawaii, and on* ***Maunakea*** *he obtained an image of ancient times, and a large pile of adzes situated outside the mouth of a cave. The image is five feet long. There are perhaps many things of this kind hidden in our green valleys and all the mountains.* [*Kuokoa*, October 25, 1862; Maly, translator]

W.D. Alexander (1892, in this study) reported that in 1892, the carved wooden image was still in the possession of his family.

"Ka Moolelo o Laieikawai"

One of the earliest *mo'olelo* which provides us with references to Humu'ula, Mauna Kea and neighboring lands, and associates the names of places on Mauna Kea with the goddesses of the mountain, is "*Ka Moolelo o Laieikawai*" (The Tradition of Laieikawai). This tradition spans the Hawaiian Island group, and was collected by native historian, S.N. Haleole. While introducing the series, Haleole noted that he originally wrote out the tradition in 1844 (Haleole, November 29, 1862). It was published as a serial in the Hawaiian language newspaper, *Kuokoa*, between November 29, 1862 to April 11, 1863. In 1919, Martha Beckwith published Haleole's, account, titled "The Hawaiian Romance of Laieikawai by S.N. Haleole."

In Beckwith's translation, Poli'ahu is referred to as the "goddess of the snow covered mountain," Mauna Kea. Below, is a synopsis of the account, by Beckwith, focusing on the main characters of the tradition, and their association with Mauna Kea:

> The young chief [Aiwohikupua] of Kaua'i when he goes to seek the beauty of Puna makes a vow to enjoy no other woman until he has won Laieikawai. At Hana on Maui, he is attracted by the lovely Hina-i-ka-malama as she rides the famous surf at Puhele, and he turns in at Haneoo. The chiefess falls in love with the handsome stranger and wins him at a game of *konane* (Hawaiian checkers). He excuses himself until his return and goes on to Hawaii, where he courts an even more beautiful chiefess in the person of Poliahu, who also promises him her hand. When he finally loses hope of winning Laie-i-ka-wai, he "claps his hands before his god" to free himself from his rash vow and proceeds to a marriage with ***Poliahu***, whom he fetches home with a great cortege to Kauai. While the festivities are proceeding at Mana, the disappointed Hina, apprised of her lover's duplicity, appears and claims the forfeited stake. Aiwohikupua is obliged to relinquish himself to her embraces, but the angry ***Poliahu*** envelopes the lovers in alternate waves of unendurable heat and cold until they are obliged to separate, when the mountain goddess retires to her home attended by her three maidens, ***Lilinoe***, ***Waiaie*** [sic[6]], and ***Kahoupokane***, and Aiwohikupua finds himself bereft of both ladies... [Beckwith 1970:222].

Excerpts of the native texts from Haleole's publication in *Kuokoa* are cited below, with translation by Maly. We focus here on excerpts that mention Humu'ula and specific locations on the upper slopes of Mauna Kea (sites today identified as being in the *ahupua'a* of Ka'ohe):

Mokuna VII (Dekemaba 27, 1862)

Ia Aiwohikupua ma i haalele ai ia Paliuli, hoi aku la laua a hiki i Keaau, hoomakaukau na waa, a ma ia wanaao, kau maluna o na waa, a hoi i Kauai...

Ma keia holo ana mai Keaau mai, a kau i Kamaee, ma Hilopaliku, a ma kekahi la ae, haalele lakou ia laila, hiki lakou i Humuula, ma ka palena o Hilo, me Hamakua... A hala hope o Humuula ia lakou, hiki lakou mawaho pono o Kealakaha, ike mai la lakou nei i keia wahine e noho ana i ka pali kahakai, e hiamoe ana nae ke Alii ia manawa.

Chapter VII (December 27, 1862)

Aiwohikupua and his companion departed from Paliuli, and went to Keaau, where the canoe was readied in the early morning, and they boarded the canoe to return to Kauai...

While on their way from Keaau, they arrived at Kamaee, in Hilopaliku, and on the following day they departed and arrived at Humuula, on the boundary of Hilo and Hamakua... Passing Humuula, they were outside of Kealakaha, where they saw a woman sitting along the ocean cliff. The chief (Aiwohikupua) was asleep at that time.

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[6] Waiaie appears as a typesetting error in one section of Haleole's tradition, though is written as "Waiau" in another section of the account (see Chapters XVIII & XIX, below).

Ia lakou i ike aku ai i kela wahine, hooho ana lakou iluna o na waa, "E! ka wahine maikai hoi!"

Seeing the woman, they called out from the canoe, "Oh! What a beautiful woman!"

A no keia, hikilele ae la ka hiamoe o Aiwohikupua, ninau ae la i ka lakou mea e walaau nei, haiia aku la, "He wahine maikai aia ke noho mai la i ka pali." Alawa ae la ke Alii, a ike aku la he mea e o ka wahine maikai.

Because of this, the sleep quickly departed from Aiwohikupua, and he asked what was this that they were talking about, they said, "There is a beautiful woman there, sitting on the cliffs." The Chief looked, and he saw indeed that there was a beautiful woman there.

A no keia mea, kauoha ae la ke Alii i na hoewaa e hoe pololei aku ma kahi a ka wahine e noho mai ana, a holo aku la a kokoke, halawai mua iho la lakou me ke kanaka e paeaea ana, ninau aku la, "Owai kela wahine e noho mai la iluna o ka pali maluna pono ou?"

Because of this, the Chief ordered the canoe paddlers to paddle straight to the place where the woman was sitting. Arriving there shortly, they met with a man who was pole fishing, and asked, "Who is that woman sitting there atop the cliff above your?"

Haiia mai la, "O Poliahu."

He answered, "It is Poliahu."

A no ka manao nui o ke Alii e ike i kela wahine, peahiia aku la, a iho koke mai la kela me kona aahukapa i hoopuniia i ka hau, a haawi mai la i kona aloha ia Aiwohikupua...

Great was the Chiefs desire to see this woman, he waved, and she quickly surrounded herself with her snow garment, and then extended her *aloha* to Aiwohikupua...

Ia laua e halawai malihini ana, i aku o Aiwohikupua, "E Poliahu e! E ka wahine maikai o ka pali, pomaikai wale wau ia oe ma ko kaua halawai ana iho nei, a nolaila e ke Alii wahine o ka pali nei, ke makemake nei wau e lawe oe ia'u i kane hoao nau, a e noho kanaka lawelawe aku malalo ou, ma kau mau olelo e olelo ai, a malaila wale no wau. Ina hoi e ae oe e lawe ia'u e like me ka'u e noi aku nei ia oe, alaila, e kau kaua maluna o na waa, a holo aku i Kauai, a pehea ia?"

Meeting as strangers, Aiwohikupua spoke, "Say Poliahu! The beautiful woman of the cliff, I am indeed blessed by you, at our meeting here. So you, Chiefess of these cliffs here, I desire that you would take me as your husband, as one who will live as a person below you. If you will speak the words, there I will be. If you agree to take me as I have asked you, then we two shall board the canoe, and travel to Kauai. How would that be?"

I mai la ka wahine, "Aole wau he wahine no keia pali, no uka lilo mai wau, mai ka piko mai o kela mauna, e aahu mau ana i na kapa keokeo e like me keia kapa a'u e aahu aku nei. A pehea la i hikiwawe ai ka loaa ana o ko'u inoa ia oe e ke Alii?"

The woman responded, "I am not a woman of these cliffs, I come form the distant uplands, from the summit of that mountain, always adorned in the white garment, just as I am wearing now. And how is it that you come to have my name, o Chief?"

Olelo aku la o Aiwohikupua, "Akahi no wau a maopopo no Maunakea mai oe, a ua loaa koke kou inoa ia makou ma ka haiia ana e kela kanaka paeaea."

Aiwohikupua then said, "I only now, understand that you are from ***Maunakea***, but I got your name from the man that is fishing there.

"A no kau noi e ke Alii," wahi a Poliahu, "E lawe wau ia oe i kane na'u, a nolaila, ke hai aku nei wau ia oe, me ka ninau aku; aole anei

"And regarding your request, o Chief," Poliahu said, "I will consider taking you as my husband. But, I say this of your request; are

o oe ke Alii i ku iluna a hoohiki ma ka inoa o kou mau Akua, aole oe e lawe i hookahi wahine o keia mau mokupuni, mai Hawaii nei, a Kauai; aia kau wahine lawe noloko mai o Moaulanuiakea? Aole anei oe i hoopalau me Hinaikamalama, ke kaikamahine Alii kaulana o Hana? A pau ko huakai kaapuni ia Hawaii nei, alaila, hoi aku a hoao olua? A no kau noi mai e lawe kaua ia kaua i mau mea hoohui nolaila, ke hai aku nei wau ia oe; aia a hoopau oe i kau hoohiki mua, alaila, aole na'u e lawe ia oe, nau no e lawe ia'u a hui kaua e like me kou makemake."

you not the Chief who stood and made an oath in the name of your Gods, that you would not take a wife, from Hawaii to Kauai; for your wife is to be taken from Moaulanuiakea? Yet, are you not betrothed to Hinaikamalama, the famous young chiefess of Hana? And when your journey around Hawaii was completed, that you would return and you two would be married? Now that you have asked that the two of us be joined together, I tell you that you must end your previous oath, or else I cannot take you; if you do, then you may have me as you desire."

A no keia olelo a Poliahu, pili pu iho la ko Aiwohikupua manao me ke kaumaha no hoi; a liuliu hoopuka aku la o Aiwohikupua i wahi ninau pokole penei, "Pehea la oe i ike ai, a i lohe ai hoi no ka'u mau hana au e hai mai nei? He oiaio, e Poliahu e, o na mea a pau au e olelo mai nei, ua hana wau e like me ia nolaila, e hai mai i ka mea nana i olelo aku ia oe."

Because of these words of Poliahu, Aiwohikupua's thoughts were saddened; Aiwohikupua then asked, "How do you know, how have your heard of my tasks, as you have stated? Poliahu, it is true, all the things that you have said, I have done as you've described. So tell who told you these things."

"Aole o'u mea nana i hai mai i keia mau mea, e ke Alii kane, no'u iho no ko'u ike," wahi a ke Alii wahine, "no ka mea, ua hanau kupuaia mai wau e like me oe, a ua loaa no ia'u ka ike mai ke Akua mai o ko'u mau kupuna a hooili ia'u, e like me oe, a na ia Akua wau i kuhikuhi mai e like me ka'u e olelo nei ia oukou. Ia oukou no e holo mai ana i Humuula, ua ike wau nou na waa, a pela wau i ike ai ia oe."

"No one has told me these things, o Chief, it is known to me by my own knowledge," the Chiefess said. "Because I, like you am of a wondrous birth, and I have the knowledge from the Gods, from my ancestors, as inherited by me, like you. These Gods have directed me in my words to you. When you traveled to Humuula, I saw your canoes, and thus, I saw you."

A no keia olelo, kukuli iho la o Aiwohikupua, a hoomaikai aku la imua o Poliahu, me ke noi aku e lilo ia i kane hoopalau na Poliahu, me ke noi aku a holo pu i Kauai...

Because of these words, Aiwohikupua, kneeled down, and praised Poliahu, asking her to take him as the promised one of Poliahu, and also asked that she travel with him to Kauai... [Maly, translator]

The narratives continue, telling readers that Poli'ahu stated that she would only travel with 'Aiwohikūpua and his companions as far as Kohala. She then told him that if she was to agree to a betrothal, he must first be released from his previous engagement to Hina-i-ka-mālama.

Upon preparing for his departure from Kohala, Poli'ahu gave 'Aiwohikūpua her "*kapa hau*" (snow mantle), describing its sacred nature. The following events are described in the narratives below:

...Ia lakou ma Kohala, a hiki i ka la i haalele ai o Aiwohikupua ma ia Kohala, lawe ae la o Poliahu i kona kapa hau, a haawi aku la ia Aiwohikupua me ka olelo aku, "O kuu kapa hau, he kapa i papa loaia e ko'u mau makua, aole e lilo i kekahi mea e ae, ia'u wale iho no;

Arriving at Kohala, the day for Aiwohikupua's departure arrived, ***Poliahu*** took her snow mantle and gave it to Aiwohikupua, saying, "This is my *kapa hau* (snow mantle), it is a mantle that is very sacred to my parents, not to be given carelessly to any other, only for

aka, no ko kaua lawe ana ia kaua i kane hoao oe na'u, a pela hoi wau ia oe, nolaila, he haawi lilo aku nei wau i keia kapa, a hiki i kou la e manao mai ai ia'u a loaa, iluna o Maunakea, alaila, hoike ae oe ia'u, alaila, hui kino kaua..."

me. But because you are to be my husband, I thus give it to you, until the day that you think of me and take me, there atop ***Maunakea***, then you will know me, and we two shall join together..."

...la manawa, kii aku la o Aiwohikupua i kona Ahuula, lawe mai la a hoouhi aku la ia Poliahu, me ka olelo aku, "E like me kau olelo ia'u mamua o kou haawi ana mai ia'u i ke kapa hau, pela no oe e malama ai a hiki i ko kaua hui ana e like me ke kauoha."

At that time, Aiwohikupua took his Feather Cloak, and placed it upon Poliahu, saying, "As you have told me, when you gave me your snow mantle, so too shall you keep this until we two are joined together as instructed."

A pau ka laua kamailio ana i ka wanaao, hookaawale lakou i ka wahine noho mauna, a holo aku la a hiki i Hana, a halawai me Hinaikamalama...

It was as the early light of dawn appeared, that they finished their conversation. They then departed from the woman who dwells upon the mountain, sailing to Hana, to meet with Hinaikamalama... [Maly, translator]

'Aiwohikūpua then returned to Kaua'i, though he failed to formally break off his betrothal to Hina-i-ka-mālama. After some time, 'Aiwohikūpua sent his messenger to Hawai'i to arrange for Poli'ahu to meet with him in preparation for their marriage.

At this point, Haleole introduced readers to Lilinoe, Waiau (a type setting error by the newspaper in this issue gave the name as Waiaie), and Kahoupokane, the companion-goddesses of Poli'ahu, who dwelled upon the mountains; and places for which names are still known on the mountain landscape today.

The messenger, Koa'e, went to Hawai'i and met with Poli'ahu, giving her the message of 'Aiwohikūpua. Arrangements were made, and on the appointed day, 'Aiwohikūpua and his retinue, departed from Kaua'i, and traveled to Kawaihae, and then on to the designated meeting place at Wai'ula'ula (the boundary between the *ahupua'a* of Kawaihae and *'ili* of 'Ōuli, Waimea):

Mokuna XVIII (Ianuali 17, 1863)

...hoouna hou aku la oia ia Koae, kekahi o kana mau elele mama e like me ka olelo kauoha i na elele mua.

Chapter XVIII (January 17, 1863)

...he sent Koae, one of his swift messengers, with the command, as given to the first messenger.

A hiki o Koae i o Poliahu la, halawai aku la laua, hai aku la o Koae i ke kauoha a ke Alii e like me ka mea i haiia ma na pauku hope o ka Mokuna XVII o keia Kaao; a pau na olelo a ke Alii i ka haiia, hoi aku la ko ke Alii elele, a hai aku la ma ka pololei, alaila, he mea maikai ia i kona Haku.

Koae arrived before Poliahu, and they met. Koae told her the command of the Chief, as given in the last paragraph of Chapter XVII of this tale. When the words of the Chief had been spoken, the Royal messenger repeated the words to his Lord's satisfaction.

Noho iho la o Aiwohikupua, a i na la hope o ke kolu o ka malama; lawe ae la ke Alii i kona mau kaukaualii, a me na punahele, i na haiawahine hoi, na hoa kupono ke hele pu ma ke kahiko ana i ka hanohano Alii ke hele ma kana huakai no ka hoao o na Alii.

Aiwohikupua then sat down, and in the last days of the third month; the Chief took his royal attendants, favorites, female retainers, and those necessary companions, adorned in their Chiefly manner, and traveled to where the chief would be married.

I na la i o Kaloa kukahi, haalele o Aiwohikupua ia Kauai, holo aku oia he kanaka kaulua, elua kanaka kaukahi, he iwakalua peleleu.

On the day of *Kaloa kukahi*, Aiwohikupua departed from Kauai with his people on double and single-hulled canoes, and twenty *peleleu* canoes.

Mamua o ka po hoao o na Alii, i ka po i o Huna, hiki lakou i Kawaihae, ia manawa, hoouna aku la oia ia koae, kona elele e kii ia Poliahu e iho mai e halawai me Aiwohikupua, i ka la i kauohaia'i e hoao.

Before the night of the Royal wedding, on the night of Huna, they arrived at Kawaihae, he [Aiwohikupua] then sent his messenger, Koae, to fetch Poliahu, bringing her down to meet with Aiwohikupua, on the day set for the wedding.

A hiki ka elele imua o Aiwohikupua mai ke kii ana ia Poliahu, a hai mai la i kana olelo mai a Poliahu mai, "Eia ke kauoha a ko wahine, ma Waiulaula olua e hoao ai, ina e ike aku kakou ma ke kakahiaka nui o ka la o Kulu, e halii ana ka hau mai ka piko o Maunakea, Maunaloa, a me Hualalai, a hiki i Waiulaula, alaila, ua hiki lakou i kahi o olua e hoao ai, alaila, hele aku kakou, pela mai nei."

Returning from his trip to get Poliahu, the messenger went in front of Aiwohikupua, and gave him the message that Poliahu had given him, "Here is the command of your woman; at Waiulaula you two will be wed. When, in the early morning of Kulu we see that the snows have spread from the summit of ***Maunakea***, to Maunaloa, and Hualalai, and are descending to Waiulaula, we are to go, for there is the place where you two will wed."

Alaila, hoomakaukau ae la o Aiwohikupua i kona hanohano Alii.

So Aiwohikupua prepared in his Royal honor.

Kahiko aku la o Aiwohikupua i kona mau kaukaualii kane, a me na kaukaualii wahine, a me na punahele, i ka Ahuula, a o na haiawahine kekahi i kahikoia i ka Ahuoeno. A kahiko iho la o Aiwohikupua i kona kapa hau a Poliahu i haawi aku ai, kau iho la i ka mahiole ie i hakuia i ka hulu o na Iiwi. Kahiko aku la oia i kona mau hoewaa o ke Alii, pela no na hoewaa o kona puali alii a pau...

Aiwohikupua adorned his supporting chiefs and chiefesses, and his favorites in Feather cloaks; his female attendants were adorned in fine woven garments (*ahu'o'eno*). And Aiwohikupua was adorned in the snow mantle, which ***Poliahu*** had given him, and with an *ie* helmet, covered with the feathers of the *iiwi* birds. He also adorned all of his Royal paddlers and all of his warriors...

Ma ka la o Kulu, ma ke kakahiaka, i ka puka ana ae o ka la a kiekie iki ae, ike aku la o Aiwohikupua ma i ka hoomaka ana o ka hau e uhi maluna o ka piko o na mauna, a hiki i kahi o laua e hoao ai.

On the day of *Kulu*, in the early morning, as the sun was just rising, Aiwohikupua and companions saw that the snow began to cover the summits of the mountains, and then descended to the place where they two were to be married.

I kela manawa, ua hiki o Poliahu, Lilinoe, Waiaie [Waiau], a me Kahoupokane, i kahi e hoao ai na Alii.

At that time, ***Poliahu, Lilinoe, Waiaie [Waiau], and Kahoupokane*** arrived at the place where the Royal couple was to be wed.

Ia manawa, hoomaka o Aiwohikupua e hele e hui me ka wahine noho mauna o Maunakea. E like me ka mea i oleloia maluna, pela ko ke Alii hele ana.

At that time, Aiwohikupua then went to join the mountain-dwelling woman of ***Maunakea***. As described above, the Chief went to meet her.

Ia Aiwohikupua ma e holo aku ana i ka moana mai Kawaihae aku, he mea e ka olioli

Aiwohikupua and his companions traveled across the ocean from Kawaihae, and Lilinoe

o Lilinoe i ka hanohano launa ole o ke Alii kane.

rejoiced at the unequaled glory of the Chief.

A hiki lakou i Waiulaula, ua pauia lakou e ke anu, a nolaila, hoouna aku la o Aiwohikupua i kona elele e hai aku ia Poliahu, "Aole e hiki aku lakou no ke anu."

When they arrived at Waiulaula, they were overtaken by the cold. Therefore, Aiwohikupua sent his messenger to tell ***Poliahu***, "They could not continue because of the cold."

Ia manawa, haalele e Poliahu i kona kapa hau, lalau like ae la ka poe noho mauna i ko lakou kapa la, hoi aku la ka hau a kona wahi mau.

Poliahu then set aside her snow mantle, as did the others who dwell on the mountain, and the snows returned to their usual abode.

Ia Aiwohikupua ma i hiki aku ai ma ko Poliahu ma wahi e noho ana, he mea lealea loa i ke Alii wahine na mea kani o na waa o ke Alii kane, a he mea mahalo loa no hoi ia lakou ka ike ana i ko ke Alii kane hanohano, a maikai hoi.

When Aiwohikupua and his companions arrived at the place where ***Poliahu*** and her companions were sitting, there was great joy between the Chiefesses, and those of the canoes of the Chief. They greatly admired the Chief in his glory.

Ia laua i hui ai, hoike ae la o Aiwohikupua, a me Poliahu, i na aahu o laua i haawi muaia i mau hoike no ka laua olelo ae like...

When they met, Aiwohikupua and ***Poliahu*** both showed one another their garments which they had first given as a sign of their original agreement... [Maly, translator]

Poli'ahu, 'Aiwohikūpua and his party then departed for Mānā, Kaua'i, as had been agreed upon earlier. They joined the Chiefs Hauailiki and Makaweli, and entered into enjoyable contests in the lover's game of *kilu*.

In the meantime, Hina-i-ka-mālama heard of 'Aiwohikūpua's wedding to Poli'ahu, and she determined to travel to Kaua'i to claim her first right to 'Aiwohikūpua as a husband.

As described in the summary of the *mo'olelo* prepared by Martha Beckwith (1970), the promised marriage between Poli'ahu and 'Aiwohikūpua was not meant to be. Outraged, Poli'ahu abandoned 'Aiwohikūpua to Hina, but punished them by sending waves of cold and heat over them.

Mokuna XIX (Ianuali 24, 1863)

...Iloko o ko laua manawa i hoomaka ai no ka hooko ana i ka hoohiki, alaila, ua pono ole ia mea i ko Poliahu manao.

Ia manawa, lawe ae la o Poliahu i kona kapa la, a aahu iho la, ia manawa ka hookuu ana'ku o Poliahu i ka wela maluna o Hinaikamalama. Ia manawa, hapai ae la oia he wahi mele, penei:

"He wela--e, he wela,
Ke poi mai nei ka wela a kuu ipo ia'u,
Ke hoohahana nei i kuu kino,
Ke hoonakulu nei hoi i kuu manawa,
No kuu ipo paha keia wela---e."

Chapter XIX (January 24, 1863)

...***Poliahu*** felt sorely wronged at the time they [Aiwohikupua and Hinaikamalama] set out to fulfill their oath.

At that time, ***Poliahu*** took her mantle and put it on, and then she released a heat upon Hinaikamalama. At that time, she [Hinaikamalama] took up a chant, thus:

It is so hot, so hot,
The heat of my love covers me,
Warming my body,
Causing my feelings to flutter,
Perhaps the heat is from my sweetheart.

I aku o Aiwohikupua, "Aole no'u na wela, malia paha no Poliahu no na wela, ua huhu paha ia kaua..."

Aiwohikupua said, "This heat is not from me, it is perhaps a heat from ***Poliahu***, who is perhaps upset with us..."

...I ke kolu o ka po lealea o Hauailiki, i na'lii e akoakoa ana, a me na mea e ae, oia ka po i hui ai o Lilinoe, me Poliahu, o Waiau, a me Kahoupokane, no ka mea, ua imi mai lakou ia Poliahu, me ka manao ke pono nei ko Aiwohikupua ma noho ana me Poliahu.

On the third night of the contests of Hauailiki, the chiefs gathered together, as well as the others. And it was on that night that ***Lilinoe***, ***Waiau***, and ***Kahoupokane*** joined with ***Poliahu***. They had been searching for her, thinking that all was good between ***Poliahu*** and Aiwohikupua.

Ia po, ia Aiwohikupua me Makaweli, e kilu ana, a i ka waenakonu o ko laua manawa lealea, komo ana na wahine noho mauna iloko o ka aha lealea.

That night, while Aiwohikupua and Makaweli were playing *kilu*, the women who dwell upon the mountain entered the assembly.

Ia Poliahu ma eha e ku ana me na kapa hau o lakou, he mea e ka hulali, ia manawa, nei aku la ka aha lealea no keia poe wahine, no ke ano e o ko lakou kapa. Ia manawa, popoi mai la ke anu i ka aha lealea a puni ka papai kilu, a kau mai la maluna o ka aha ka pilikia a hiki i ka wanaao, haalele o Poliahu ma ia Kauai. O keia manawa pu no hoi ka haalele ana o Hinaikamalama ia Kauai...

With ***Poliahu***, the four of them stood in their glistening snow mantles. The crowd murmured among themselves about these women and the nature of their garments. Then, the assembly in the *kilu* shelter was buffeted waves of severe cold, a trouble which persisted to the early morning light. ***Poliahu*** and her companions then left Kauai. Hinaikamalama also left Kauai at that time... [Maly, translator]

As described by Beckwith, 'Aiwohikūpua was left without the company of either of the women, Poli'ahu and Hina-i-ka-mālama.

Heiau of the Mountain Lands Described in "Na Kaao a Kekahi Elemakule o Hawaii" (1865)

Among the early accounts penned by Hawaiian writers, in which reference to features associated with Humu'ula, Ka'ohe and the *'āina mauna* are found, is an 1865 account, originally collected in 1853. The Hawaiian newspaper "*Ke Au Okoa*" published an article titled "*Na Kaao a Kekahi Elemakule o Hawaii*" (May 8, 15, & 22, 1865), taken from the stories collected by Jules Remy, a French man who came to Hawai'i in 1851. While introducing the article, readers are told that Remy dwelt in Hawai'i for about three years, during which time he became quite proficient in the Hawaiian language. While here, Remy traveled around the islands, documenting sites and events which he witnessed, and recording histories that were related to him. His narratives, written in French, reached Hawai'i, and were translated into Hawaiian by W.D. Alexander (*Ke Au Okoa*, *Mei* 8, 1865).

"*Na Kaao a Kekahi Elemakule Hawaii*" was collected by Remy in March 1853, when he visited Ho'opūloa, South Kona. Upon landing, Remy records that he was warmly greeted by the people on the shore, and among the many people gathered, he observed an elderly gentleman. He was "stout and broad-chested, and on the account of his age, his hair was reddish gray."

Remy learned that the old man was Kanuha[7], a man of chiefly descent, born before the time that Alapa'i-nui died, in 1752 (*Ke Au Okoa*, *Mei* 8, 1865). Remy noted that Kanuha was nearly 116 years old, and in good health. Because of his advanced age, he spoke with authority on ancient customs and history of the Hawaiian people, that few, if any, other people were able to (*Ke Au Okoa*, *Mei* 8, 1865).

[7] Kanuha is found in several historical accounts recorded by Kamakau (1961) and Fornander (1973).

Among the traditions which Kanuha told Remy, was an account of the ascent of 'Umi to the position of king on the island of Hawai'i. In the account, Kanuha describes the history behind the construction of the famed *heiau* (temple) Ahu-a-'Umi, and the construction of three other *heiau* on the *'āina mauna*—one on Mauna Kea, one on Mauna Loa, and one on a hill near the Ka'ohe-Waikōloa boundary. In addition to 'Ahu-a-'Umi (*Figure 3*), these *heiau* included Pu'u Ke'eke'e (an area of a known *pu'u* in Ka'ohe, near Pu'u ka Pele), Mauna Halepōhaku (on Mauna Kea), and Pōhaku o Hanalei (on Mauna Loa). By description, and in some cases, by physical features on the ground, these *heiau* were situated in the lands of Humu'ula (perhaps two of the *heiau*), Ka'ohe, and Keauhou.

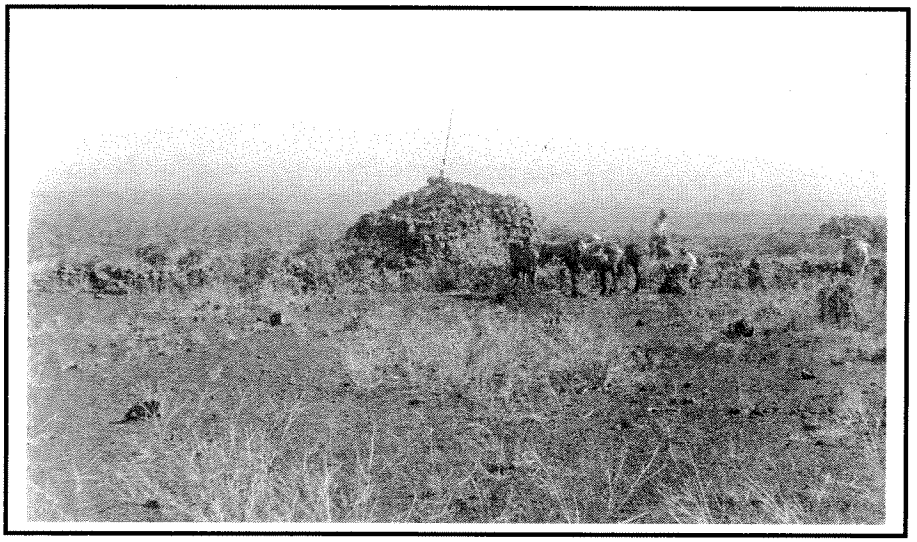

Figure 3. Portion of 'Ahu-a-'Umi Heiau, Mauna Kea viewed in the Background (ca. 1890; in collection of the Hawai'i State Archives)

It is noted here, that in his own work, Abraham Fornander (1973) acknowledged the age and authority of Kanuha, but he also found inconsistencies in the genealogical relationship of individuals mentioned by Kanuha (Fornander 1973:99-101). In particular, Remy reports that Kanuha conveyed to him that 'Umi went to war with Keli'iokaloa, a chief of Kona. Historical accounts by native writers and Fornander record that Keli'iokaloa was the son of 'Umi, and that he became king of Kona for a time following his father's death (Fornander 1973:99-101). It should be considered here that this historical inconsistency may actually be attributed to Remy's own hand, rather than the narratives of Kanuha.

Regardless of the possible genealogical differences, one of the unique qualities of the account is that it provides us with otherwise unrecorded documentation regarding construction and occurrence of *heiau* in the high mountainous region of Hawai'i. The following narratives, with excerpts of the original Hawaiian and translations of the accounts (translated by Maly), are taken from Remy's recording of Kanuha's story in 1853, and published in *Ke Au Okoa* on May 22, 1865:

> Umi ruled in place of Hakau, and his friends Koi and Omaokamau dwelt with him. Piimaiwaa, Umi's war leader dwelt in Hilo. With Umi, there was also his trusted companion Pakaa, and his priest Lono. At this time, Umi ruled the eastern side of Hawaii, while on the western side, his relative Keliiokaloa, ruled and dwelt at Kailua... In the time that he dwelt in Kailua, Keliiokaloa was known as an evil chief, he cut down the coconut trees and desecrated the cultivated fields. It was because of these evil deeds that Umi made preparations to go to war against him. Umi marched to battle, joined by his famous warrior, Piimaiwaa, and his companions Koi and Omaokamau. Also with him were his favorite, Pakaa, and his priest Lono.

The Hawaiian narrative then reads:

> *Mawaena o **Maunakea** a me Hualalai ka hele pualu ana o ua alii nei me kona manao e iho ae i Kailua. Aole nae i kali o Keliiokaloa, aka, ua pii nui aku oia me kona poe koa e houka aku ia Umi. Ua halawai na puulu kaua a i elua maluna o kekahi wahi papu i hoopuni ia e na mauna ekolu, a i kapaia hoi ke **Ahu a Umi**. Kaua mai o Laepuni ma (he mau kanaka makaainana pili alii ole) ia Umi, a aneane e make o Umi ia laua, lele mai o Piimaiwaa e kokua iaia, a oia ka mea nana i hooholo ae ka lanakila ma ko Umi aoao. Aohe mau mea nui i hai ia mai, aka, me he mea la, ua make ke alii o Kailua iloko oia kaua ana. Ma keia kaua ana, ua lilo holookoa ia Umi ke Aupuni, a lilo iho oia ke alii ai moku o ka mokupuni o Hawaii. I mea e ili aku ai ka hoomanao ana no ia kaua ua hanauna aku a ia hanauna aku, ua kukulu ae la ia i ke ahu aa, e o ia nei a hiki i keia wa ke **ahua a Umi**...*
>
> Between ***Mauna Kea*** and Hualalai the chief and all his party traveled, with the thought of descending to Kailua. Keliiokaloa did not wait though, but instead, traveled with his warriors to meet Umi in battle. The two armies met on a broad open plain, surrounded by the three mountains, at the place [now] called ***Ahu a Umi***. There, Laepuni and them (people who were unattached to a chief) fought with Umi. Umi was almost killed, but Piimaiwaa leapt in and helped him, it was he who turned the battle in the favor of Umi's side. There is not much else that is said, but, it is known that the chief of Kailua died in the battle. Thus, with this battle, the entire kingdom was gained by Umi. He became the chief that controlled the entire island of Hawaii. *So that the battle would be remembered from generation to generation, he (Umi) built the stone altar, that remains to this day,* ***the altar (ahua) of Umi***... [*Ke Au Okoa*; *Mei* 22, 1865]

The narrative records that early in 'Umi's life, the priests Nunu and Wawa had discerned 'Umi's nature, and foretold that his god Kā'ili, made with a feather from the god Halulu, had empowered him. Indeed, 'Umi was a religious chief, and made many temples for his god. Among the temples were—

> *...Ua kukulu no hoi ia he heiau malalo o **Pohaku Hanalei**, a ua kapaia o ke **ahua o Hanalei**; a ma na aoao o **Maunakea** e hele ala i Hilo, ua kukulu no ia i ke kolu o ka heiau, ma kahi i kapa ia o **Puukekee**[8]; a ma **Mauna Halepohaku** malaila ia i kukulu ai i ka ha o na heiau, a malaila no hoi i olelo ia ai ua noho o Umi malaila me kona mau kanaka. Ua olelo ia o Umi he alii noho mauna, no kona aloha i kona poe kanaka, nolaila, ua hoi aku ia i waenakonu o ka mokupuni ilaila kona wahi i noho ai me kona poe kanaka, a na kona makaainana e noho ana ma na kapakai, e lawe mai i ka ai na lakou, mai kela pea, keia pea...*
>
> *...He (Umi) also built a heiau (temple) below **Pohaku Hanalei**, it is called the **ahua o Hanalei** (altar of Hanalei); and on the side of **Mauna Kea**, by where one travels to Hilo, he built the third of his temples, at the place called **Puukekee** [also written Puu Keekee in historical texts]; and there at **Mauna Halepohaku** he built the fourth of his temples;*

[8] Puukekee (Pu'u Kēke'e or Pu'u Ke'eke'e) is a hill that sits on the boundary between Waikōloa, Kohala, and Ka'ohe, Hāmākua.

> *there, it is said, Umi dwelt with his many people. It is said that Umi was a chief who dwelt upon the mountain, it was because of his love of his people, that he (Umi) returned and dwelt in the middle of the island [Ahu-a-Umi], that is where he dwelt with his beloved people. His commoners lived along the shores, and they brought food for them (in the uplands), from one side of the island to the other...* [*Ke Au Okoa*; *Mei* 22, 1865; Maly, translator]

Also, in the 1860s, Hawaiian historian Samuel Mānaiakalani Kamakau (1961), provided readers with several early Hawaiian historical accounts of Mauna Kea and environs (either directly or indirectly by association with place names). These accounts are particularly significant because they can be dated by genealogical associations with individuals identified in text. Two of Kamakau's narratives are set in the period of the great king 'Umi-a-Līloa, who in c. 1525-50, unified the island of Hawai'i under his rule, and established the land division and land management system that remained in place until the *Māhele* of 1848.

In Kamakau's description of the rise of 'Umi to power, we learn of his conquest of Hilo, and the route traveled from Waipi'o, Hāmākua, crossed Mauna Kea, via the trail that ran across Humu'ula-Pi'ihonua, and through Kaūmana, to the royal community on Hilo Bay:

> It was decided to make war on the chiefs of Hilo and to go without delay by way of ***Mauna Kea***. From back of Ka'umana they were to descend to Hilo. It was shorter to go by way of the mountain to *the trail of* ***Poli'ahu*** *and Poli'ahu's spring* [***Waiau***] at the top of ***Mauna Kea***, and then down toward Hilo. It was an ancient trail used by those of Hamakua, Kohala, and Waimea to go to Hilo. They made ready to go with their fighting parties to ***Mauna Kea***, descended back of Hilo, and encamped just above the stream of Wai-anuenue... [Kamakau 1961:16-17]

Describing a later period during the reign of 'Umi, Kamakau related an account of the death and burial of the *kahuna* Pae, who served 'Umi. Kamakau reports that Pae was "a descendant of ***Lilinoe***, the woman of the mountains" (Kamakau 1961:215). Kamakau also reported that Lilinoe was an important ancestral figure in the genealogy's of Hawai'i's *ali'i* (royalty), and that she was buried on Mauna Kea. He observes that in 1828 Ka'ahumanu traveled to Hawai'i to:

> ...attempt the recovery of the bones of ***Lilinoe*** on ***Maunakea*** where her body was said to have lain for more than a thousand years in a well-preserved condition, not even the hair having fallen out. Others deny this and say her body was too well-hidden ever to have been found. Her offspring count from Hua-nui-i-ka-la'ila'i; she was the ancestress of ruling chiefs, and from her line was born 'Umi-ka-lani [father of the Mahi family on Hawaii], son of Keawe-nui-a-'Umi by Ho'opili-a-Hae. It is said that Ka-'ahu-*manu* did not find the bones of Lilinoe... [Kamakau 1961:285]

Warriors Traveled the Mountain Paths and Met in Battle on the 'Āina Mauna

Among S.M. Kamakau's traditions are found the history of Keawe-nui-a-'Umi and his brother Ke-li'i-o-Kaloa, who shared the rule over Hawai'i. When it was learned that Ke-li'i-o-Kaloa was abusing his people, Keawe-nui-a-'Umi determined to depose Ke-li'i-o-Kaloa. The warring parties traveled across the mountain lands, with Keawe-nui-a-'Umi's war parties marching from Hilo, Puna, and Ka'ū, across the plateau between Mauna Kea and Mauna Loa, and towards 'Ahu-a-'Umi, the temple built by his father. Kamakau (1961) reported:

> When Keawe-nui-a-'Umi learned of the unjust rule of Ke-li'i-o-kaloa and the burdening of the common people, he was filled with compassion for the chiefs and commoners of Kona. Therefore he made himself ready with his chiefs, war lords, war leaders, and

warriors from Hilo, Puna, and Ka-'u to make war on Kona. The war parties [met?] at the volcano (pit of Pele) before going on to battle along the southern side of ***Mauna Kea*** and the northern side of Mauna Loa. The mountain road lay stretched on the level. At the north flank of Hualalai, before the highway, was a very wide, rough bed of lava—barren, waterless, and a desert of rocks. It was a mountain place familiar to 'Umi-a-Liloa when he battled against the chiefs of Hilo, Ka-'u, and Kona. There on that extensive stretch of lava stood the mound (*ahu*), the road, the house, and *heiau* of 'Umi.* It was through there that Keawe-nui-a-'Umi's army went to do battle against his older brother, Ke-li'i-o-kaloa.

When the chiefs of Kona heard that those of Hilo were coming by way of the mountain to do battle, Ke-li'i-o-kaloa sent his armies, but they [page 35] were defeated by the armies from Hilo. The armies of Kona were put to flight. When the armies of Hilo reached the shore of Kona the war canoes arrived from Ka-'u and from Hilo. The battle was [both] from the upland and from the sea. Ke-li'i-o-kaloa fled and was killed on a lava bed. The spot where he was killed was called Pu'u-o-Kaloa (Kaloa's hill), situated between Kailua and Honokohau... [Kamakau, 1961:36]

In the next generation, Lono-i-ka-makahiki, grandson of 'Umi-a-Līloa, was also called upon to battle, this time, against the invading forces of the Maui chief, Kama-lālā-walu. Once again, we find that warriors of Hawai'i made use of the mountain land trails to meet the final challenge on the plains of Waimea. The warriors from the Ka'ū, Puna and Hilo districts passed by Mauna Kea, to join in the battle below Pu'u 'Oā'oaka, in Waimea:

Kama-lala-walu, the heedless chief, paid no attention, but followed the advice of two old men of Kawaihae who counseled falsely. One of them was named Puhau-kole. They said, "Pu'uoa'oaka is a good battlefield and will be a great help to the chief. All the canoes should be taken apart because the warriors may desire to run back to the canoes and depart in secret for Maui. The best thing to do is to cut up the canoes and outriggers, for there are canoes enough in Hawaii. When it is conquered, there will be many canoes from Kona and Ka-'u. There will be much property and wealth for the Maui chiefs." The chief, Kama-lala-walu, listened to the advice of Puhau-kole and his companion. Their suggestions were carried out, and the canoes were broken up. Then Kama-lala-walu's fighting men went up to the grass-covered plain of Waimea.

After Kama-lala-walu's warriors reached the grassy plain, they looked seaward on the left and beheld the men of Kona advancing toward them. The lava bed of Kaniku and all the land up to Hu'ehu'e was covered with the men of Kona. Those of Ka-'u and Puna were coming down from ***Mauna Kea***, and those of Waimea and Kohala were on the level plain of Waimea. The men covered the whole of the grassy plain of Waimea like locusts. Kama-lala-walu with his warriors dared to fight. The battlefield of Pu'oa'oaka was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led to the waterless plain lest Maui's warriors find water and hard, waterworn pebbles. The men of Hawaii feared that the Maui warriors would find water to drink and become stronger... [Kamakau, 1961:58]

"He Moolelo Kaao Hawaii no Laukaieie" (1894)

"*He Moolelo Kaao Hawaii no Laukaieie...*" (A Hawaiian Tradition of Laukaieie) was published in the native language newspaper, *Nupepa Ka Oiaio*, between January 5th 1894 to September 13th 1895. The *mo'olelo* was submitted to the paper by Moses *Manu.* The story is a rich and complex account with island-wide references to—places; descriptions of place name origins; history and *mele*; interspersed with accounts from other traditions and references to nineteenth century events.

* It is reached "by a fourteen mile journey from Holualoa up the old Judd trail, or by an eighteen or twenty mile trip from Kealakekua, via Pu'ulehua and Kanahaha... It is on the slope of Hualalai, at between 4,500 and 5000 feet elevation, with Mauna Kea and Mauna Loa towering snow-clad, much farther away."

The following narratives (translated by Maly), have been excerpted from the *mo'olelo*, and include an overview of the tradition and those narratives which recount the travels of Pūpū-kani-'oe, an elder of Lau-ka-'ie'ie—

> Kaholokuaiwa [w] and Koa'ekea [k] lived at Ulu, in Waipi'o Valley on the island of Hawai'i. They were descended from the chiefly and godly lines of Kahiki and Hawai'i. Their first child was Lauka'ie'ie. But because she was born in an *'e'epa* (mysterious) form, looking more like a plant than a child, she was wrapped in *līpoa* seaweed and set in the stream. Without her parents knowledge, Lauka'ie'ie was retrieved by a mountain goddess and nurtured. Later, two other children, boys, were born to Kaholokuaiwa and Koa'ekea. One was named Hi'ilawe, and the other was Makanikeoe (who was also a wind deity).
>
> Koa'ekea's sister was Pōkāhi, and her husband was Kaukini. Though they had been married for a long time, they were childless, and because of their prayers and offerings, the forest goddess, Hinaulu'ōhi'a, approached Pōkāhi while she was gathering seaweed, and told her that she would have a girl child to raise as her own. The condition was, that no one, not even her brother and sister-in-law were to know about this child. Because Pōkāhi and Kaukini lived on the mountain ridges between Waipi'o and Waimanu, it was easy for her to keep the secret. It was in this way, that Lauka'ie'ie came to be raised by her own aunt and uncle. As a youth, Lauka'ie'ie's companions were the spirits of the plants and animals of the forest. When she matured, she was very beautiful, and thoughts of finding an acceptable mate for her began to grow. One night, when Lauka'ie'ie was sleeping, she dreamed of flying past the valley lands of Hawai'i, and across, Maui, Moloka'i, O'ahu, Kaua'i, Ni'ihau, Ka'ula, and on to *Lehua*[9], where she saw a handsome young chief, named Kawelonaakalāilehua. It was this chief that was destined to become her husband, and who was fetched to Hawai'i, by her elder relative, Pūpū-kani-'oe... [January 5-19, 1894]
>
> Pūpū-kani-'oe and her companions from *Lehua* and Ka'ula, sailed in their canoe, passing Kaho'olawe, guided by the sharks of those waters. They entered the channel of 'Alenuihāhā, and her companions, who had never before seen Hawai'i, saw the mountains of ***Mauna Kea***, ***Mauna Loa*** and Hualālai rising above. Ka-welona-a-ka-lā-i-*Lehua* inquired of Pūpū-kani-'oe, the names of those places on Hawai'i. She answered, telling them that they were the mountains on which dwell the women who wear the *kapa hau* (snow garments), and who covered the lands down to where the woods were found. Pūpū-kani-'oe then chanted:
>
> | | |
> |---|---|
> | Ma'ema'e i ka hau ka luna o Mauna Kea, | Pure are the snows atop **Mauna Kea** |
> | Ōpū iho la iluna o ka hinahina, | Little clumps settled upon the hinahina, |
> | *Ka pua luhiehu a ka māmane,* | Adorned with the blossoms of the *māmane*, |
> | *He lama wale ala no ke ike aku,* | It looks like a light when seen, |
> | *Aloha mai nei hoi ka Aina...* | There is such love for the land... |
>
> She then called out, describing Haleakalā:
>
> | | |
> |---|---|
> | *Aia ho'i ke kuahiwi kaulana o Maui,* | Behold the famous mountain of Maui, |
> | *Ke kunihi a'e la i ka makani,* | Standing boldly in the winds, |
> | Akāka wale no Haleakalā, | Haleakalā is clear, |
> | *Ka 'uwē a ke kini of Ko'olau...* | And the multitudes of Ko'olau cry out... |

[9] The lengthy narratives include site descriptions and traditional accounts for various locations on each of the named islands.

The party then passed Kohala, and arrived at Waipi'o, were they landed. [March 9, 1894; Maly, translator]

Po'e Lawai'a Manu: Bird Catchers in Old Hawai'i (1895)

Among those people who would have most often frequented the uplands of the *'āina mauna*, being both the forested region and the upper plateau and mountain slopes were the *lawai'a manu* or *kia manu* (bird catchers). Their knowledge of the mountain lands, trails, shelters, and resources was widely valued throughout the nineteenth century, and the bird catchers were often sought out as guides and for their expertise in matters of land.

There are a number of traditional accounts describing the arts of the class of people who caught native birds in order to collect their feathers, or catch birds which were considered delicacies in the Hawaiian diet. And several methods of bird catching were widely practiced by native Hawaiians. The practices of the *kia manu* were also dictated by *kapu* and a code of conduct. Accounts from the later period in the life of Kamehameha I, reported that as a result of growing commercial activities in the islands, traditional methods of harvesting resources and catching birds, were changing (Kamakau, 1961 & Emerson, 1895). Regarding these changes, and the response of Kamehameha I to careless collection of bird feathers, in which the birds were killed, Kamakau (1961) wrote:

> ...Troubles that arose were not of his [Kamehameha's] making, and those that had to do with disputes about religion came after his time. He ordered the sandalwood cutters to spare the young trees and, not to let the felled trees fall on the saplings. "Who are to have the young trees now that you are getting old?" he was asked and he answered, "When I die my chief and my children will inherit them." He gave similar orders to bird catchers, canoe makers, weavers of feather capes, wood carvers, and fishermen. These are the acts of a wise and Christian king who has regard for the future of his children, but the old rulers of Hawaii did the same... [Kamakau, 1961:209-210]

In 1895, N.B. Emerson, published an article pertaining to bird catchers of old. The article notes the importance of the Hilo region forest lands for the favored honey creepers, which were sought after by the *kia manu*. The following narratives describing the arts and practices of the *kia manu*, and the nature of the forest and birds therein, were collected by Emerson from native practitioners:

> ...Bird-catching, while of great fascination, was a most exacting profession, demanding of the hunter a mastery of bird-craft and wood-craft attainable only by him who would retire from the habitations of men and make his home for long periods in the wooded solitudes of the interior.
>
> The kings of Hawaii constantly had men in their service who followed the vocation of bird-catching, called *kia-manu*. It is related of one of the ancient kings that at a critical juncture in his affairs he led off his warriors into the mountains with the purpose or pretext of engaging in bird-catching for plumage. But this is not a business in which a multitude can successfully engage in close proximity to each other. The *kia-manu* needs room; he must do his work in solitude, with the field to himself.
>
> The feathers of Hawaiian plumage-birds may be divided, as to color, into several classes:
>
> 1. Pure yellow. The yellow feathers were taken either from the *o-o* or from the coat of the still rarer *mamo*. Those of the *mamo* were of a deeper tint, but of shorter staple than the former, and as the bird was shy and difficult of capture, they were greatly coveted for the richest articles for feather-work, cloaks, capes and necklaces. It is a question still in dispute whether this rare bird is not extinct.
>
>   The *o-o*, though a proud and solitary bird, was more prolific than the *mamo*. Its coat was of deep black, set off with small tufts of clear yellow under each wing

and about the tail and in some varieties about the neck and thighs. Those from the axial were called *e-e* and were the choicest, and being of a longer staple were in the greatest demand for the *lei*.

No swan's down can surpass, in delicacy of texture, the axilliary tufts of the *o-o*.

2. Red. Scarlet, or red feathers were obtained from the body of the *i-iwi* and the *akakani* (*akakane* or *apapane*). It may be disputed whether one or the other of these is not to be designated as common. The color-tone of the feathers varies. They were song-birds, and when on the wing, displaying their plumage of black and scarlet, were objects of great brilliancy. There [page 102] was, I am told, another red-feathered bird called *ula-ai-hawane*, a beautiful thing in scarlet, wild and shy, a great fighter, a bird very rarely taken by the hunter. Its plumage would have been a welcome addition to the resources of Hawaiian feather-workers had it been obtainable.

3. Green. Feathers of an olive green were obtained from the *o-u*, and from the *amakihi* those of a greenish-yellow. Though of less value than some others, the green feathers were an important resource in adding variety to Hawaiian feather-work. This color, however, was not used in the richest and most costly cloaks and capes.

4. Black. Feathers of black were obtained from the *o-o*, *mamo*, *i-iwi* and *akakani*, not to mention numerous other sources, including the domestic fowl, which also contributed feathers of white.

While this list is not intended to be exhaustive, mention should be made of the *koa*'e (bosen, or tropic bird), which furnished two long feathers from its tail used in making kahilis. Though this bird took its prey from the ocean, its nest was in the face of the steep mountain palis and in the cliffs of the small, rocky island, Kaula, Nihoa, Lehua, and Necker. There are two varieties of this feather.

The methods used by one hunter in the capture of the birds differed from those used by another. They also varied somewhat, no doubt, in different districts, on the different islands, at different seasons of the year and seen in the different islands, at different hours of the day.

There could be nothing stereotyped in the way the hunter of birds practiced his art. While the method might remain essentially the same, it was necessarily subject to a wide range of modification, to suit the skill and ingenuity of each hunter in his efforts to meet the habits and outwit the cunning of the birds themselves.

For the purpose of observing more closely the manner of life and methods of the bird-catcher, let us transport ourselves in imagination to the interior wilderness of Hawaii, and live for a time amid the stretches of forest with which the climate of rainy Hilo clothes the volcanic debris of active Kilauea and extinct ***Mauna Kea***. [page 103]

There were two seasons of the year favorable to the operations of the hunter; first, during the months of March and April, extending into May, and second, during August, September and October.

These two bird-seasons corresponded with the two flowering seasons of the *lehua*. The *lehua* of the lower woods flowered in the earlier season, that of March, April and May, at the same time with the *ohia-ai*, (the fruit-bearing *ohia*), commonly known as the mountain-apple.

The upland *lehua*, situated in a more temperate climate, flowered during the later season, that from about the beginning of August till the last of October or into the early part of November.

The birds in general moved from upland to lowland, or vice versa, to be in at the flowering season, and many of the hunters moved likewise.

In the early season (*kau mua*), the birds, except the *mamo*, who was a true highlander and despised the lowlands, migrated to the lower levels, *makai.* Later in the year, during the second season, the birds were to be found in the more interior uplands.

The yellow-green *amakihi*, and the *elepaio*, famous in legend and poetry, were exceptions to this rule. These two birds were insectivorous, in addition to being honey and fruit-eaters.

A bird-hunting campaign was not an affair to be lightly entered upon. Like every other serious enterprise of ancient Hawaii, a service of prayer and an offering to the gods and aumakuas, must first be performed... ...Having selected a camp, he erects the necessary huts for himself and his family. His wife, who will keep him company in the wil- [page 105] derness, will not lack for occupation. It will be hers to engage in the manufacture of *kapa* from the delicate fibers of the *mamake* bark, perhaps to aid in plucking and sorting the feathers.

The early morning, when the vapors are beginning to lift, is the favorite time for most of the birds to visit their aerial pasturage. A few hours later, when the sun has had time to dull the edge of the sharp morning air, and to clear away the fogs, the aristocratic *o-o* will come to his more fashionable breakfast. Necessity makes the hunter an early riser, that he may repair to his chosen ground before the morning sun has begun to illuminate the summits of ***Maunakea*** and ***Maunaloa***.

Behold him then setting forth at dawn from his rude thatched cottage, with the implements of his craft in hand. The bag, or wallet, hanging at his side contains, besides food for himself, fine lines twisted from tough *olona* fiber, to be used in making snares, also a supply of tenacious bird lime carefully wrapped in leaves of the ti plant.

This important article was made in several ways. The sticky gum of the breadfruit tree was sometimes used but that of the *papala*, and of the *oha* were more highly esteemed. Sometimes a compound of two or more was made, being mixed and purified while gently boiling with the water over a fire.

The most important implements of the hunter's craft were his spears, called *kia*, or *kia-manu*, a name often used to indicate his vocation [*Figure 4*]. They were long, slender, well polished poles, like fishing rods, made sometimes of dark spear wood, *kauila*, also of tough *ulei* wood from Kona. Bamboo was sometimes used, but for some reason or other it was not a favorite. The birds did not take to it. And as they were the ones whose tastes were most to be considered, that settled the question.

There were different styles of dressing the *kia*, and no one can assume to be acquainted with them all. One method is that illustrated in the cut.

The hunter himself must remain concealed beneath the shelter of the foliage, or, if that be too scanty, under a covert extemporized from material at hand, fern leaves, or *i-e-i-e* fronds. If the day is a good one and the charm of his prayer works well, the birds will presently make their appearance, singly, or by twos and threes. Anon a struggling and a

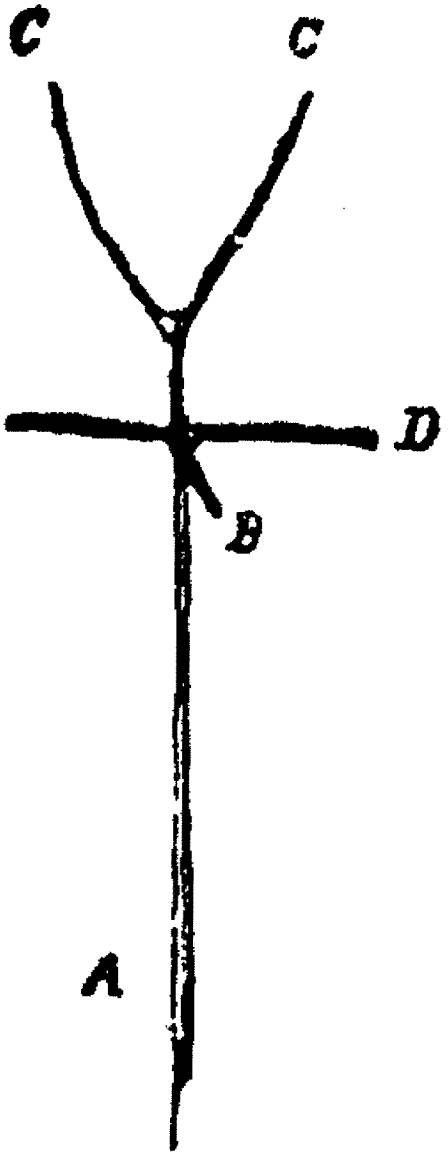

Figure 4. Kiamanu.

A. Portion of the pole, *kia-manu.*
B. The hook, *kihele*, by which the pole is hung in position high up in the tree.
C. The forked branch, *lalua* or *amana.*
D The cross-piece, *kano.*

fluttering of wings an- [page 106] nounces to the watchful hunter that the little creatures have alighted on his poles and are held fast by the sticky gum.

It would seem as if the alighting of one bird on the limed fork or cross-piece of the hunter's pole did not deter others from seeking to put themselves in the same plight. At the right time the hunter cautiously withdraws one pole after another, and using care that no bird escapes, transfers the captured birds to the bag that hangs at his side, or to a cage of wicker work that is kept at hand.

It seems unaccountable, almost incredible, that any wild thing of the air should prefer alighting on the limed twig of the hunter's pole to seeking refreshment elsewhere from the scarlet honey-flowers of the *lehua* which at this season abound. The explanation given me by the hunter was that he depended entirely upon the efficacy of his incantations to draw the birds to his *kepau* (birdlime). Sometimes instead of this formal arrangement of fork and cross-piece, a small branch with several twigs attached, the whole plentifully smeared with gum, was bound to the tip of the pole and displayed as before.

The hunter often made his pole attractive to the birds by baiting it with their favorite honey-flowers. This was done in a variety of ways, but always with an effort to imitate nature, appreciating that the highest art is to conceal art. With this intent he sometimes attached to his pole a flowering branch artfully smeared with gum, or the *kepau* would be applied directly to some part of the tree where the hunter's judgment told him the bird would alight to feed.

Another ingenious plan was the use of the decoy, called *maunu* (literally bait). For this purpose the gay *i-iwi*, or *akakani*, were among the favorites, perhaps because they were likely to be captured earliest in the day. The decoy, still alive, was tied in an upright position to the prong at the tip of the pole, together with an arrangement of flowers. It was necessary to smear the gum at such a distance from the decoy as not to be within reach of its wings, if extended in an effort to fly. [page 107] It was a common practice to preserve alive in special cages certain birds to be used as decoys, feeding them daily with their nectar-flowers. The *o-o*, *i-iwi* and *akakani* were thus treated. In time these wild things became quite domesticated and were of great service.

The *o-o*, with his suit of jetty black touched with points of gold, was of a jealous and domineering spirit that would allow no other bird to enjoy a meal peacefully in his

presence. He no sooner espied the hunter's decoy, though of his own species, in quiet possession of a flowery perch than he would alight to dispute with him its tenancy and seek to drive him away, thus himself becoming a captive. The note of the *o-o* is one that no one who has heard it can ever forget; it may be properly described as "most musical and most melancholy".

It delights to sound it forth from the topmost branch of some over-looking forest-tree, either as a call to its mate, or in pure joy of existence, as a token that its delicate tastes have been satisfied.

The *mamo*, from the richness and brilliancy of its coat, as well as from the pride and audacity of its nature, was often spoken of as the prince, or king, of Hawaiian plumage-birds. If one is not to distrust the enthusiasm of a Hawaiian writer on birds, its actions and manners entitled it to that distinction. To quote from this writer: "The *mamo-kini-oki* was the king of the small birds of the uplands. This bird was most ostentatious in its bearing, proud and lordly. Look at it perched on its tree prinking and preening and displaying itself, turning this way and that, disdaining the *o-o, i-iwi* and other birds that approach, attacking and driving away any bird that comes to alight upon its tree," etc., etc. In addition to its mixture of pride and vanity the *mamo* had a reputation for great shrewdness and for being full of alert suspicion and watchfulness. The hunter had to use all his wits to compass its capture.

While the *o-o* haunted the depths of the forest and ranged equally the lower as well as the higher forest-regions, the *mamo* made his home principally in the upper borders, where the forest-vegetation is seen to have changed from its dense massing into a more open and park-like arrangement. Here the *lehua* no longer reaches its full height as the lord of the forest, and, [page 108] becoming somewhat more branching and scrubby, yields its supremacy to the still more imposing *koa*.

The means generally employed for the capture of the *mamo* was the snare, *pahele*, baited with flowers or fruit.

The flowers of the *ke'a, oha, lehua* and *mamane* were often used, also the flowers and fruit of the banana, and the fruit (*kokole*) of the parasitic *i-e-i-e*, of which the *mamo* was very fond. The *hawane*, a palm that grew in the protection of the upland forests of Hawaii, had a flower, the nectar of which the *mamo* was said to esteem as a food and the hunter sometimes succeeded in capturing this bird by means of gum applied directly to its flower-stalk.

The greatest art was necessary in arranging the snare and bait for the *mamo*. The bird was most shrewd and observant, and if he detected any traces (*meheu*) of the hunter's work, from breakage or trampling his suspicions were aroused and he would take his leave at once. Having baited his trap and fixed in position his snare, which was a simple noose at the end of a fine line, fifteen or more yards long, the hunter placed himself in hiding, with his line in hand, and began to call the bird with an imitation of its penetrating whistle.

If the *mamo* was within hearing and pleased with the hunter's call, he would answer, and soon be on the wing in that direction to make acquaintance of the siren that had called him. At the bird's approach the hunter modulates his tone, only piping forth an occasional reassuring note, to lead the *mamo* still nearer, relapsing into silence and motionless quiet soon as the bird has come within sight of the baited trap. Having made his reconnaissance and satisfied himself that all is right, the bird alights and, warily cocking his head to one side and the other, to observe more closely, he moves forward to taste

the hunter's bounty, in doing which he must set his foot within the reach of the nicely placed snare;—on the instant the bird-catcher pulls his line and the bird is his.

One old bird-catcher aroused my incredulity by the surprising tale, which I recommend the readers of this article to take with as many grains of salt as are necessary for the attaching of a bird, that so long as the hunter remained rigidly motionless and kept his features hidden from the sight of the [page 109] *mamo*, by bending his head forward upon his chest, not even venturing to open his eyes, lest their flash betray him, the little creature took no offence, and would even go so far as to perch unsuspiciously upon the hunter's head and shoulders. "*Credatiste Judaeus! Non ego.*"

The plumage-birds, like everything else in Hawaii, were the property of the *alii* of the land, and as such were protected by *tabu*; at least that was the case in the reign of Kamehameha I, and for some time before. The choicest of the feathers found their way into the possession of the kings and chiefs, being largely used in payment of the annual tribute, or land tax, that was levied on each *ahupuaa*.

As prerequisites of royalty, they were made up into full length cloaks to be worn only by the kings and highest chiefs. Besides these there were capes, *kipuka*, to adorn the shoulders of the lesser chiefs and the king's chosen warriors, called *hulumanu*, not to mention helmets, *mahiole*, a most showy head-covering. The supply needed to meet this demand was great, without reckoning the number consumed in the fabrication of lei and the numerous imposing *kahili* that surrounded Hawaiian royalty on every occasion of state.

It is, therefore, no surprise when we learn that in the economic system of ancient Hawaii a higher valuation was set upon bird-feathers (those of the *mamo* and *o-o*) than upon any other species of property, the next rank being occupied by whale-tooth, a jetsam-ivory called *palaoa pae*, monopolized as a perquisite of the king.

While the plumage-birds were of such diminutive size and so difficult of capture that it would not have been profitable to hunt them for food, they were in reality such delicacies for the table, that the hunters were quite willing to use them in that way.

And, in truth, it is difficult to see what better disposition could have been made of them in many cases. In the case of the *mamo, i-wii, akakani, o-u* and *amakihi* the extent of skin-surface left bare after stripping the plumage from the bird was so considerable that it would have been an act of cruelty, if not of destruction, to have set it loose in such a condition. It was entirely different with the *o-o*. In its case the injury done was trifling and constituted no bar to its being immediately released. [page 110]

Kamehameha I is said to have reproved his bird-catchers for taking the life of the birds. "The feathers belong to me, but the birds themselves belong to my heirs," said the considerate monarch.

It was the practice of some hunters to release the first bird caught, unplucked, as an offering to the gods.

The greatest care was always used to keep the feathers from becoming ruffled or wet in rainy weather.

The *mamo, i-iwi* and such birds as were destined to be eaten after being plucked, were, as soon as caught, killed by pressure over the thorax and then wrapped in the outer dried parchment of the banana-stalk, and packed in the hunting bag. The *o-o* and birds destined to be released were secured in cages.

As a means of accomplishing the double purpose of protecting himself and of preserving the plumage of his birds from injury by the wet, the hunter was provided with a long, hooded cloak that encased him from his head to his knees. The basis of this garment was a net-work, into the meshes of which were looped strips of dried ti-leaf that hung point down on the outside. The method was almost identical with that used in roofing a grass hut. The garment might with propriety be termed a thatched cloak. Its water-shedding power is said to have been most excellent, of which it had opportunity to give ample proof in the fierce, tropical, down-pours of the region.

Hooded and encased in this unique garment, the hunter must have presented a fantastic resemblance to a Capuchin monk.

The days of the bird-catchers of ancient Hawaii are over. Their place has been taken by those who know not *Ku-huluhulumanu* and the other gods of the craft. In their hands, instead of the snare and the pole, with its gum, its flowers and decoy, there is the deadly shot-gun.

The birds that were once the pride of Hawaii's woods have to contend for their existence under conditions imposed by the marauding mynah and thievish sparrow, that seem to have been imported for their destruction. Emerson, 1895:111]

"Ahele Manu" – Bird Catching Techniques on the Mountain Lands

While researching various ethnographic records of the Bernice Pauahi Bishop Museum (BPBM), the author reviewed Hawaiian language papers (handwritten and typed) collected by island historian, Theodore Kelsey. Kelsey was born in Hilo in the late 1800s, and spent his entire life speaking with elderly Hawaiian people, collecting their stories, and translating their writings. Among his papers found at the Bishop Museum (BPBM Archives–SC Kelsey; Box 1.5), are notes on various aspects of Hawaiian culture including bird catching. Kelsey's informant, was the elder Reverend Nālimu, who shared his account of bird catching, both as a means of providing feathers used for making Hawaiian emblems of royalty, and with other birds, as a food source. The account specifically references localities in the uplands of the Hilo District, and is a first-hand description of traditional and customary practices which had broad application in the mountain regions.

The following Hawaiian texts are presented verbatim as recorded by Kelsey in c. 1921 (including his use of diacritical marks). The English translation of the Hawaiian narratives was prepared by the author of this study, and reflects the basic tenor of the Hawaiian narratives. It should be noted here, that in the Hawaiian language, occurrences of certain words naturally imply a specific action or statement, which is reflected in the translation:

"Ahele Manu."
by H.B. Nalimu
Po'e kia manu o Laa, oia ka po'e ahele manu, kekahi me ka laau a kekahi me ka lehua. O ka mea ahele manu ma ka lehua malaila ka puka e hanai kokoke i ka lehua, he puka paa ke-ia. Kekahi piko o ke kaula ma ka la-la o ka 'ohi'a e paa ai. Elima, eono paha anana ka loihi o ke aho mai ka puka mai a hiki i ka lima o ke kanaka e paa nei i ka piko o ke aho. A o ka puka aia ma kahi kokoke i ka lehua e kiko aku ai ka manu i ka lehua. I ka wa e lele mai ai ka manu lele no a ku maluna o ke-ia puka e kiko aku i ka lehua. A ia manawa e huki ai ke kanaka i ka piko o ke kaula a paa ka wawae o ka manu. Pii ke kanaka iluna a lawe i ka manu a hana hou aku i kela puka malaila. O ka akakane a me ka 'iiwi, a me ka 'o-o' iluna o ka pua lehua. Ahele me ke aho olona' makalii. Maluna o ka mai'a pala e ahele i' ai ka manu o-u'.

"Kāwili Kēpau."
O ke kepau oia ke kohu o ka 'ulu. E 'oki-oki ai i ka 'ulu a kahe mai ke kohu ke'oke'o, a i ka wa e maloo ai ua kohu 'la i ke ahiahi alaila ua paa a'e ua kohu la.

Hele oe e ho-ulu-ulu ke-ia kohu a pau. Ho-ulu-ulu a nui, alaila lilo a'e'la ua' kohu nei i kepau. Alaila hele oe e 'ohi i hookahi kukui maka a hemo kona iwi 'a 'o kona 'i'o malama 'oe kela'. Hele hou oe i ka' pa-ihi ku-kepau (kind of clover) he pa-ihi 'ele-ele ia, a hoohui me ke kukui maka, alaila nau a wali ke kukui maka me ka pa-ihi. Hookomo iloko o ke kapa wauke (he mea uaua ia), alaila 'uwi' i ka wai o ke kukui a me ka pa-ihi iloko o ka 'opihi, oia ka "ipuhao" e kupa 'ai iluna o ke kapuahi. I ka wa e hoomaka ai e paila alaila 'oki-oki i ke kepau a liilii a hookomo iloko o ke-ia wai kukui me ka pa-ihi i paila ia. Kii elua ni-au ai 'ole ia, mau laau liilii paha e koali ai iloko o ke-ia wai paila.

Pela e hanai a pau kela' wai a mo'a kela' kepau. Hookomo iloko o ke poho 'opihi a i 'ole he la-i' a wahi i ka la-i'. Kāwili 'iuka a'e nei o Mokau-lele. Neenee ke pulu 'ohi'a o ia wahi ilalo o ka pahoehoe.

Ilalo no oe e ku ai o ka pahoehoe a hana oe i ke kepau iluna o ka pua lehua. Ina ekolu, eha' pua lehua au i kāwili ai i ke kēpau alaila i ka wa e pili ai kekahi pua lehua i ka manu alaila alualu a loaa. Pee hou oe iloko o ka pulu 'ohi'a (kāhi o ka lau 'ohi'a e luhe ana ilalo, oia ka pulu 'ohi'a) a pili hou kekahi manu. Opa' ke poo o ka manu a make. Hookomo iloko o kekahi eke. Hola ekolu paha alaila ho'i, nui ka manu, i hookahi kaau, iwakalua, kanakolu paha. A kela manu makalii; ua momona—kuhikuhi kona i'o, momona. Oia ke kāwili kēpau.

***"Laau Kia Manu**."*
*Ekolu, eha' paha anana ka lo-ihi o ka laau. Kau ia ka pua lehua iluna o ia laau nei mai kekahi 'ao-ao o ka laau a hiki i kekahi poo o ka laau. Hana elua kanaka, kekahi ma kekahi laau a kekahi ma kekahi. Kepau maluna o ka laau a he mau pua lehua mawaena o ke-ia mau kēpau—he laau kia manu ia /_____/. Olaa ka Aina kia manu a me **Piihonua**. Nui ka manu o-o ma **Puu O-o**. Malaila ka po'e kia manu e hele ai a loaa na lei hulu no na lii. O Pana-'ewa kekahi wahi kia manu.*

Huki ka laau kia manu iluna mawaena o na 'ohi'a elua. Hana me ka 'upena kekahi. Huki ia iluna ka 'upena, hookahi laau maluna, hookahi laau malalo. He 'upena 'olona' maka hakahaka, a he kaula 'olona' ma na poo. 'Elima, eha', ekolu paha anana kela' 'upena palupalu. Lele no ka manu, paa ka wawae, paa ka pekekeu. Ina' hookahi, elua manu, waiho no pela', oia na manu e kahea ana i na manu e a'e. Nui ka manu, hookuu ilalo ka 'upena a huki hou iluna. He ulu 'ohi'a ma kekahi 'ao-ao a me kekahi 'ao-ao. Oia ka hana ana o ka po'e lawai'a manu. Ho'i i ka hale e wehe ai ka hulu o ka manu 'o-o'. Piha ke po'i i ka hulu a haku lei. Malalo o ka po-ae-ae o ka o-o' oia ka hulu a-a', a maluna o ka piapia oia me pue.

Bird Snaring (or Trapping)
Bird catchers (*kia manu*) of 'Ōla'a were people who snared (*'āhele*) birds. Some with branches and others with *lehua* blossoms. The individual who snared birds among the *lehua* made a snare (lasso) close to the *lehua* flower, the snare was secured there.

One end of the line was securely fastened on the branch of the *'ōhi'a*. The cord of perhaps five or six fathoms long, extended from the lasso (on the branch) to the man's hand where the end of the line was held tightly. The snare was placed close to a *lehua* blossom, where the bird would step (*kīko'o*) to the *lehua*. At that time, the man would then pull the end of the cordage and secure the feet of the bird. The man then climbed the tree, took the bird, and he would make the snare there again. The *'akakane* (*'apapane*), the *'i'iwi*, and the *'ō'ō* were caught up in the *lehua*, snared with fine *olonā* cordage. The *'ō'ū* bird was snared while it was on the ripe banana fruit.

Preparing Bird Lime to Kāwili, or Ensnare Birds.
The bird lime (*kēpau*) is made from the sap of the breadfruit. Cut the breadfruit bark and the white sap flows, and when the sap is dry, say in the evening, the sap is hardened. You go and gather the sap. When enough has been gathered, the sap can be made into bird lime. Then you go and gather some raw *kukui*, removing the shell, you keep its meat. You then go and get the "clover" for making bird lime (*'ihi-ku-kapu*, the *Nasturtium sarmentosum*), it is a black *pā'ihi*, and you mix it with the raw *kukui*. Then you chew it, and the *kukui* and *pā'ihi* become slimy. This is put into a *wauke* bark cloth (it is a tough piece), then the juice of the *kukui* and *pā 'ihi* are squeezed into the *'ōpihi* (shell), it is the "pot" for cooking the broth over the fire. When it starts to boil, the (*'ulu*) gum is cut into small pieces and put in the juice of the *kukui* and *pā'ihi* so it can boil. Then get two coconut mid-ribs or perhaps little sticks to stir this boiling juice. This is how it is done until the juice is cooked and becomes the birdlime. It is then placed into the empty *'ōpihi* or a *ti* leaf, wrapped up in ti leaves. Kāwili is in the uplands adjoining Mokaulele. Then go to where there is low branching *'ōhi'a* (*pulu 'ōhi'a*), where the *pāhoehoe* is below.

You are below on the *pāhoehoe*, and you apply the bird lime above around the *lehua* flowers. Now you *kāwili* (twist, i.e. apply) this bird lime in among three or four *lehua* flowers, then when a bird is stuck by one of the *lehua* that blossoms, you free it and it is caught. You then hide again among the low *'ōhi'a* branches (a place where the *'ōhi'a* tops droop down, that is the *pulu 'ōhi'a*), and catch another bird. You squeeze the birds head and it is killed. It is placed into a bag. Returning (home) perhaps around three 'o clock, there are many birds, perhaps forty, twenty, or thirty. Those small birds; when fat—the meat is tasty and sweet. That's how one prepares *kawili kēpau*, or bird lime to ensnare birds.

Snaring Birds on Branches.
The (decoy) branch is perhaps three or four fathoms long. *Lehua* blossoms are placed on this branch, from one side of the branch up to the tip of the branch. Two men do this job, one at one (end of the) branch and one at the other. Bird lime is placed on top of the branch along with many *lehua* blossoms in between this bird lime—this is a bird catchers (*kia manu*) branch [drawn] |_____|. 'Ōla'a and ***Pi'ihonua*** are lands of bird catchers. The are many *'ō'ō* birds at ***Pu'u 'Ō'ō***. It is there that the bird catchers go to get the feathers for adornments (*lei*) of the chiefs. Pana'ewa is also a place of the bird catchers.

The bird catchers (decoy) branch is pulled in between the *'ōhi'a lehua* trees. One (person) uses the net. The net is pulled up, one branch is above, one branch is below. It is an open (wide) meshed *olonā* net (*'upena olonā maka hakahaka*), and *olonā* cordage at the tip. It is a soft (pliable) net perhaps five, four, or three fathoms long. As the birds fly their feet are caught, or their wings caught. Now if there are one or two birds, they are left, these are the birds that call out to the other birds. When there are many birds the net is let down (the birds taken), then the net is pulled up again. *'Ōhi'a* growth is all around. So this is the work of the "bird-fishers," or *lawai'a manu*. They return to the house and then remove the feathers of the *manu 'ō'ō*. When the container is filled with feathers, a *lei* is made. Below the wing-pit is where the male *'ō'ō* bird feathers are, and above on the back by the tail, are the pale yellow feathers. [Nalimu in Kelsey; Bishop Museum , Archives–SC Kelsey; Box 1.5; Maly, translator]

"Kaao Hooniua Puuwai no Ka-Miki"
(The Heart Stirring Story of Ka-Miki)
Perhaps one of the most detailed native traditions which includes rich accounts of place names and practices of natives of the land, and describing features of Mauna Kea, Humu'ula, Ka'ohe, Pi'ihonua and the *'āina mauna*, is a historical account titled "*Kaao Hooniua Puuwai no Ka-Miki*" (The Heart Stirring Tale of Ka-Miki). The story of Ka-Miki was published in the Hawaiian language newspaper *Ka*

Hoku o Hawaii between 1914 to 1917. It is a long and complex account that was recorded for the paper by Hawaiian historians John Wise and J.W.H.I. Kihe with contributions by local informants.

While "Ka-Miki" is not entirely an ancient account, the authors used a mixture of local traditions, tales, and family accounts in association with place names to tie together fragments of site specific history that had been handed down over the generations. The complete narrative includes historical accounts of more than 800 place names (many personified, commemorating particular individuals) around the island of Hawai'i. While the personification of specific individuals in this account, and their associated place names may not be entirely "ancient," such place name-person accounts are common throughout Hawaiian traditions (as noted in the preceding *mo'olelo*); and the locational documentation within the "story of Ka-Miki" is of both cultural and historical value.

The selected narratives below, are excerpted from several sections of the tradition, and provide readers with descriptions of the land, resources, areas of residence, and practices of the native residents, as handed down by *kama'āina* (those familiar with the land). The English translations (Kepā Maly, translator), are a synopsis of the Hawaiian texts, with emphasis upon the main events of the narratives. Also, when the meaning was clear, diacritical marks have been added to help with pronunciation of the Hawaiian.

Synopsis of Translations from the Historic Account of Ka-Miki

This *mo'olelo* is set in the 1300s (by association with the chief Pili-a-Ka'aiaea), and is an account of two supernatural brothers, Ka-Miki (The quick, or adept, one) and Maka-'iole (Rat [squinting] eyes). The narratives describe the journey of the brothers, as they walked around the island of Hawai'i along the ancient *ala loa* and *ala hele* (trails and paths) that encircled the island. During their journey, the brothers competed alongside the trails they traveled, and in famed *kahua* (contest fields) and royal courts, against *'ōlohe* (experts skilled in fighting or in other competitions, such as running, fishing, debating, or solving riddles, that were practiced by the ancient Hawaiians). They also challenged priests whose dishonorable conduct offended the gods of ancient Hawai'i. Ka-Miki and Maka-'iole were empowered by their ancestress Ka-uluhe-nui-hihi-kolo-i-uka (The great entangled growth of *uluhe* fern which spreads across the uplands), who was one of the myriad of body forms of the goddess Haumea, one of the creative forces of nature—also called Papa or Hina— and was also a goddess of priests and competitors.

The excerpted narratives from Ka-Miki, in this study, include place name accounts that range from the summit of Mauna Kea, to the plains of Humu'ula, Ka'ohe, and Waimea, and to the depths of Waipi'o Valley. The names—*Nana-i-ke-kihi-o-Kamalama* and *Nana-i-kaulu-o-Kamalama*—by which Ka-Miki is called while ascending Mauna Kea, and the names by which he was empowered while undertaking his various tasks, are also the names of stars known in the Hawaiian skies. In the Hawaiian cultural context, such narratives demonstrate depth of the relationship of various points of the heavens, land, and resources to one another—

> Born in *'e'epa* (mysterious – premature) forms, Ka-Miki and Maka-'iole were the children of Pōhaku-o-Kāne (*kāne*) and Kapa'ihilani (*wahine*), the *ali'i* of the lands of Kohana-iki and Kaloko, North Kona. Maka-'iole was the first born child and Ka-Miki was the second. Following their birth, Ka-Miki was given up for dead and placed in the cave of Pōnahanaha, and though Maka-'iole was of a misshapen form, he was taken to his paternal grandparents Pohokinikini and Pu'uwalea to be cared for. Being aware of all that took place at the time of their birth, Ka-uluhe retrieved Ka-Miki from the cave and reared him at Kalama'ula on the heights of Hualālai. It was there that Ka-uluhe began instructing Ka-Miki in the uses of his supernatural powers. Maka-'iole joined his young brother and together, they learned various techniques of contest skills, in preparation for their journey around Hawai'i Island.
>
> After a period of training and tests, Ka-uluhe instructed Ka-Miki to journey to the *hālau ali'i* (royal compound) of one of their elder relatives, ***Poli'ahu***. Poli'ahu and her companion

Lilinoe, were the guardians of ***Waiau*** and the sacred water of Kāne. While Maka-'iole was to go collect the *'awa* (*Piper methysticum*) of the god Luanu'u at Waipi'o. These two items would be used in an *'ai-lolo* (ceremony of graduation), commemorating sacred nature of the brothers and completion of their training in *'ōlohe* skills. Ka-uluhe told the brothers:

Waipi'o Ha'iwahine *'awa* of Waipi'o

O 'oe e Maka-'iole, e ki'i 'oe i ka 'awa 'ili lena a ke akua e inu ala, a 'ona, 'ōleha, kūnewanewa nā maka, aia la ia i ka pali kapu o Waipi'o i ka poli (ka-ulu) o Ha'iwahine - i ka papa lohi mai o 'Āpua...

...You, Maka-'iole, are to fetch the yellow barked *'awa* which the gods drink till they are drunk and bleary eyed, till their eyes are reeling, it is the *'awa* that is there along the sacred cliff of Waipi'o in the breast (the ledge) of Ha'iwahine - at the long plain of 'Āpua...

Maka-'iole stood up straight, prepared to fly like the *'iwa* bird soaring upon the winds... The ancestress then called to Ka-Miki, telling him:

Poli'ahu Lilinoe Waiau Pōhaku-a-Kāne & Pōhakuloa a platform feature on Mauna Kea

...e ki'i 'oe i ***ka wai a Kāne****, aia i luna i ka piko o ke kuahiwi i ka hālau ali'i o* ***Poli'ahu*** *a me* ***Lilinoe****, me ka hānai a lāua o* ***Ka-piko-o-Waiau****. Aia malalo mai o kaulu o ka paepae o* ***Pōhaku-a-Kāne*** *e nānā iho la iā* ***Pōhakuloa****, o ka 'ohana 'ia o ko makuakāne. E ki'i 'oe i ka wai no ka 'awa o 'olua...*

...You are to fetch ***the water of Kāne*** which is there atop the summit of the mountain (Mauna Kea), at the royal compound of ***Poli'ahu***, ***Lilinoe***, and their ward, ***Ka-piko-o-Waiau***. The water is there below the ledge of the platform of ***Pōhakuakāne***, from where you may look down to ***Pōhakuloa***; they are your family through your father's genealogy. You are to fetch the water that will be used to make the *'awa* for you two...

Telling Ka-Miki to travel with all swiftness, Ka-uluhe then offered a traveling chant, to keep Ka-Miki warm while traveling the trail to the *hālau ali'i* of ***Poli'ahu*** —

A mele for traveling on Mauna Kea

Ala hele mauka la	The path goes to the uplands
Ala hele makai la	The path goes to the lowlands
Ala hele mehameha i ke kualono	It is a lonely path to the mountain
Ala hele kuo-ū ko'eko'e	A damp dreary path
He ahi kou kapa e mehana ai which warms you	A fire will be the wrap
E lala ai i ke ala kapu la	Warming you along the sacred trail
A ko kūpuna wahine kino manamana	[Fire] of your ancestress with many body forms
Manamana ke ala nui ou e ku'u kama	Your path will have many branches my child
E Nana-i-ka-ulu-o-Kamalama	O Nana-i-ka-ulu-o-Kamalama (Ka-Miki)
Ku ana ho'olono i ka leo o'u	Stand and heed my voice
O ko kūpuna wahine nei la	It is I your ancestress
Kū—e, kū la	Stand, make ready
Kū ho'olono, lono e!	Stand and hear, listen!

Ka-uluhe also told the brothers that they were to:

Lani-mamao items used for an *'awa* ceremony

Go to the place of their ancestress Lani-ku'i-a-mamao-loa (whose name is commemorated in the place name ***Lani-mamao*** at Waimea); for she had the *kānoa* (*'awa* bowl) that was called ***Hōkū'ula*** and the *mau'u 'awa* (strainer) Ka-lau-o-ke-Kāhuli, which would be used in preparing the *'awa* ceremony. Ka-uluhe then told Ka-Miki:

Sacred water of Kāne and Kanaloa; awe inspired by Mauna Kea

*...e ukuhi ai i **ka wai kapu a Kāne mā lāua me Kanaloa**, a e hi'i a'e i ka poli a huli ho'i mai. Maluna mai 'oe o nā kualono, kuahiwi, kuakea, e lehei ana ma nā kuamauna, mauna kapu kameha'i ho'opa'e'e i ke kanaka, a moe luhi ka leo—e, 'ae...*

(...dip into ***the sacred water of Kāne and Kanaloa*** and hold it close to your breast while returning. You shall be at the heights of the mountainous region, at the whitened peaks, leaping on the mountain top, the sacred and astonishing mountain, that causes people to go astray, and the voice is wearied by calling out—indeed it is so...)

Lani-mamao

Ka-Miki and Maka-'iole then set out to complete their tasks, first traveling to meet their ancestress Lani-mamao on the windward plains of Waimea (in the region of Mahiki). [February 5, 1914]

The brothers greeted their *kupuna* with genealogical chants, and gained her recognition of their descent. When Lani-mamao inquired of their journey and quest, Maka-'iole called out to her with a *mele* (chant):

Mele 'awa

Aia la ilalo o Waipi'o,	[The *'awa*] is there below in Waipi'o
I ka pali o Kaholokuaī	Along the cliff of Kaholokuaīwawa
I ka 'awa 'ili lena	The yellow barked *'awa*
I ka papa lohi o 'Āpua	of the long plain of 'Āpua
A kini o ke akua	[*'Awa*] of the 40,000 gods
A ka mano o ke akua	[*'Awa*] of the 4,000 gods
A ka lehu o ke akua	[*'Awa*] which the 400,000
e inu a—i...	gods drink...

Lani-mamao exclaimed:

Luanu'u, the god of ghosts

What is your *kupuna* thinking of, sending you to fetch the cherished *'awa* of Luanu'u-a-nu'u-pō'ele-ka-pō-loa, king of the hordes of ghosts who dwelt at Waipi'o? And where is the water that she told you to fetch?

Ka-Miki answered:

The sacred water of Kāne and Kanaloa (Waiau); sacred platform of Kāne; the mountain mist Kākīkepa

I ka wai kapu a Kāne mā lāua me Kanaloa, i ka paepae kapu o ka Pōhaku-a-Kāne, ke na'i 'ia ala e ka 'ohu Kākīkepa, e ka 'uwahi noe a ka wahine o ka lua...

(It is the sacred water of Kāne and Kanaloa at the sacred platform of ***Pōhaku-a-Kāne***, overcome by the mists, *Kākīkepa*, that is like the steaming mists of the woman [Pele] who dwells at the crater...) [*Figure 5*]

The thick mountain fog

Because of the great challenges the brothers would face while going to fetch the *'awa* and water of the gods, Lani-mamao tested their *'ōlohe* skills to make sure that they were prepared to meet the challenges which lay ahead of them. Lani-mamao set out the supernatural net *Ku'uku'u* which was also called *Kanikawī - Kanikawā* [the thick rain belt fog] that trapped and

likened to a supernatural net

ensnared many travelers. She told Ka-Miki and his brother to leap into the net, which they did, she then pulled the net closed and placed high overhead in the rafters of her house. In no time, Ka-Miki had pulled on the lines and caused the net to *ho'omōhala* (to blossom or open), thus the brothers were freed. Lani-maomao then told Nana-i-ke-kihi-o-Kamalama (Ka-Miki):

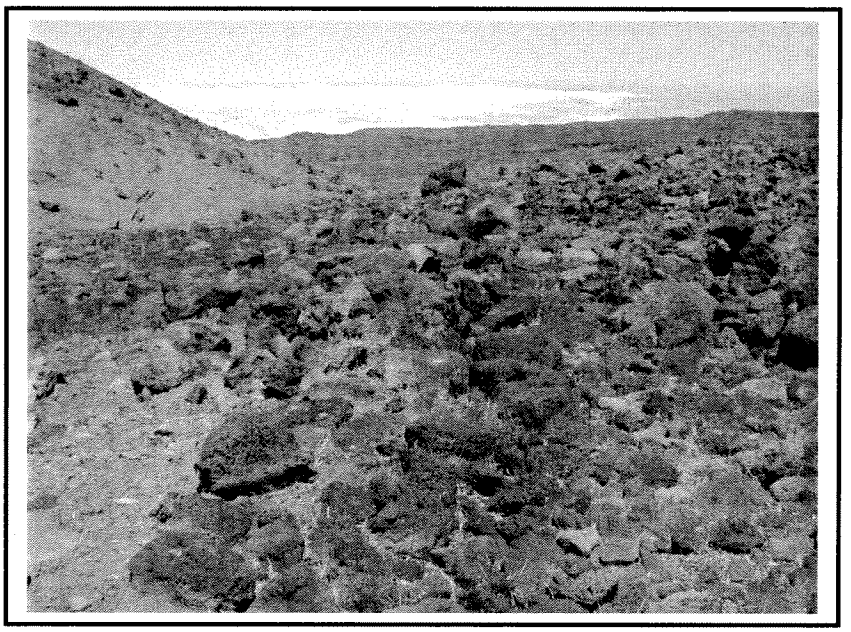

Figure 5. Ka Paepae Kapu o ka Pōhaku a Kāne (Photo KPA-3722)

Great is your alertness, bravery, skill, cleverness, strength, and wisdom; indeed if you possessed only half of your abilities you would not have been able to free yourself. No one has ever escaped from this net, and if you had not been able to free yourselves, your training would not have been adequate. Because of this sign, it is you Ka-Miki who must fetch the *'awa* of the ghost king Luanu'u, for only you could succeed. [February 12, 1914]

Waipi'o

Waikōloa

Thus, Ka-Miki agreed to go to Waipi'o. Lanimamao then told Maka-'iole, that he was to go to fetch the strainer Ka-lau-o-ke-kāhuli [from the plains of Waikōloa]. And this is why Ka-uluhe sent you to me, to test your abilities. Lani-mamao then warned Ka-Miki not to make any sounds lest he awaken the gods as he drew near the ledge of Ha'iwahine. She went on to tell him:

Sites and features in Waipi'o

"When you reach the hill of Pua'ahuku, gaze below to the *heiau* of Pāka'alana, and look upon Waipi'o, there you will see the cliff of Kaluahine. Then look to the side and go into the *'ōhi'a* forest of Ka'auana. It is there that you will find the *'awa* container called Ka-pāpāiaoa [*Ka pāpāia'awa* (the ceremonial *'awa*)], which Luanu'u-a-nu'u-pō'ele-ka-pō uses as his pillow so that no one may take it. Luanu'u will be there in the center of his *hālau hale ali'i* (royal compound), and the assembly of 4,000, 40,000, 400,000 ghosts will be outside."

Mahiki

When Lanimamao completed her instructions, she allowed Ka-Miki to depart. In the blink of an eye Ka-Miki disappeared, leaping to the forest of Mahiki. Leaping again, Ka-Miki arrived at Pua'ahuku, and he looked upon the beauty of Waipi'o. Ka-Miki then turned and leapt to the heights of Ka'auana, and went to the cliff of

The royal compound of Luanu'u

Kaholokuaīwa where he saw the royal compound of Luanu'u along the ledge of Hea-ke-Akua, overlooking Nā-po'opo'o (The-nooks and crannies), in Waipi'o, not Kona.

The ghost hordes of Luanu'u;

Hālau thatched with bird feathers

Indeed, there were innumerable ghost beings throughout the region. Ka-Miki called upon Ka-'ohu-kolo-mai-iluna-o-ka-lā'au, and a thick mist settled on Waipi'o, even covering the compound of the god [Luanu'u]. Ka-Miki then leapt and landed upon the ridge pole of the god's long house. Ka-Miki parted the bird feathers, for this is what the house was thatched with, and looked in. He saw that the god and those with him were sleeping, nestled in the mists of the *'awa*. Now those in the house were of various shapes and sizes, some with hollow eyes, others with long thin necks, or hands that reached to their feet, truly, things which living people would fear.

While Ka-Miki was looking in the house, he heard the voice of Luanu'u's lead ghosts, Hio and Nana-nui call out in a *mele*:

mele kahea

Mū e, Mū a	O Mū ghosts, Say Mū
Mū ho'i, Mū na'ana'a	Return Mū, Mū of the protruding bellies
Mū ho'okiki'i,	Mū which lean back,
Mū ho'olono a lono	Mū which listen and hear
Mū kānaka, Mū hauna	Mū like men, Mū of the unpleasant odor
Mū hono—a, 'Oia...	Mū of the excrement, So it is...

Upon hearing the call, all of the ghosts arose and left Luanu'u alone in his house with only his guardians Mū-kī and Mū-kā, who also served as Luanu'u's messengers.

Before taking Luanu'u's *'awa*, Ka-Miki played a trick on Luanu'u and awakened him from his *'awa* induced sleep. Ka-Miki then hid unseen amongst the rafters of the *hālau*. Luanu'u called upon his *kūkini*, Mū-kā and Mū-kī, commanding that they capture the one who would attempt stealing his cherished *'awa*.

Luanu'u sent his messengers to places where *'awa* was grown or would be consumed.

Sites in Ka'ū, Kohala, Kona; And the god Kapu-ko-malo

Mū-kā was sent to the cliff of Mōlīlele by Palahemo, Ka'ū. Mū-kī was sent to start at the cliff of Ka'enamakaohue (at Neue, Kohala), where the wind entered along the cliff of Makanikāhiō. Mū-kī was then to encircle the island searching, Kapākai and Kahuā (Kohala), Kalina'ōpelu, on the plain of Kanikū; and ascend the hills of Anahulu (Kona) to look for a sign from the place of the god, Kapu-ko-malo.

Humu'ula; The hills of 'Ōma'okoili & 'Ōma'okanihae; Poli'ahu, Lilinoe & Waiau; an *'auwai* from the spring

Then they were to circle around to the heights of ***Humu'ula*** and inquire of ***'Ōma'okoili*** and ***'Ōma'okanihae*** if either of them knew who this rascal thief was. "Encircle ***Ka-piko-o-Waiau***, the ward of the chiefesses ***Poli'ahu*** and ***Lilinoe***. Pier down upon the multitudes, and watch the sacred water of Kāne mā[10]. Look too, to where they dug the *'auwai* (water channel)." Then Luanu'u commanded them to "go to Pu'u-o-Moe'awa in the forest of Mahiki and stand guard."

Mahiki & Pōkāhi Pū'awali'i

Mū-kā and Mū-kī departed and the multitudes of other ghosts wandered (*'auana*) through the depths of forests of Mahiki and Pōkāhi in search of this rebel. Ka-Miki heard the indistinct voices of these many ghosts ascend the cliff, and pass through the forests to the heights of Pū'awali'i in the thick mist which ensnares the fished birds (at *Pōkāhi*). When all the ghosts were gone Luanu'u fell

[10] *Mā* is a Hawaiian word that means "and companions, friends," or "and others."

The *'awa* container of Luanu'u; *'awa* preparation

back to sleep with the *'awa* container as his pillow. Ka-Miki then leapt from the ridge pole and took Ka-pāpāiaoa which was filled with *'awa* that had been made ready to use and bundled into balls [wrapped] with *limu pā'ihi'ihi* (a native *limu pōhaku* (rock moss) weed [*Nasturtium sarementosum*]).

Luanu'u arose greatly angered thinking that he would ensnare this rascal upstart in the net of Nananana-nui-ho'omakua (Nana-nui was also one of Luanu'u's ghost marshals). But unseen, Ka-Miki hid on the ridge pole of the *hālau hale ali'i* where he held the *'awa* container. [February 19, 1914]

Luanu'u, also called Pahulu-nui; Pahu Hāwea Pāka'alana

Koholālele, Maulua, Kalai'eha Mahiki

Luanu'u, who was also called Pahulu nui then leapt to the place where the sacred *pahu* (drum) Lono Hāwea was kept at the *heiau* of Pāka'alana. Striking the *pahu*, he called all the wandering ghosts to return to the low-lands of Waipi'o. The voice of this drum was a great sign that all of the path ways were to be sealed. The command was heard by all; along the *hula'ana* cliffs from Waipi'o to the ledge of Makanikāhiō; heard by those who were at Koholālele and Maulua; heard by those who were by the steep cliffs looking to the uplands of ***Kalai'eha***; and heard by those who were in the forests of Mahiki. And so all of the pathways and swimming trails were blocked, and the net trap was set.

Ka-Miki departs from Waipi'o

While all of this occurred Ka-Miki remained hidden in the rafters of the *hālau*. One of the ghosts looked inside and saw Ka-Miki upon the ridge pole and prepared to call out on the *hōkio* (gourd nose flute) which would alert the ghosts that the upstart had been found. With great speed, Ka-Miki then leapt from Heakeakua up to the ridge heights, and landed on a *kāwa'u* (*Ilex anomala*) tree branch. Ka-'ohu-kolo-mai-iluna-o-ka-lā'au then covered the region in a thick mist, blocking everything from sight.

Ka-Miki thwarts the hordes of Luanu'u's ghosts; accounts of various place name origins

The cry of the ghost hordes could be heard from uplands to shore, as they hungrily looked for Ka-Miki, having been thwarted in their attempts to ensnare him in their supernatural net Nananana-nui-ho'omakua, just as birds were caught. Because the ghosts wandered along the cliffs and forests of Ka'auana (Kohala side of Waipi'o) and Mahiki (Hāmākua side of Waipi'o), and were unable to catch Ka-Miki, they went hungry. Under the cover of his ancestresses' mist body form, Ka-Miki leapt from the *kawa'u* tree to Pu'u-o-Moe'awa in the forest of Mahiki. The ghosts wandered hungrily about and two place names commemorate their wandering and having gone hungry: Ka-'auana (The wandering), and in Mahiki, Pōloli-ke-akua (The gods [ghosts] are hungry) which is also called Pōloli-(i)-ka-*manu* (Hungry for the bird). At Pu'uomoe'awa, Ka-Miki met with the ghost runner Mū-kī who had been stationed there by Luanu'u. [February 26, 1914]

Ka-Miki thwarted his efforts at catching him by throwing foul smelling dirt (dabs of excrement) at him. Though many other ghosts arrived for the fight, they were all driven off, as Ka-Miki began destroying them.

The conch Kihapū

Hio and Nana nui Luanu'u's ghost marshals told their chief about the events at Pu'uomoe'awa, and Luanu'u blew the conch Hā-nō, also called Kiha-pū, which was the conch that the supernatural dog Puapualenalena stole from the ghosts of Waipi'o. Hearing the call of the conch, the remaining ghosts fled from Pu'uomoe'awa, leaving Ka-Miki who returned to Lanimaomao. Ka-Miki presented the sacred *'awa* container Kapāpāiaoa and *'awa* to his ancestress, and she bathed him in her rains, and caused lighting and thunder to praise his accomplishments.

Hōkū'ula Lono-Makahiki water of Kāne (Mauna Kea)

Lanimamao then gave Ka-Miki the *kānoa 'awa* (*'awa* bowl), Hōkū'ula—with the *kapu* of Lono-Makahiki—so that he could go get the *wai kapu* (sacred water) of Kāne and Kanaloa (at Mauna Kea). [March 5, 1914]

Ka-Miki then leapt and disappeared in the mists that seem to crawl upon the forest growth. Arriving at the spring, Ka-Miki began dipping the ladle into the sacred water of Kāne, to fill the *'awa* bowl Hōkū'ula...

Naming of Ka-wai-hū-a-Kāne

...a ia wā i 'ike mai ai ua wahi akua kia'i i ka 'ale o ka wai a hū a'e lā mawaho o ka pūnāwai. A iā lāua i holo mai ai, o ka mā'alo o ke aka ka lāua i 'ike a nalo aku lā. A ua kapa 'ia ka inoa o ua pūnāwai ala o "Ka Wai Hū a Kāne," a hiki i kēia lā. No ka hū ana i ke kī'o'e ana a Ka-Miki i ka wai iloko o ke kānoa 'awa o ke akua.

...at that time, the guardians [Pōhakuakāne and Pōhakuloa] saw the water rippling, and overflowing from the spring. As they went to investigate, they saw a shadow pass them by. Because of the overflowing of the water, the spring came to be called ***Ka-wai-hū-a-Kāne*** (The-overflowing-waters-of-Kāne), and so it remains named to this day [*Figure 6*]. It overflowed because Ka-Miki scooped the water, filing the *'awa* bowl of the god.

Holoholokū; the wind goddess Waikōloa; Pōhaku-a-Kāne; naming Waiki'i; Pu'u Keke'e

Pōhaku-a-Kāne & Pōhakuloa, deity of Mauna Kea make other springs

Ka-Miki then joined Maka-'iole at ***Holoholokū*** on the plain of Waikōloa. As they traveled along the hill tops, the wind goddess ***Wai-kō-loa*** (Water-carried-far) caused the water to splash over the brim of Hōkū'ula. Some of the water was carried afar by the wind and fell, forming a new spring. When the spring appeared, Pōhaku-a-Kāne fetched some of the water. Because Pōhaku-a-Kāne fetched some of the water, that place is called ***Wai-ki'i*** (water fetched) to this day. This happened near the hills of ***Pu'u Keke'e***. ***Pōhaku-a-Kāne*** took the water he retrieved to the base of the cliffs of ***Mauna Kea*** and dug into the earthen plain of ***Pōhakuloa*** and placed the water there. From Pōhakuloa, the water flowed underground and appeared as springs at several other places, including ***Ana-o-Hiku*** at ***Hanakaumalu***, Honua'ula, and ***Kīpahe'e-wai*** on the slopes of Hualālai...

...Having successfully completed their tasks, and collected the necessary items, the brothers returned to Kalama'ula. Ka-uluhe performed the *'awa* and *'ailolo* ceremonies, marking the completion of their *'ōlohe* training, at Kaukahōkū. The ghost king and his hordes had followed after Ka-Miki, thinking they would trap him, but Ka-Miki ensnared the king and his ghost hordes in the supernatural net Ku'uku'u.

'Ailolo and *'awa* ceremonies Luanu'u killed by Ka-Miki

Luanu'u was bound so tightly that his eyes bulged out and they were used for the *pūpū 'awa* (*'awa* drink condiment) for the ceremony. After the *'ailolo* ceremony was completed, Ka-Miki took the net filled with the bodies of Luanu'u *mā* and deposited them in the ocean of Makalawena... [March 12-19, 1914]

In a later section of the tradition of Ka-Miki, we find that Ka-Miki and his companions have traveled around the island from Kona, and arrived at Waiākea in the District of Hilo. During competitions on the *kahua* (arena) of Kalepolepo, Ka-Miki defeated all challengers. One last hope was held out for the *'ōlohe* of the region, and a message was sent into the uplands of Pi'ihonua, at Kīpuka-'āhina, to call Kālanakāma'a, the *'ōlohe*-ward of Kīpuka-'āhina[k], Hale-aloha [w], and Hale-loulu[k]. The names of the these guardians of Kālanakāma'a are all commemorated as places on the mountain landscape. The narratives record:

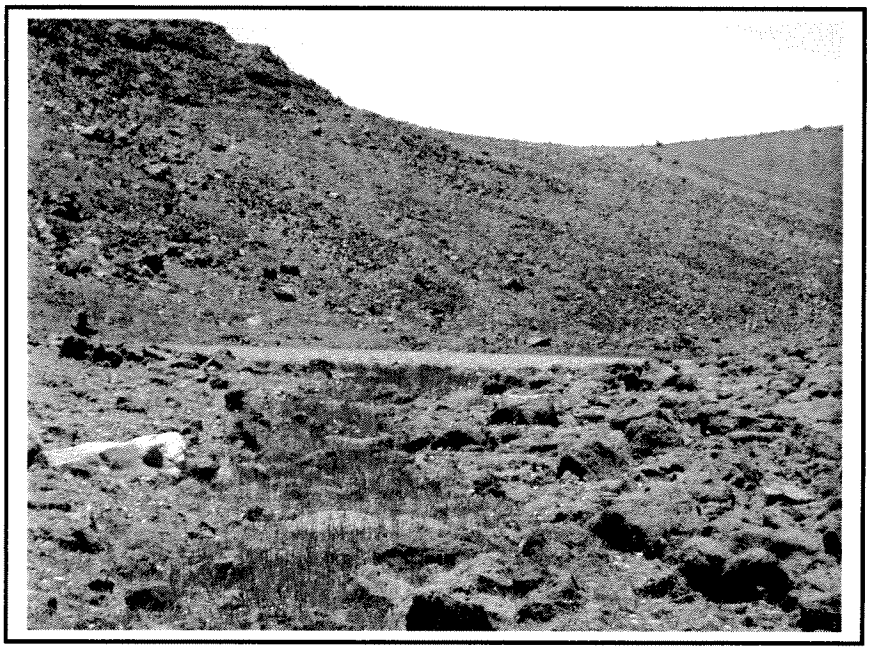

Figure 6. Hā Wai (Water Channel) from Waiau to Pōhakuloa Gulch, above Ka Wai Hū a Kāne (Photo KPA-3733)

Waiākea
Pi'ihonua
Pana'ewa
Kalepolepo
'Ūpēloa
Kapunakō
Kaūmana
Kalanakāma'a
Kīpuka'āhina
Hale-aloha
Hale-loulu

...The lands of Waiākea were named for the high chief Waiākea-nui-kumuhonua, the brother of Pi'ihonua-a-ka-lani [k] and Pana'ewa-nui-moku-*lehua* [w]. After departing from Pana'ewa, Ka-Miki *mā*[11] met Haili-kula-manu, who was a guardian of Waiākea. Haili led Ka-Miki and his companions to his chief's compound at Kalepolepo [February 17, 1916]. Arrangements were made for Ka-Miki to compete with the *'ōlohe* – experts of Waiākea, with the events to be held at the *kahua* of Kalepolepo...

Ka-Miki—"the image of the war club of Ka-uluhe-nui-hihi-kolo-i-uka"—entered the *kahua* and the contest rules were set. It was agreed that the method of competition would be *'ōka'a lā'au* [war club fighting], and that the loser would be killed and baked in an *imu*... Ka-Miki and the champion 'Ūpēloa competed, and to everyone's amazement, 'Ūpēloa was defeated...

Hearing that his foremost champion had been defeated by Ka-Miki, Waiākea called to his messenger, Kapunakō to go get Kaūmana the foremost teacher of *lua, ha'iha'i, kākā lā'au* [bone breaking, fighting, and spear fighting], and all other manner of fighting, and bring him to the *kahua*. Upon arriving before his chief, Kaūmana asked Waiākea to send his messenger Kapunakō, to bring Kalanakāma'a, Kaūmana's foremost student to join him at the *kahua* of Kalepolepo.

[The place called] Kalanakāma'a was named for Kalana-kāma'a-o-uli, the foremost *'ōlohe* student of Kaūmana, and champion of Waiākea. Kalanakāma'a was the ward of ***Kīpuka-'āhina***[k], ***Hale-aloha***[w], and ***Hale-loulu***[k], who dwelt above Hilo at places which now bear their names. When Kapunakō arrived before Kīpuka-'āhina, he spoke about the great rains and rivers of Hilo; a poetic reference to the many skilled *'ōlohe* for which Hilo was famed. It was in this way that Kapunakō described the overwhelming skills of Ka-Miki and his victory over 'Ūpēloa. Kīpuka-'āhina then asked—

Māmā Hilo i ka wai? – Is Hilo [without] lightened of its water?

[11] *Mā* – a Hawaiian word used to indicate and companion, or associates.

Describing Hilo rains and the mountain terrain

Kapunakō responded – *'Ae māmā Hilo i ka wai 'ole, ua kau i ka lani ka holo [wa'a] ua o Hilo, na ka Mālualua e ki'i ala i pulu ka liko o ka lehua a me ka māmane!* Indeed one can move swiftly through Hilo, for the streams are without water, the water trough [figuratively the clouds] of Hilo are set in the heavens, it is the Mālualua which fetches moisture for the budding *lehua* and *māmane*. ***Kīpuka-'āhina*** then asked in amazement – *Nawai e nele o Hilo i ka wai? He lau ka pu'u, mano ka ihona, he kini nā kahawai o Hilo, e 'au i ka wai o Hilo a pau ke aho!* – Who could possibly make Hilo destitute of water? There are 400 hills, 4,000 places to descend, and 40,000 streams to cross, indeed one is worn out swimming through the waters of Hilo!

It was in this way that ***Kīpuka-'āhina*** learned that a master *'ōlohe* had come to Hilo challenging it's many *'ōlohe*. Using his *ipu hōkiokio* (gourd nose flute), ***Kīpuka-'āhina*** awakened Kalanakāma'a, for this was the only way in which Kalanakāma'a could be safely awakened, or he would kill whoever awakened him [February 24-March 2, 1916].

Kalanakāma'a and Ka-Miki compete

Kalanakāma'a joined his teacher Kaūmana, and met with the assembly at Kalepolepo. Carrying his club *Pūpū-kani-oe-i-ka-ua-o-Hilo* (Land snails singing in the rain of Hilo), Kalanakāma'a entered the kahua with Kaūmana and a great cry arose praising the abilities of these Hilo champions. Ka-Miki and Kalanakāma'a exchanged taunts, Ka-Miki stated that Kalanakāma'a would become the *kāma'a lau-'ī i hili kuanaka 'ia* (twined *ti* leaf sandals) which Ka-Miki wears upon his feet. Outraged, Kalanakāma'a leapt to attack Ka-Miki with his club *Pūpū-kani-oe-i-ka-ua-o-Hilo*, Ka-Miki leapt out of the way, and took 'Ūpēloa's club from Maka-'iole. Seeing his student miss, Kaūmana called out to Kalanakāma'a telling him how to strike Ka-Miki—

Placed in the heavens is the water trough of Hilo, entwined in the cordage of the rains, *'Io* [Hawk] is the war club strike to use, for there is no place that can't be hit. Strike at the head and reach to the feet, for once struck, there will be no movement. If there is any movement, he is indeed a skilled expert of the depths [deepest knowledge], then return and strike again in the manner of the wind swept *koa* trees [March 9, 1916].

Kaūmana and Ka-Miki compete

Ka-Miki then attacked Kalanakāma'a and quickly over came him, Kaūmana then leapt to the *kahua* and was beaten as well. After Ka-Miki defeated Kaūmana, word spread throughout the region, and Pi'ihonua, Waiākea's brother called his council together wondering how they might help regain the honor of Hilo from this stranger... [March 16, 1916]

This section of the account ends with Ka-Miki meeting the chief Hanakāhi—for whom the section of Hilo called Hilo Hanakāhi was named—in honorable competition at Kalepolepo. Because of the honest and humble nature of Hanakāhi, Ka-Miki befriended him and peace was restored in the region of Hilo-one and Hilo-Hanakāhi.

Boundary Commission testimonies of 1873 (cited later in this study), and the writings of E.D. Baldwin (1890) give us the locations of three of the upland residential sites referenced in the narratives above (see also Register Map No. 1718). In summary, we find:

> ***Kīpuka-'āhina*** is situated on *pāhoehoe* flats, crossed by the boundary of Pi'ihonua and Waiākea (Kainoa Boundary Commission, 1873:57). In drawing near to ***Kīpuka-'āhina***, Baldwin reports, "We are now nearing the main base of ***Mauna Kea***," and once at ***Kīpuka-'āhina***, he states, "We are now on the slopes of ***Mauna Kea***" (Baldwin 1890:55).

Hale-aloha is situated at approximately the 4,050 foot elevation. Baldwin noted: "the trail leaves the woods about two miles from ***Halealoha***," and he states that ***Halealoha*** is about "five miles from ***Kīpuka-'āhina***" (Baldwin 1890:55).

Hale-loulu was identified as being near the boundary of ***Humu'ula***, where ***Ka'ula*** gulch meets ***Ka'ala*** (below ***Ahu-a-po'o-pua'a*** and near the mountain road) (Waiki Boundary Commission, 1873:41).

Travel Across the 'Āina Mauna in the Time of Kamehameha

Stephen Desha, Sr., editor of the native newspaper, *Ka Hoku o Hawaii*, and a group of his peers published many historical accounts for the education of Hawaiian readers in their native history. One account, "*He Moolelo Kaao no Kekuhaupio, Ke Koa Kaulana o ke Au o Kamehameha ka Nui*" (A Tradition of Kekuhaupio, the Famous Warrior in the time of Kamehameha the Great[12]), describes the time leading up to Kamehameha's securing his rule over the island of Hawai'i (Desha, translated by Frazier, 2000). When Kamehameha (Pai'ea) inherited the god Kūkā'ilimoku from Kalani'ōpu'u, there was dissension among some of the chiefs. Fearing that treachery might arise, Kekūhaupi'o traveled with Kamehameha from Ka'ū towards Kīlauea, to 'Ōhaikea, and then went on to Mauna Kea and Lake Waiau, where Kamehameha made a ceremonial offering:

> ...When Pai'ea had completed the ceremonial offering, Kekūhaupi'o encouraged them to go, as it was not known what secret harm might come after them, as some of the chiefs had treacherous thoughts. Because of this thought by Kekūhaupi'o he directed them to leave the customary pathway, and to travel where they could not be followed. They climbed straight up from that place to a certain part of Mauna Loa and came down seaward at a certain part of Ka'ū named 'Ōhaikea. They spent the rest of that night in a cave called Alanapo. *The next morning, after Kamehameha had made [page 93] his ceremonial offering and prayer to Kūkā'ilimoku, they left that place and climbed up another mountain trail till they reached the summit of* ***Mauna Kea****. At a place close to Lake* ***Waiau****, Kamehameha again made an offering. They were unable to remain there for long because of the cold, and so they descended to Waimea at a place called Moana by the ancients, going straight down to the wide plain of Waimea...* [Desha, 2000:94]

Following the battle of Moku'ōhai in ca. 1782, we find again reference to travel across the *'āina mauna*. Kamakau (1961) reported that the sacred chief, Keawemauhili, his wife, Ululani, and their daughter, Kapi'olani, traveled from Kona to the uplands, across Mauna Kea, and down to Pā'auhau (Kamakau 1961:122). Desha (2000) elaborated on the account, by which the small party traveled for safety, to the mountain lands, passing the slopes of Mauna Kea and continued on the mountain trail to Hilo.

After the battle ended at Moku'ōhai, Keawemauhili and his family were held captive, and transported to the Kaumalumalu section of Kona. Then, with the help of faithful friends, they escaped, traveling to the uplands of Kona, past Mauna Kea, and on to Hilo. It was reported that:

> ...Keawemauhili, Ululani his wife, and their small daughter Kapi'olani were secretly helped to flee. They were taken to Kaumalumalu, North Kona, by Kaleipaihala as ordered by the *ilāmuku* Kanuha. When Keawemauhili went ashore at that place of North Kona, he sought escape for them by a mountain trail which ascended to the gap between Hualālai and ***Mauna Kea***, taking that path in order to arrive at their home in Hilo. The pathway was very tangled with forest growth. There were five of them on this journey, with Keawemauhili choosing the way, and Ululani following her husband, and the *kahu* [servants] who were carrying Kapi'olani. There were many impediments in the path but the important thing was to survive. The chill and bitter rain and entanglement of ferns and

[12] *Ka Hoku o Hawaii*, December 16, 1920 to September 11, 1924.

other obstructions were disregarded. At times Ululani carried her beloved daughter because their personal servants were heavily burdened with their bedding which was carried in calabashes on carrying sticks. While they were patiently ascending, Kapi'olani cried because of the strangeness of this mountain way. This grieved the parents of the beloved child but they were unable to help. When they entered into the fern wilderness, Kapi'olani wailed loudly because of this troublesome pathway, causing them to have qualms, because when Kīwala'ō's forces were put to flight, many people had fled into the forest and were being widely sought by the victorious warriors of Kamehameha's side. At this time they were climbing in darkness because they had fled at nightfall. However dawn was breaking at the time they entered the fern wilderness and were pushing through it. When it was full daylight and while they were moving on the mountain trail, the wailing of Kapi'olani was very loud which burdened the minds of Keawemauhili and his wife. At this time, the wails of Kapi'olani guided some of Kamehameha's warriors who were Kohala people, and they met the escapees. The leader of these warriors saw this distinguished man of noble stature, and the thought came to him that this must be the *ali'i* Keawemauhili of whom they had only heard. The leader said to Keawemauhili: "Stand and speak! Are you perhaps Keawemauhili, the *ali'i* of the Hilo districts...?" [Desha, 2000:153]

The account is continued with the eventual safe return of Keawemauhili *mā* to Hilo, and little other mention of the journey over the mountain lands.

Kūkahau'ula and Lilinoe

An undated account from the archive collections of the Bernice Pauahi Bishop Museum, translated by Mary Kawena Pukui, provides us with further details regarding Lilinoe, and her husband Kūkahau'ula (Kukahaula). The narrative also records that Kauikeaouli (King Kamehameha III) visited the graves of Lilinoe and Kūkahau'ula (Kukahaula), and tells us that Pōhe'epali, a descendant of the retainers of Kūkahau'ula, hid their bodies following the visit of Kamehameha III.

A Tale of a Royal Couple who Froze on Mauna Kea

Kukahaula was a chief of Waimea, So. Kohala. He took to wife, Lilinoe of Kau and because his people resented her, chief Kukahaula went to dwell on ***Mauna Kea***, above Lake ***Waiau***. They died there and their bodies were wrapped for burial.

When King Kauikeaouli (Kamehameha III) reigned, he went there to visit them and was the last ruler to see these chiefs who had practically turned to stone because they were frozen and so remained. It was believed that they were a good likeness of themselves when they were alive, except that their bodies were so stiff.

After this visit of King Kamehameha III (Kauikeaouli) the bodies of Kukahaula and Lilinoe were hidden by the attendant of Kukahaula, Poheepali, who was the very last of the family of retainers who upheld their chiefs. It is said that these chiefs lived in a cave and it was in this cave that their bodies remained until Poheepali hid them away.

It is said that when these chiefs lived on ***Mauna Kea***, two strangers went up there on a visit. They became thirsty and discovering a woman wrapped in several layers of *tapa*, they asked where they could get some water to drink. The woman answered, "There is no water now." The sun was shining brightly at the time and they saw the reflection of water on the woman's chest. They said, "There is the water you are hiding, reflected on your chest." The woman was Lilinoe and the water she was hiding was the water of Poliahu. (Bishop Museum, Hawaiian Ethnological Notes; Legends Vol. II:149)

"Lilinoe and Nuu"

Abraham Fornander, a prominent foreign historian, was married to a Hawaiian woman of chiefly rank from the Kāne'alai line of Moloka'i. During his residence in the Hawaiian Islands (c. 1830-1887),

Fornander compiled a great collection of Hawaiian history, much of it directly from native informants. While he worked closely with prominent native historians like Kamakau and Kepelino, he also had contact with many individuals from remote areas, who retained personal family accounts and knowledge. Over the years, it has also become clear that some of the work that Fornander did, also incorporated knowledge or concepts that were foreign to the native Hawaiian experience—his accounts would sometimes link Christian and other religious philosophies into Hawaiian lore and genealogies.

Among the accounts that blended Christian concepts with Hawaiian tradition is a narrative about Lilinoe, her husband Nu'u, and their children, in the time of a great flood. Fornander (1973) wrote:

> Nuu, by command of his god, built a large vessel with a house on top of it, which was called and is referred to in the chants as He Waa-Halau-Alii o ka Moku, "the royal vessel," in which he and his family, consisting of his wife Lili-noe, his three sons, and their wives, were saved. When the flood subsided, "Kane," "Ku," and "Lono" entered the "Wa'a Halau" of Nu'u and told him to go out. He did so and found himself on top of ***Mauna Kea*** the highest mountain on the island of Hawaii), and he called a cave there after the name of his wife [Lili-noe], and the cave remains there to this day... [Fornander 1973:91]

Fornander's narratives were in part constructed from texts recorded previously by native historians, though he added details which none of the earlier versions of the account included. Indeed, native historians, David Malo (1951:234-237) and S. M. Kamakau (1964:13-14:)[13], refer to a great flood caused by the rising sea (not an inundation of rainfall). Neither of the earlier narratives mention Mauna Kea or sites known to be associated with the mountain. The account collected by Ellis, cited above, conforms with the early Hawaiian accounts, and in reference to Mauna Kea, may reflect localized embellishments to the account.

The Rivalry Between Poli'ahu and Pele

One of the prominent late historic writers, was W. D. Westervelt, who resided in Hawai'i between 1889-1939. Westervelt wrote of the conflicts between Pele and Poli'ahu, and told them how Poli'ahu came to gain control over northern portion of Hawai'i, while Pele retained dominance over the arid and volcanically active southern part of Hawai'i. In his tradition of "Pele and the Snow-Goddess," Westervelt reported an eruptive event that took place after Hawaiian settlement (contrary to geological research) of the island group, explaining how Laupāhoehoe and Onomea Arch were formed. Westervelt writes:

> ***Poliahu***...loved the eastern cliffs of the great island Hawaii—the precipices which rise from the raging surf which beats against the coast known now as the Hamakua district. Here she sported among mortals, meeting the chiefs in their many and curious games of chance and skill. Sometimes she wore a mantle of pure white *kapa* and rested on the ledge of rock overhanging the torrents of water which in various places fell into the sea... [Westervelt 1963:55]

Westervelt then tells readers that once, when Poli'ahu and her companions were competing in the sport of *hōlua* (sledding), on the slopes of Mauna Kea, south of Hāmākua. There appeared among them a beautiful stranger, who was invited to participate in the sport with them. But, the woman instead:

> ...threw off all disguise and called for the forces of fire to burst open the doors of the subterranean caverns of ***Mauna Kea***. Up toward the mountain she marshaled her fire-fountains. ***Poliahu*** fled toward the summit...Soon she regained strength and threw the [snow] mantle over the mountain...the lava chilled and hardened and choked the flowing,

[13] It is noted here, that in his "*Na Hunahuna no ka Moolelo Hawaii,*" Hawaiian historian, John Papa I'i, made no direct references to Mauna Kea (cf. I'i, 1959, in "Fragments of Hawaiian History").

> burning rivers... The fire-rivers, already rushing to the sea, were narrowed and driven downward so rapidly that they leaped out from the land, becoming immediately the prey of the remorseless ocean.
>
> Thus the ragged mass of ***Laupahoehoe*** was formed, and the great ledge of the arch of Onomea, and the different sharp and torn lavas in the edge of the sea which mark the various eruptions of centuries past [Westervelt 1963:61-63]

The Love of Poli'ahu and Kūkahau'ula

In 1931, Emma Ahu'ena Taylor (Ahu'ena), a Hawaiian historian of royal lineage, published an account of the gods Poli'ahu and Kūkahau'ula (Ahuena Taylor in Paradise of the Pacific, July 1931). Descended from the Hoapili-Beckley line (the chiefess Ahiakumaikalaniki'eki'e and Geo. Beckley), she had a direct genealogical relationship to the Waimea lands, that were nestled on the slopes of Mauna Kea. Indeed, while introducing her account, she tells readers of her youth and a beloved *kahu* hānai (guardian), who told her stories of ancient times (Ahu'ena 1931:13). In this particular narrative, Ahu'ena speaks of the sacred nature of Poli'ahu, and describes the various attributes of Waiau, Lilinoe, and Kūkahau'ula. She also reports that a *mo'o* (a deity of ponds, capable of taking human and other forms), named Mo'o-i-nanea, was placed at the pool of Waiau, by Kāne, as a guardian of Poli'ahu and Waiau.

> ***Poliahu***, the snow goddess of ***Mauna-kea***, was reared and lived like the daughter of an ancient chief of Hawaii.
>
> She was restricted to the mountain ***Mauna-kea*** by her godfather Kane. She had a nurse ***Lihau*** (the chilling rain) who never left her for a moment.
>
> Kane created a silvery swimming pool for his daughter at the top of ***Mauna-kea***. The pool was named ***Wai-au***. The father placed a supernatural guard at that swimming pool so that ***Poliahu*** could play at leisure without danger of being see by a man... [Ahuena Taylor July 1931:13]

Ahu'ena tells us that the god Kū-ka-hau-'ula ("the pink tinted snow god") had been selected as a husband for Poli'ahu, and that he appeared:

> ...every morning with the rising of the sun and again every afternoon with the setting of the sun. He saw the secluded water pool ***Wai-au*** and the lovely ***Poliahu***... Each day he became more fascinated and made every effort to reach her abode and win her for his bride.
>
> Poliahu's attendants drove him away. ***Lili-noe*** (fine mist rain), ***Lihau*** (chilling frost) and ***Kipu'upu'u*** (the hail) drove him from the mountain... [Ahuena TaylorJuly 1931:13-14]

As the story continues, we learn that eventually Mo'o-i-nanea determined that Kūkahau'ula's love was true, and she allowed the god-chief to embrace Poli'ahu. And to this day, "Ku-kahau-ula, the pink snow god, and Poliahu of the snow white bosom, may be seen embracing on Mauna-kea" (Ahuena Taylor July 1931:14-15).

II. Ka 'Oihana Kilokilo Hōkū (The Practices Associated With Observing Stars)

As described earlier, in the prayer chants like the *Kumulipo*, the stars and heavenly bodies were significant in Hawaiian beliefs and traditions. Thus, as was the case in all facets of Hawaiian life, the traditions, customs and practices associated with the *'oihana kilokilo* (astronomy) and *kilo hōkū* (observing and discerning the nature of the stars) were deeply tied to the spiritual beliefs of the Hawaiian people. The stars were physical manifestations of the gods who created the heavens, earth, and humankind, or forms granted to select individuals or beings of nature (Malo, 1951 and Beckwith, 1951). One of the *mele pule* (prayer chants) from the class of Lono priests, states "*'Oi ho'okui aku o Lono nā hōkū e mihai ka lani!*" (Behold Lono places the stars that sail through the heavens.!) (*Pule Hainaki* in Malo, 1951:145).

The greatest accounts of Hawaiian knowledge of the stars—their seasons, the paths followed, and how to mark locations on the earth by them—are found in the traditions of the *po'e ho'okelewa'a* or *po'e holomoana* (navigators). Through such knowledge, combined with knowledge of the ocean winds, allowed the *po'e kahiko*—and in the present day, modern wayfinders—to successfully travel the vast expanse of the Pacific Ocean, and settle on the islands of Hawai'i. Knowledge of the stars and movements of the heavens, was also applied to many facets of life. Such knowledge could ensure success in any undertaking. When planting or fishing during seasons in which certain stars appeared, or on specific nights of the moon, crops and fish would be plentiful. A child born under a certain star was predestined to be a great leader, and the alignment of stars in a manner determined to be inauspicious, could herald the fall of a kingdom.

The earliest recorded accounts of Hawaiian navigation lore were recorded in 1823 by British missionary, Wm Ellis, who conducted a tour of Hawai'i, in the company of missionaries of the American Board of Commissioners of Foreign Missions, who had settled in Hawai'i in 1820. Ellis learned of voyages between Hawai'i and other islands of Polynesia that were made in antiquity. He also named the navigator, and his god. Ellis reported:

Traditions of Voyages to Marquesas and Tahiti

> In this part of the island there is another tradition very generally received by the natives, of a somewhat more interesting character; and as it may tend to illustrate the history of the inhabitants, and the means by which the islands were peopled, I shall introduce it in this place.
>
> These traditions respect several visits, which in remote times some of the natives made to Nuuhiva and Tahuata, two islands in the Marquesan group, and to Tahiti, the principal of the Society Islands.
>
> One of these accounts the natives call, "The Voyage of Kamapiikai," in which they state that Kamapiikai (child running or climbing the sea—from *kama*, a child, *pii*, to run or climb, and *kai*, the sea) was priest of a temple in Kohala, dedicated to Kanenuiakea.
>
> The exact period of their history when he lived, we have not been able to ascertain; but it is added, that the god appeared to him in a vision, and revealed to him the existence, situation, and distance of Tahiti, and directed him to make a voyage thither. In obedience to the communication, he immediately prepared for the voyage, and, with about forty of his companions, set sail from Hawaii in four double canoes. [page 284]
>
> *After an absence of fifteen years, they returned, and gave a most flattering account of* ***Haupokane****, the country which they had visited. We know of no island in the neighbourhood called by this name, which appears to be a compound of Haupo,*

sometimes a lap, and Kane, one of their gods. Among other things, they described the one *rauena*, a peculiar kind of sandy beach, well stocked with shell-fish, &c. The country, they said, was inhabited by handsome people, whose property was abundant, and the fruits of the earth delicious and plentiful. There was also a stream or fountain, which was called the *wai ora roa*, (water of enduring life).

Other Voyages to Tahiti

Kamapiikai made three subsequent voyages to the country he had discovered, accompanied by many of the Sandwich Islanders. From the fourth voyage they never returned, and were supposed to have perished at sea, or to have taken up their permanent residence at Tahiti. Many were induced to accompany this priest to the country he visited, for the purpose of bathing in the life-giving waters, in consequence of the marvelous change they were reported to produce in those who used them; for it was said, that however infirm, emaciated, or deformed they might be when they went into the water, they invariably came out young, strong, and handsome.

Without making further remarks, these traditions furnish very strong evidence that the Sandwich Islanders were acquainted with the existence of the Marquesan and Society Islands long before visited by Captain Cook; and they also warrant the inference, that in some remote period the Sandwich Islanders have visited or colonized other islands in the Pacific... [Ellis, 1963:285]

We note here that Ellis' reference to "Haupokane" a form of the name Houpo Kāne (also Houpo-a-Kāne), is an important one, as a place of that name is also situated on Mauna Kea, in the vicinity of the springs—which in native tradition are fed by the waters of Waiau. Houpo-a-Kāne, erroneously written as "Hopukani," on maps dating from the 1930s, demonstrates the association of Hawaiian gods with places, and traditions of star lore, and tie the same gods to the celestial bodies. We also see in this one name that there is a depth of relationship and knowledge shared between the native peoples of Polynesia.

Several accounts describing traditional knowledge of the stars have been located. In the 1800s, several native writers described the importance and relationship of *hōkū* (stars) in Hawaiian beliefs, culture and practices (Malo 1951, I'i 1959, and Kamakau 1964 and 1976). Kamakau (1964) tells us that there were many orders of *kāhuna* (priests and expert practitioners). He also recorded that generally, those practitioners in the various orders of the priesthood were of the *papa ali'i*, or chiefly class (Kamakau 1964:7). Among the *kāhuna* were several classes of priest-experts, who specialized in learning about the heavens—both near earth and in the distant night skies. Those *kāhuna* belonged to the classes of:

Papa kilokilo lani, those who could read the signs, or omens, in the sky; the *kilo hoku,* those who studied the stars; the *kilo 'opua*, those who studied and read the omens in clouds... [Kamakau 1964:8]

There follow below, several historical articles on the practices of the *'oihana kilokilo* and *kilo hōkū* of ancient Hawai'i, as recorded by both native writers, and foreign writers, who relied on native informants as their sources. Two of the articles are translated here for the first time, in their entirety, from the original Hawaiian texts. We note that some of the language from the Hawaiian texts was beyond our knowledge base—sometimes presented in metaphorical or esoteric language, or in descriptions that exceed our limited knowledge of the science of astronomy. Thus, we have included the original Hawaiian texts with our translations, to allow readers with greater skill than ours, to delve into the depths of the information conveyed by those who recorded the histories. The combined writings—collected from the 1830s to 1935—provide us with a list of more than 270 Hawaiian names for stars (not including alignments of stars which marked the heavens and pathways of traditional navigators).

"Moolelo Hawaii"

Among the earliest native traditions recorded by Hawaiian writers, are those compiled by Davida Malo, who was of chiefly lineage, and who was among the first students to attend Lahaina Luna seminary. A part of the program at the seminary, included the collection and writing of native traditions and lore—documenting beliefs, practices and customs, of the Hawaiians. In the work compiled by Davida Malo, we find examples of the intimate knowledge and integrated approach of Hawaiians, in observing the relationships of the stars, planets, and heavenly bodies, to the occurrences of natural phenomena—such as the annual position of stars in correlation with annual seasons, and periods of weather—and in the planning of all facets of life, from the most sacred, to the most utilitarian.

In a chapter compiled by Malo, translated by Nathaniel Emerson (ca. 1898), and published in 1951, we find the following account of the pattern of Hawaiian life based on knowledge of the heavens and the earth around them. Readers are requested to keep in mind that Malo's account, while one of the earliest, is but one of many recorded by native writers and others interested in traditional lore. Thus, other variations of the subject matter exist.

Chapter 12
The Divisions of the Year

1. The seasons and months of the year were appropriately divided and designated by the ancients.
2. The year was divided into two seasons *Kau* and *Hoo-ilo*. *Kau* was the season when the sun was directly overhead, when daylight was prolonged, when the tradewind, *makani moae*, prevailed, when days and nights alike were warm and the vegetation put forth fresh leaves.
3. *Hoo-ilo* was the season when the sun declined towards the south, when the nights lengthened, when days and nights were cool, when herbage (literally, vines) died away.
4. There were six months in *Kau* and six in *Hoo-ilo*.
5. The months in *Kau* were *Iki-iki*, answering to May, at which time the constellation of the Pleiades, *huhui hoku*, set at sunrise. *Kaa-ona*, answering to June,—in ancient times this was the month in which fishermen got their *a-ei* nets in readiness for catching the *opelu*, procuring in advance the sticks to use in keeping its mouth open; *Hina-ia-eleele*, answering to July, the month in which the *ohia* fruit began to ripen; *Mahoe-mua*, answering to August,—this was the season when the *ohia* fruit ripened abundantly; *Mahoe-hope*, answering to September, the time when the plume of the sugar-cane began to unsheath itself; *Ikuwa*, corresponding to October, which was the sixth and last month of the season of *Kau*.
6. The months in *Hoo-ilo* were *Welehu*, answering to November, which was the season when people, for sport, darted arrows made of the [page 30] flower stalk of the sugar-cane; *Makalii*, corresponding to December, at which time trailing plants died down and the south wind, the *Kona*, prevailed; *Kaelo*, corresponding to January, the time when appeared the *enuhe*, when also the vines began to put forth fresh leaves; *Kaulua*, answering to February, the time when the mullet, *anae*, spawned; *Nana*, corresponding to March, the season when the flying fish, the *malolo*, swarmed in the ocean; *Welo*, answering to April, which was the last of the six months belonging to *Hoo-ilo*.
7. These two seasons of six months each made up a year of twelve months,[2] equal to nine times forty days and nights—but the ancients reckoned by nights instead of days.

8. There were thirty nights and days in each month; seventeen of these days had compound names (*inoa huhui*) and thirteen had simple names (*inoa pakahi*) given to them.

9. These names were given to the different nights to correspond to the phases of the moon. There were three phases—*ano*—marking the moon's increase and decrease of size, namely, (1) the first appearance of the new moon in the west at evening:

10. (2) the time of full moon when it stood directly overhead (literally, over the island) at midnight.

11. (3) The period when the moon was waning, when it showed itself in the east late at night. It was with reference to these three phases of the moon that names were given to the nights that made up the month.

12. The first appearance of the moon at evening in the west marked the first day of the month. It was called *Hilo* on account of the moon's slender, twisted form.

13. The second night when the moon had become more distinct in outline was called *Hoaka*; and the third when its form had grown still thicker, was called *Ku-kahi*; so also the fourth was called *Ku-lua*. Then came *Ku-kolu*, followed by *Ku-pau* which was the last of the four nights named *Ku*.

14. The seventh, when the moon had grown still larger, was called *Ole-ku-kahi*; the eighth, *Ole-ku-lua*; the ninth, *Ole-ku-kolu*; the tenth, *Olepau*, making four in all of these nights, which, added to the previous four, brings the number of nights with compound names up to eight.

15. As soon as the sharp points of the moon's horns were hidden, the name *Huna* (hidden) was given to that night—the eleventh. The twelfth night, by which time the moon had grown still more full, was called *Mohalu*. The thirteenth night was called *Hua*, because its form had then become quite egg-shaped (*hua* an egg); and the fourteenth [page 31] night, by which time the shape of the moon had become distinctly round, was called *Akua* (God), this being the second night in which the circular form of the moon was evident.

16. The next night, the fifteenth, had two names applied to it. If the moon set before daylight *ke ao ana*—it was called *Hoku palemo*, sinking star, but if when daylight came it was still above the horizon it was called *Hoku ili*, stranded star.

17. The second of the nights in which the moon did not set until after sunrise—sixteenth—was called *Mahea-lani*. When the moon's rising was delayed until after the darkness of night had set in, it was called *Kulua*, and the second of the nights in which the moon made its appearance after dark was called *Laau-ku-kahi* (eighteenth); this was the night when the moon had so much waned in size as to again show sharp horns.

18. The nineteenth showed still further waning and was called *Laau-ku-lua*; then came *Laau-pau* (twentieth), which ended this group of compound names, three in number. The name given to the next night of the still waning moon was *Ole-ku-kahi*. Then in order came *Ole-ku-lua* and *Ole-pau*, making three of this set of compound names (twenty-first, twenty-second and twenty-third).

19. Still further waning, the moon was called *Kaloa-ku-kahi*; then *Kaloa-ku-lua*; and lastly, completing this set of compound names, three in number, *Kaloa-pau* (twenty-fourth, twenty-fifth and twenty-sixth).

20. The night when the moon rose at dawn of day (twenty-seventh) was called *Kane*, and the following night, in which the moon rose only as the day was breaking (twenty-eighth), was called *Lono*. When the moon delayed its rising until daylight

had come it was called *Mauli*—fainting; and when its rising was so late that it could no longer be seen for the light of the sun, it was called *Muku*—cut off. Thus was accomplished the thirty nights and days of the month.

21. Of these thirty days some were set apart as *tabu*, to be devoted to religious ceremonies and the worship of the gods. There were four *tabu* periods in each moon.

22. The first of these *tabu* periods was called that of *Ku*; the second, that of *Hua*; the third, that of *Kaloa* (abbreviated from Kana-loa); the fourth, that of *Kane*.

23. The *tabu* of *Ku* included three nights; it was imposed on the night of *Hilo* and lifted on the morning of *Kulua*. The *tabu* of *Hua* included two nights; it was imposed on the night of *Mohalu* and lifted on the morning of *Akua*. The *tabu* of *Kaloa* included two nights; it was imposed on the night of *Ole-pau* and raised on the morning of *Kaloa-ku-* [page 32] *lua*. The *tabu* of *Kane* included two nights; being imposed on the night of *Kane* and lifted on the morning of *Mauli*.

24. These *tabu* seasons were observed during eight months of the year, and in each year thirty-two days were devoted to the idolatrous worship of the gods.

25. There were now four months devoted to the observances of the *Makahiki*, during which time the ordinary religious ceremonies were omitted, the only ones that were observed being those connected with the *Makahiki* festival. The prescribed rites and ceremonies of the people at large were concluded in the month of *Mahoe-hope*. The keepers of the idols, however, kept up their prayers and ceremonies throughout the year .

26. In the month of *Ikuwa* the signal was given for the observance of *Makahiki*, at which time the people rested from their prescribed prayers and ceremonies to resume them in the month of *Kau-lua*. Then the chiefs and some of the people took up again their prayers and incantations, and so it was during every period in the year. [Malo, 1951:33]

Hawaiian Astronomy and Navigation
The Journal of William Richards (1841)

The following narratives are excerpted from an 1841 manuscript written by William Richards, in answer to a series of questions asked by Captain Charles Wilkes, Commander of the United States Exploring Expedition. While Richards comments are at times bigoted and minimize the extent of traditional Hawaiian knowledge of the universe around them, the documentation pertaining to aspects of native knowledge of the skies and navigation, is of historic value. His manuscript offers readers one of the earliest written accounts of such knowledge and the documentation of native customs and practices.

Wm. Richards was among the party of first American missionaries to arrive in the Hawaiian Islands (in 1820), and by the death-bed request of the sacred chiefess Keōpūolani (in 1823), he raised Kauikeaouli (Kamehameha III) and his sister, Nahi'ena'ena. In his life time, Richards served in many official capacities in the Hawaiian Kingdom. Richards identified the chief, Hoapili, counselor to the first three Kamehamehas, as the primary source of his information, which was also corroborated by Kamehameha III, prior to Richards sending it to Wilkes (in text below).

Ulumaheihei Hoapili was the son of Kame'eiamoku, one of the "four Kona uncles" and confidants of Kamehameha I. Kame'eiamoku and his twin brother Kamanawa were of a line of priests of the "class of Ka-uahi and Nahulu" (Kamakau 1961:188, 190, 231); these lines of priests were noted for the knowledge of the stars and heavens. When Kame'eiamoku died in 1804, his son Hoapili, inherited his position, which he retained until his death in 1840. It was also Hoapili, who in 1819, cared for and hid

the bones of Kamehameha I (Kamakau 1961:211, 212, 215). Even this was done, in association with the stars, it being said "*O ka Hoku o ka malama ke ike ia Kamehameha*" (The morning star alone knows where Kamehameha's bones are guarded) (Kamakau in *Nupepa Kuokoa* September 28, 1867).

Wm. Richards; to Charles Wilkes ESQ., Commander of the U.S.A. Exploring Expedition
Lahaina March 15—1841:
Previous to your departure from the Islands, I must acknowledge the reception of yours of the 9th. But, in which you have done me the honor to propose several very important questions in relation to these Hawaiian Islands.

I beg you to receive this rather as an apology, than as a full reply to those questions, for though I feel the deepest interest in the subject of them, and the strongest wish that they should be correctly answered, yet your very limited stay at this place removes all possibility of doing justice to a reply. The simple subject of the Government would require a volume to give a full view of it. I can not even enter up on the theory of it in its various branches but simply state a few facts representing it... [page 1]

..."10th If any knowledge of Astronomy."
Of the system by which the heavenly bodies are regulated, the Hawaiians had no knowledge. With a few of the most noticeable facts in relation to the planets they were acquainted. *They were some what accurate observers of some of the phenomina [sic] of the heavens. There was a clan of persons whose profession it was to watch the motions of the stars. The late Hoapili with whom I have often conversed on the subject was accounted one of their most skillful astrologers. From him I learned that they had names for many of the largest stars, and principle constellations. They were acquainted with five planets, which they called "traveling stars." Hoapili was much in the habit of observing these that he could at any moment tell the then present positions of each.* [Page 37]

Their names were as follows:

Kawela — Mercury.

Naholoholo —Venus.

Hoomanalonalo — Jupiter.

Holoholopinaau — Mars

Makulu — Saturn.

Hoapili said he had heard from others that there was one more traveling star, but he never recognized it, and was acquainted with only these five. The more distinguished fixed stars and constellations not only had their distinct names, but the people were in the habit of observing them so accurately that they judged the hours of the night quite as correctly as they did the hour of the day. This remark applies most particularly to the fishermen and those persons whose employment called them to be out considerably in the night.

It was by the particular positions of the planets in relations to certain fixed stars and constellations, that the prophets grounded their predictions in relation to the forte of battles, the success of new enterprises [page 38] &c, &c. The contiguity of their planets to certain fixed stars was considered to be a real indication of the pending death of some high chief. The goddess of the Volcano was also supposed to hold intercourse with these traveling stars, and from their movements therefore, the people often predicted hers.

The motions of the stars in the vicinity of the north pole, attracted their attention considerably and were often a subject of dispute among the astrologers. These they said were "traveling stars, but they travel regularly, where as the others wander here and there."

Of the true manner of accounting for these phenomina they had not the most distant conception.

Their best Chronologists, measured time by means both of the moon and fixed stars. They divided the year into twelve months, and each month into thirty days. They had a distinct name for each of the days of the month, and commenced the numbering on the [page 39] first day that the new moon appeared in the west. This course made it necessary to drop a day about once in two months, and thus reduce their year to twelve lunations instead of three hundred and sixty days which they numbered according to their *theory.*

This being about eleven days less than the sidereal year, they discovered the discrepancy, and corrected their reckoning by the stars. In practice therefore, the year varied, having sometimes twelve, and sometimes thirteen lunar months. So also they sometimes numbered twenty nine days in a month.

Though their system was thus broken and imperfect, still as their chronologists could tell the names of the day and the names of the month on which any great event occurred, it was generally easy to revise their time to ours by a reference to the phase of the moon at the time. But when the change of the moon takes place about the middle of our calendar month, then we are liable to a mistake of a whole month in reducing their time [page 40] to ours. We are also liable to another mistake of a single day from the uncertainty of the day that the moon was discovered in the west. Having nothing to rely upon except merely their memories, they were also liable to numerous mistakes even in their own method.

Eclipses were uniformly considered to be brought about by an attack of the gods on the sun & moon, and always presaged a war, the death of some high chief, or some other disaster.

The ability of foreigners to predict eclipses, and other astronomical phenomina at first created the highest astonishment. The first almanac published by the American missionaries predicting the phases of the moon, eclipses, tides &c., in 1834, was received by them with great interest, and tended much to confirm their belief in the testimony of the missionaries on every subject.

They were however themselves, in the habit of referring the tides to the actions of the moon, and when they could see the moon, were able to tell the state of [page 41] the tides.

Though they thought much of their success depended on their acting on it were in unison with the heavenly bodies, yet as they were unable to calculate even the most simple of all the movements of the planets for any length of time before hand, they were unable to plan their battles or their enterprises with reference to any particular positions of those planets, and therefore, when the time arrived and they saw that position to be what they supposed unfavorable, they were often at once discouraged and gave up their enterprise, or fled from their enemies even though not pursued.

Could one of their ancient warriors have known enough of astronomy to have calculated even a few of the more simple celestial phenomina, it would have given him vast

advantage over those who had not that knowledge; for he might then have planned his attacks and his enterprises in conjunction with the heavenly bodies, and his followers seeing their positions favorable would [page 42] have been inspired with undaunted courage, while his enemies would have fled in dismay, thinking that they were contending not only with human enemies but with the stars in their course too.

The first little book which was published containing some of the true principles of astronomy awakened their surprise and they at once brought forth the common vulgar objections to it.

Hoapili the astrologer mentioned above, said however, respecting the figure of the earth, "Stop, do not be so quick with your objections to the foreign theory. Fact is look at it. This is what I have always seen. When I have been far out at sea on fishing excursions, I always first lost sight of the beach — then the houses and trees — then the low mountains and last of all the high ones. So, when I returned, I first saw the high mountains, then the lower ones, then the trees and houses, last of all, the beach. I think these foreigners are right, and that the earth is round." [page 43]

11th If any knowledge of Navigation.

The Hawaiians were in the habit of sailing frequently from one Island to another in the group, and were frequently out of sight of land, both on these voyages and on their fishing excursions, but still they can hardly be said to have any knowledge of navigation. They were pretty accurate observers of the weather, and of certain atmospheric phenomina, & their observations of these together with the heavenly bodies, when in sight, enabled them to sail a little distance from land with considerable safety.
They usually never went out of sight of land except by accident.

When they found themselves in these circumstances, they rely mostly on the heavenly bodies if in sight. If not, they were able to judge of the points of compass by the winds and state of the atmosphere, there being considerable difference in the appearance of the weather ac- [page 44] -cording to the direction of the wind. The appearance of the clouds in the vicinity of or in the direction of land afforded them another beacon. Probably very few Hawaiians have ever been lost at sea by mistaking the points of compass and sailing away from land. Their disasters arose from the frailty and smallness of their canoes, which being in some manner disabled by stress of weather, they were prevented from shaping their coarse in the direction they desired.

Their skill in the management of canoes was perhaps unexampled, especially in the surf. But since the high chiefs have possessed foreign vessels, there is sailing to a distance in canoes, and the people are probably losing a portion of their skill.

They do well in the management of their own vessels. No one has ever been lost by being driven away from land. The science of navigation is now taught in the seminary and a considerable number have made proficiency in the study... [page 45]

...Thus Sir, in a very hasty and imperfect manner have I attempted the near outline of a reply to your important questions. I regret my inability to do it in a more perfect manner.
Several of the subjects were too extensive to allow even an outline of an answer in this letter. But what I have written you may rely upon as correct, for you have it not on my authority only but also on the King's as I have read the above to him and he pronounces it the truth.

Be pleased Sir to accept the assurance of the high considerations and esteem with which I remain very truly your most obedient servant. [Hawaii State Archives, Series M-126:58]

"A History of the Sandwich Islands"
(Sheldon Dibble, 1843)

Sheldon Dibble, a member of the American Mission company, arrived in the Hawaiian Islands in June 1831. He remained in the islands most of the time until his death in 1845. After serving a short time in Hilo, Dibble was stationed on Maui, where he had charge over the Lahaina Luna Seminary. While at Lahaina Luna, Dibble undertook a program of collecting Hawaiian histories, with the help of select native students, who were sent out to speak with elder Hawaiians. Describing this effort, Dibble (1843) reported:

> The method which I took to collect facts was as follows: I first made out a list of questions, arranged chronologically according to the best of my knowledge. I had continual occasion afterwards to add to the questions, to vary and to change them. I then selected ten of the best scholars of the Seminary [Lahaina Luna], and formed them into a class of inquiry. I met them at an appointed hour, gave them the first questions and conversed freely with them upon it, that they might understand fully and distinctly what was sought for. I then requested them to go individually and separately to the oldest and most knowing of the chiefs and people, gain all the information that they could on the question given out, commit each his information to writing and be ready to read it on a day and hour appointed. At the time of meeting each scholar read what he had written—discrepancies were reconciled and corrections made by each other and then all the compositions were handed to me, out of which I endeavored to make one connected and true account... [Dibble, 1843:iii-iv]

The result of his efforts, led to the collection of significant Hawaiian histories. Among the students were the well known Hawaiian historians, Davida Malo and Samuel Mānaiakalani Kamakau, and a number of lesser-known individuals who in subsequent years, contributed many important historical accounts to the native language newspapers. The above said, we note here, that the writings of the reverend Dibble, while recording significant Hawaiian information, that may have otherwise been lost, also demonstrate an almost unparalleled level of bigotry towards the people he had come to "save."

Because of the sources of information, and the early date in which much of it was recorded, we include Dibble's compilation of Hawaiian reckoning of time by nights of the moon, and the Hawaiian calendar—a system reportedly established by Wākea, for whom Mauna Kea is named; and his narratives on concepts of Hawaiian astronomy, which follow closely, those reported by William Richards above, being based in part on the authority of Hoapili.

Native Division of Time,
Phases of the Moon, and the Hawaiian Calendar

> It is said that their division of time was made by their first progenitor Wakea at the time of his domestic quarrel... Be this true or false, the tradition shows that their division of time was very ancient. [page 13]
>
> In their reckoning, there were two seasons, summer and winter. When the sun was perpendicular and moving toward the north and the days were long, and the trees bore fruit, and the heat was prevalent,—that was summer [*Kau*]. But when the sun was perpendicular and moved towards the south, and the nights were lengthened, and the trees without fruit, and the cold came,—that was winter [*Ho'oilo*]. There were also six months in each season. Those of the summer were, *Ikiki, Kaaona, Hinaiaeleele, Kamahoemua, Kamahoehope,* and *Ikua.* The winter months were, *Welehu, Makalii, Kaolo, Kaulua, Nana,* and *Welo.* These twelve months united constituted one year. *Welehu* was the completion of the year, and from *Makalii* the new year was reckoned. In one year there were nine times forty nights. The nights were counted by the moon. There were thirty nights in each month, seventeen of which were not very light, and thirteen were; the different nights (and days) deriving their names from the different aspects of the moon, while increasing, at the full, and waning. The first night was called *Hilo* (to twist), because

the part then seen was a mere thread; the next, a little more plain, *Hoaka* (crescent); then *Kukahi, Kulua, Kukolu, Kupau, Olekukahi, Olekulua, Olekukolu, Olekupau.* When the sharp points were lost in the moon's first quarter, the name of that night was *Huna* (to conceal); the next on its becoming gibbous, *Mohalu*, then *Hua*; and when its roundness was quite obvious, *Akua.* The nights in which the moon was full or nearly so, were *Hoku, Mahealani*, and *Kolu. Laaukukahi* was the name of the night in which the moon's decrease became perceptible. As it continued to diminish the nights were *Laaukulua, Laaupau, Olekukahi, Olekulua, Olepau, Kaolakukahi* [*Kaloakukahi*], *Kaloakulua, Kaloapau.* When the moon was very small the night was *Mauli*, and that in which it disappeared, *Muku.* The month of thirty days is thus completed.

From each month four periods were selected in which the nights were consecrated, or *tabu.* The following are the names: *Kapuku, Kapuhua, Kapukaloa,* and *Kapukane*; the first consisted of three nights; commencing with *Hilo* and [page 14] terminating with *Kulua*; the second was a period of two nights, beginning with *Mohalu* and ending with *Akua*; the two nights, from *Olepau* to *Kaloakulua*; the fourth from *Kane* to *Mauli.*

It is mostly in reference to the sacred seasons that I have here introduced their division of time. The method of reckoning by the moon, led, of course, to many irregularities. On a future page I may, perhaps, notice some of them...

In the regular division of time already mentioned and the occurrence of sacred seasons at intervals four times a month there may be some trace of an ancient weekly Sabbath. There were also yearly feasts, and feasts of the new moon, which were observed with much religious ceremony... [page 15]

Hawaiian Astronomy and Navigation

...Of geography they knew nothing beyond the limits of their own islands. Some names of foreign islands were indeed used in their songs and in their numerous legends, but no distinct knowledge of them existed among the people, at least as late as the days of Kamehameha.

Of astronomy they knew somewhat more, as I think is true of savage nations generally. They knew nothing of course of the system by which the heavenly bodies are regulated, but with a few of the most noticeable facts in relation to the planets they were acquainted. There was a class of persons whose profession it was to watch the motions of the stars. These astrologers, among whom Hoapili, the late Governor of Maui, was particularly skilled, had names for many of the largest stars and principal clusters. They were acquainted with five planets which they called traveling stars. Hoapili was so much in the habit of observing these, that he could at any moment tell the position of each. Their names for these five planets were as follows: *Kawela*–Mercury, *Naholoholo*–Venus, *Hoomanalonalo*–Jupiter, *Holoholopinau*–Mars, *Makulu*–Saturn. Hoapili said that he had [page 89] heard from others that there was one more traveling star, but he had never recognized it and was acquainted with only these five. The more distinguished fixed stars and clusters had their distinct names, and the people were in the habit of observing them so much that they judged of the hour of the night about as accurately as of the hour of the day; this was especially true of fishermen and those persons whose employment called them to be out considerably in the night.

It was by the particular position of the planets, in relation to certain fixed stars and clusters of stars, that the prophets grounded their predictions in relation to the fate of battles, the success of new enterprises, etc. The contiguity of these planets to certain fixed stars was considered to be a sure indication of the speedy death of some high chief. The goddess of the volcano was also supposed to hold intercourse with these traveling stars and from their movements therefore the people often predicted volcanic eruptions.

The motions of the stars in the vicinity of the north pole attracted their attention considerably and were often the subject of dispute. These they said were traveling stars, but did not wander here and there like the others, but traveled regularly.

Those who took the most care in measuring time, measured it by means both of the moon and fixed stars. They divided the year into twelve months, and each month into thirty days. They had a distinct name for each of the days of the month, as has been shown on a former page, and commenced their numbering on the first day that the new moon appeared in the west. This course made it necessary to drop a day about once in two months, and thus reduce their year into twelve lunations instead of three hundred and sixty days. This being about eleven days less than the sidereal year, they discovered the discrepancy and corrected their reckoning by the stars. In practice, therefore, the year varied, being sometimes twelve, sometimes thirteen lunar months. So also they sometimes numbered twenty-nine and sometimes thirty days in a month.

Though their system was thus broken and imperfect [page 90] yet, as they could tell the name of the day and the name of the month when any great event occurred, their time can be reduced to ours by a reference to the phase of the moon at the time. But when the change of the moon takes place about the middle of our calendar month, then we are liable to a mistake of a whole month. We are liable to another mistake of a day, from the uncertainty of the day that the moon was discovered in the west. Having nothing to rely upon except merely their memories, they were also liable to numerous mistakes from that source.

Eclipses were uniformly considered to be an attack of the gods on the sun and moon, and always presaged war, the death of some high chief or some other great disaster.

The ability of foreigners to predict eclipses and other astronomical phenomena, created at first the greatest astonishment. The Almanac published by the Mission, predicting the phases of the moon, eclipses, tides, &c, was received by them with much interest, and tended somewhat to confirm their belief in our testimony on every subject. It is worthy of remark, however, that they themselves were in the habit of referring the tides to the action of the moon and when they could see the moon were able to tell the state of the tides.

Though they thought that much of their success depended on their acting in unison with the heavenly bodies, yet as they were unable to calculate even the most simple of all the movements of the planets for any length of time beforehand, they were unable to plan their battles and their enterprises with reference to any particular position of these planets; and therefore when the time arrived and they saw that position to be what they supposed unfavorable, they were often at once discouraged and gave up their enterprise, or fled from their enemies, even though not pursued. Could one of their ancient warriors have known enough of astronomy to have calculated even a few of the most simple celestial phenomena it would have given him a vast advantage, for he might then have planned his attacks and his enterprises in conjunction with the heavenly bodies, and [page 91] his followers, seeing their position favorable, would have been inspired with undaunted courage, while their enemies would have fled in dismay, thinking that they were contending, not only with human armies, but also with the stars in their courses.

The first little book which was published in their language, containing some of the true principles of astronomy, awakened their surprise, and they at once brought against it the common vulgar objections. Hoapili, the astrologer before mentioned, when others were disputing about the figure of the earth, said: "Stop; do not be so quick with your objections to the foreign theory. Let us look at it. This is what I have always seen. When I have been far out at sea on fishing excursions, I first lost sight of the beach, then of the houses and

trees, then of the hills, and last of the high mountains. So when I returned, the first objects which I saw were the high mountains, then the hills, then the trees and houses, and last of all the beach. I think therefore that these foreigners are right, and that the earth is round."

Of navigation they could hardly be said to have any knowledge. They were in the habit, however, of sailing frequently from one island to another in the group, and were frequently out of sight of land both on these voyages and on their fishing excursions. In some instances they sailed intentionally out of sight of land, from one extreme point of the group to the other. There are numerous traditions also, of voyages performed even to and from foreign islands. When out of sight of land, they sailed by the sun and stars, which in this climate are rarely obscured. The direction of the wind was also another guide, the weather undergoing an entire change on an interruption of the trade winds. Their skill in the management of canoes was perhaps unexampled, especially in the surf. Excepting, however, this practical and common sense sailing they had no knowledge whatever of navigation... [page 92]

"No ke Ao Hoku" (About Astronomy)

In July 1865, native historian, Samuel Mānaiakalani Kamakau, wrote an article which he submitted for publication in the native newspaper, *Kuokoa* (issue of August 5, 1865:4). His account was apparently in response to some narrative or discussion of astronomy and navigation skills being practiced, and in the following article, he provided a detailed explanation of Hawaiian knowledge of the stars. W.D. Alexander, a missionary descendant, and surveyor general of the Kingdom of Hawai'i published a translation of Kamakau's article in the Hawaiian Annual of 1891. Below, follow the original Hawaiian texts of Kamakau, and a modified version of Alexander's translation. The accompanying translation, modified by Maly, attempts to provide readers with a more accurate account of Kamakau's texts. The Hawaiian is included in order that readers of the Hawaiian language may compare and clarify the actual meaning of Kamakau's narratives.

No ke Ao Hoku
Na S.M. Kamakau
Honolulu, lulai 26, 1865
Ua kulai waiho molaelae ae au i ka moolelo o na wahi keiki hookele hoku holo moana, ai ko manao o Mokuleia; noweo maka uawahi kai o Elokupaoa.

Ua ike ae au i ka lakou Kumu Ao Hoku holo moana. He wahi keiki i umi makahiki a oi ae paha, oia ka lakou kumu holomoku.

O Kanowa ke kahua o Hanai, ka halekula o Pekue, ka nalu o Kalakiki, ke kumu o Kanekahoowaha me na haumana.

No Ke Aohoku Ana.

1. *E lawe ae ke kumu i ka ipu hokeo loihi me he pauku olokaa la ke ano. Ua kunikuni ahi ia he mau alanui. Oia hoi na alanui o na hoku hookele, ua kapaia na Hoku Aiaina.*

   A mawaho o na alanui ekolu na hoku ua kapaia na Hoku o ka Lewa.

2. *Hookahi alanui e moe ana mai ka Hokupaa Akau; a hiki aku i ka Hoku Welelau Hema o Newe. O ka aoao akau o keia alanui; ua kapaia o "Kealaula a Kane." A o ka aoao hema; ua kapaia o "Ke alanui Maaweula a Kanaloa."*

3. *O na kaha hikina ekolu. O ke kaha hikina ma ka aoao akau; oia kahi e ku ai ka la i ka akau i ka la 15 me ka 16 o Kaulua, ua kapaia alanui "Ke alanui Polohiwa a Kane."*

4. *O ke kaha hikina ma ka aoao hema, oia kahi e ku ai ka la i ka aoao hema i la 15 me ka 16 o Hilinama. Ua kapaia ia alanui o "Ke alanui Polohiwa a Kanaloa."*

5. *O ke alanui iwaenakonu i kupono i ka lolo, ua kapaia o "Ke alaula a ke Kuukuu;" a o "Ke ala i ka piko o Wakea."*

6. *Mawaena o keia mau alanui na Hoku paa o ka Aina; i kapaia na Hoku hookele moana. Ua kilokilo ia kela hoku keia hoku maluna o ka ipu.*

7. *I ke ao ana, kuhikuhi mai la ke kumu i na hoku. Eia o Humu me kona mau lala iwaho, a me na loina i ka akau, a me ka hema; ke kulepe, ka puahiohio, ka waipuilani a pau ke ano. Pela no o Keoe, o Nuuanu, o Kapea, o Kokoiki, o Puwepa, Nakao, Nalalani, o Pililua, Mananalo, Kaawela, Naholo, Pinaau, Polohilani, Kaweo, Hokuloa, Ukali.*

[8.] *Ua makaukau oe no ka pauku olokaa. Alaila e ao oe i na mea o loko o ka hale, i na ipu o loko, i na mea o ka hale a pau i na loina a pau; he mau hoku kiai ia, ua pau na mea o loko i ke ao ia.*

9. *Mai na po i na Kaloa, a hiki i o Mauli. E lawe ae ke kumu i ka moena puao maikai, a hohola ae iwaho ka hua, a e moe iho oe, a e huli ae ko alo iluna; a e loaa ia oe Ke Alapolohiwa a Kane me Kanaloa aia malaila, na hoku hookele; oia hoi na Hoku Ai-Aina. Akaka ia oe na la kupono o ka moana, mala o ke Kau me ka Hooilo.*

10. *I ko holo ana i ka pae Aina o Kahiki ua loaa ia oe he lalani hoku hou me na hoku i ka lewa a me ka lepo.*

11. *I ko hiki ana i ka piko o Wakea e nalowale ia oe ka Hokupaa Akau. Alaila e lilo Newe i hoku alakai hema, a o ka pae hoku o Humu ma na koa alakai maluna. I ka pau ana o na loina ia oe o ka lani.*

12. *E ao oe i na loina o ka moana, i na la e pii ai ke au iluna, a me na e moku ai ilalo, a me na la inoino o ka wili-au, me na la haumalu newenewe malie, a ku o ke au.*

13. *E ao oe i ke Kamaikihulipu i makaukau oe i ka hoolana, i pau ka loina o ke kaula hoolana ai. E ao oe i ka au mai kekahi mokupuni, a i kekahi mokupuni.*

14. *E lolo oe i kau mau oihana i ao ai i paanaau ia oe; i kokua mai ai ke Akua i kona mana Hemolele. I kou holo ana iloko o ke kupilikii a me na kai lipolipo o ke aloha ole.*

O ka Kanekahoowaha aoao Aohoku keia. He mau elemakule Aohoku o Kahipoliau, o Namaka, o Pai, o Kahipooula, he poe Aohoku keia. Ua maopopo ia lakou na loina; ua aneane e like no lakou me ka mua, ua oi loa'ku no nae ia o ke komo ana o Kaiahuna maloko o Kuaiako. Aole au i lohe i kekahi mea like me ia ma ke ao nei. O oukou paha kai lohe e hai iho. [S.M. Kamakau in Nupepa Kuokoa, Aukake 5, 1865:4]

Translation of Kamakau – August 5, 1865 (based on Alexander, 1891:142-143)

About Astronomy

I hereby set aside, and clarify the stories of some youth who sail the ocean, the thoughts of Mokuleia, whose eyes are blurred by mist on the sea of *Elokupaoa.*

I knew their astronomy teacher and sail instructor. I was a child of perhaps ten years, and it was he who was their sailing teacher.

Kanowa was the site, at Hanai, the school of Pekue, the waves of Kalakiki, and the teacher was Kaneakahoowaha and his students.

Instructions in Astronomy.

1. Take the lower part of a gourd or *hula* drum (*hokeo*), rounded as a wheel, on which several lines are to be marked (burned in), as described hereafter. These lines are called, "*Na alanui o na hoku hookele*" (the highways of the Navigation stars), which stars are also called "*Na hoku ai-aina*" (the stars which rule the land).

   Stars lying outside of these three lines are called "*Na hoku o ka lewa*," *i.e.*, foreign, strange or outside stars.

2. The first line is drawn from the "*Hoku paa*" (North Star), to the most southerly of "*Newe*" (Southern Cross). The portion to the right or east of this line is called "*Ke alaula a Kane*" (the dawning, or the bright road of Kane); and that to the left or west is called "*Ke alanui maaweula a Kanaloa*" (the much traveled highway of Kanaloa).

3. Then three lines are drawn east and west (latitudinally), one across the northern section, indicates the northern limit of the sun, about the 15th and 16th days of the month *Kaulua*, and is called "*Ke alanui polohiwa a Kane*" (the black shining road of Kane).

4. The line across the southern section indicates the southern limit of the sun, about the 15th and 16th days of the month *Hilinama*, and is called "*Ke alanui polohiwa a Kanaloa*" (the black shining road of Kanaloa).

5. The line exactly in the middle of the sphere (the drum, the *Lolo*), is called "*Ke alanui a ke Kuukuu*" (the road of the Spider), and also "*Ke alanui i ka Piko o Wakea*" (the way to the navel of Wakea).

6. Between these lines are the fixed stars, "*Na hoku paa o ka aina;*" which are called the stars by which one navigates on the sea. The teacher will mark the position of all these stars on the gourd.

7. Thus he will point out to his scholars the situation of *Humu* (Altair), and its associates on the outside, and to the north and south, with the winds *Kulepe, Puahiohio, Waipuilani,* and of all types. The stars are *Keoe* (Vega), *Nuuanu, Kapea, Kokoiki, Puwepa, Nakao* (Orion), *Nalalani, Pililua, Mananalo, Kaawela, Naholo, Pina-au, Poloahilani, Kaweo, Hokuloa* (Venus), *Ukali* (Mercury).[14]

[8.] Now you are prepared with the gourd container. Now you are taught of the things within the "house," those things of the *ipu*, all the things of the house, all the customs; there are many guardian stars, all of these things are found in the teachings.

9. During the nights from *Kaloa* to *Mauli* (the dark nights of the moon), are the best times for observation. Spread out a mat, lie down with your face upward, and contemplate the dark-bright sections of Kane and Kanaloa, and the navigating stars contained within them; that is of the *Hoku Ai-aina*. The good days for the ocean, in the seasons of *Kau* and *Hooilo*.

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[14] To the list originally recorded by Kamakau in 1865, Alexander (1891) added several additional star names and their English equivalents. Alexander translated the paragraph as:

Between these lines are the fixed stars, "*Na hoku paa o ka aina.*" On the sides are the stars by which one navigates. The teacher will mark the position of all these stars on the gourd. Thus he will point out to his scholars the situation of *Humu* (Altair), *Keoe* (Vega?), *Nuuanu, Kapea, Kokoiki, Puwepa, Na Kao* (Orion), *Na Lalani o Pililua, Mananalo, Poloahilani, Huihui* (the Pleiades), *Makalii* (the Twins), *Ka Hoku Hookelewaa* (Sirius), *Na Hiku* (the Dipper), and the planets, "*hoku hele*," *Kaawela* (Jupiter), *Hokuloa* (Venus), *Hokuula* (Mars), *Holoholopinaau* (Saturn), *Ukali* (Mercury), etc. [Alexander, 1891:142-143]

10. If you sail for the Kahiki groups, you will discover new constellations and strange stars over the deep ocean, "*hoku i ka lewa a me ka lepo.*"

11. When you arrive at the "*Piko o Wakea*" (Equator), you will lose sight of the "*Hoku-paa*" (North Star). Then "*Newe*" will be the southern guiding star, and the constellation of "*Humu*" will stand as a guide above you, "*Koa alakai maluna.*" That is when you have mastered all the customs of the heavens.

12. You will also study the regulations of the ocean, the movements of the tides, floods, ebbs and eddies.

13. You will also study the art of righting upset canoes, "*ke kamaihulipu,*" and learn the currents that run from one island to another.

14. All this knowledge contemplate frequently, and remember it by heart, that the God will empower you. So that it may be useful to you on the tough, the dark and unfriendly ocean.

Thus are the Astronomy teachings of Kaneakahoowaha. There are still several old men who know Astronomy, they are Kahipoliau, Namaka, Pai, and Kahipooula, they are Astronomers. They know the customs, and they are of almost the same skill as the first. But he was the foremost, in the skill of entering Kaiahuna and in Kuaiako. I have not heard of any other like him on earth. If perhaps you have heard, say so. [Translation of W.D. Alexander, in the Hawaiian Annual, 1891:142-143; modified by Maly to reflect the original text of S.M. Kamakau]

Nā Hōkū o ka Ho'okelewa'a (Stars of the Navigators)

In December 1865-1866, Kupahu, contributed a series of articles to the native newspaper, *Kuokoa*, discussing Hawaiian religion. One article in the series (*Kuokoa*, December 30, 1865:4), was dedicated to the practices of those people who knew the stars, and their importance in Hawaiian beliefs and customs. Kupahu's article is of particular importance, as it names many stars of the Hawaiian skies, and also provides us with some traditions associated with their names and with whom they were associated. The original Hawaiian texts, as published in the *Kuokoa*, and an English translation, prepared by Maly, follow below. As in the account above, we note that some of the concepts and use of language were confusing to us. Thus, readers more expert in the field of language and astronomy may be able to clarify the meaning of Kupahu, through their own careful review of the narratives.

Hoomana Kahiko.
HELU 33.

Na inoa a ka poe kahiko i kapa ai i na Hoku a me ke kilokilo ana i na Hoku.
Ua oleloia e ka poe Ao-Hoku o Hawaii nei mai kinohi mai, ua lawa pono na kanaka a pau i na hoku, mai ka mea e noho ana ma ka nohoalii, a hiki loa i ka mea i kapaia he kauwakuapaa. Nolaila, eia malalo iho nei kekahi mau hoku, a me ko lakou ano, a me na hana a lakou.

1. O na hoku kokua i ka hookelewaa ana.
Aia ma ka aoao akau kekahi hoku i kapaia e ka haole he Hokupaa Akau, a i kapaia hoi e ko Hawaii nei poe Ao-Hoku i na inoa ekolu; o Kiapaakai, Noho-loa ame Kumau. Ua kapaia keia mau inoa [illegible] no kona panee ole iluna [illegible] aole no hoi ma o, aole [illegible] ma kekahi wale no wahi e no [illegible] e akaka ai kona kokua no na poe hookelewaa. Ina e noho no kekahi kanaka ma Hawaii, a makemake e holo i Maui, alaila, o kana hana no ia, o ka hoomakaukau i na mea e pili ana i ka waa, a makaukau ia mau mea; i ke ahiahi ana aku, o ka hoomaka mai la no ia i ka holo ana mai Hawaii mai, me ka hoopololei i ka ihu o ka waa i kahi o ka hoku i kau ai, nona na inoa ekolu i haiia maluna'e. A pela mau no hoi e hoopololei ai a hiki i kahi i makemake ai e holo. I ka hoi ana hoi i Hawaii, e

hoopololei no i ka hope o ka waa i kahi kupono i ua hoku la. Aia hoi mawaho ae o keia hoku, i kapaia i na inoa ekolu, kekahi mau hoku ehiku e poai mau ana ia ia, i ka po a me ke ao; a pela mau aku no. O ke kau ana o keia mau hoku, aia no ia ma ka lalani kekee. Ina e ikeia keia mau hoku ehiku e kau ana maluna pono iho o keia hoku, i ka wa mahope iho o ka napoo ana o ka la, alaila, e maopopo no i ka poe i ike i ke Ao-Hoku o Hawaii nei. Aia a kau hou keia mau hoku i ko lakou poai ana ia ia, alaila, e kokoke ana i ke ao.

2. Kekahi mea e kokua ai i ka poe e hookelewaa ana.

Aia ma kahi i kapaia e ko Hawaii nei poe ao-hoku, o Kuamoo kekahi mau hoku he lehulehu, aka, o ko lakou kau ana, ua kau no ma ka lalani poepoe. He nui na hoku ma kauwahi, a kakaikahi ma kauwahi, a hookahi no ma kauwahi. Ua kapaia na inoa o na hoku o keia lalani, ke nana iho no hoi kakou malalo nei. O ka nui o ko lakou mau inoa, he iwakalua kumamaono. A eia no hoi ka mua: O Ikaika, oia no ka inoa i kapaia e ko Hawaii nei poe ao-hoku, a i kapaia hoi e ka poe akeakamai o lubita, Kaawela. Eia kona wehewehe ana: Ua kapaia aku kona inoa mamuli o kona ano malamalama, oia kela inoa i hoikeia'e nei maluna. O keia hoku no hoi kekahi mea nona i hoike mai ka lilo wale ana mai o Kauai ia Kamehameha I., me ke kaua ole ia. I ka wa e noho alii ana o Kaumualii no Kauai, ua kaua mai o Kamehameha I, me ke alii o Maui nei, ua lanakila no o Kamehameha, a pela no i ko o Oahu. Noho iho la o Kamehameha ma o Oahu, a kupu ae la kona manao e ku e kaua ia Kaumualii, ke alii o Kauai. Mamua ae nae o ka holo ana o Kamehameha i Kauai, hoomaka kona kilokilo hoku, e nana i na ouli o ka lani ma ka mea e pili ana i kana oihana he kilo hoku, aka, i kona nana ana, ike aku la oia i keia hoku i kapaia o Ikaika, a me ko Kaumualii hoku e kau pu ana.— Ia manawa no, pane ae la ua kilo hoku nei ia Kamehameha, "E lilo ana o Kauai ia oe, no ka mea, ke hoike ia mai la, ua lilo ka Aina nou; a e lilo wale mai aka no ka Aina ia oe, me ke kaua ole mai o ke alii o Kauai, a pela aku no hoi oe."

Mahope mai, kena ae la o Kamehameha i kona mau waa kaua, e holo aku i Kauai e kaua ai. Ia lakou i hiki ai ma Kauai, hoomaka lakou no ka hoonoho ana i ke kaua, me ka manao no hoi e kaua koke no. I ko lakou hoomaka ana e kaua aku, ia manawa, pane aku o Kaumualii, "O hoi, a nana mai oe, a uhi ae kapa eleele, a kau ka puna i ka nuku, alaila, kii mai i ko Aina." Ia manawa, akahi no a hoomaopopo o Kamehameha i ka olelo mua a kona kilo hoku i hai mua aku ai ia ia, mamua ae o ko lakou holo ana i Kauai, me kona olelo iho iloko ona. Ua ko io no ka ike a kona kilo hoku i hai aku ai ia ia ma Oahu. Eia ka lua o na inoa o na hoku o keia lalani hoku. O Mulehu, aole nae oia inoa wale no, aka, he mau inoa e ae no kekahi o keia hoku, oia hoi o Poloahilani, a me Poloula. O ke ano o keia hoku, he hoku makapo, a he pohina no kona ano ke nana aku kakou i ka po. Ua kapaia no hoi ka inoa o keia hoku mamuli o kekahi alii o Hawaii nei, oia hoi o Poloahilani, a o kona ano o ka noho ana, he alii makapo, elua mea nona ia e alakai iwaho, a iloko; e paa ana kekahi ma ka lima akau, a pela no hoi ma lima hema. A no ka makapo o keia alii, ua lele kona hauli iluna o ka lani, a kau i kela mau hoku i kapaia i na inoa ekolu maluna ae. O ke kau ana o keia mau hoku, hookahi mawaena, oia ka hoku pohina, a o kekahi hoku ma kekahi aoao, a o kekahi no hoi ma kekahi aoao, e like me keia kii molale iho, a pela ko lakou ano ke nana aku i ka po.

O keia hoku ua pili ia Kuakini a me kana mau mamo.

Eia ke kolu o na inoa o keia lalani, oia hoi o Nanamua ma. Elua nae keia mau hoku, aole nae i ike ia ko laua mau moolelo.

Eia hoi ka ha o na hoku o keia lalani. O Nanaakeauhaku; elua no mau hoku laua, aole no hoi i ikeia ko laua moolelo.

Eia ka lima o na hoku o keia lalani, o Kupuku; ehiku mau hoku ko lakou nui, a ua kau paapu lakou ma kahi hookahi. A nolaila mai ke kumu o ko lakou inoa, o Kupuku, no ka paapu loa ma kahi hookahi.

Eia ke ono o na inoa o na hoku o keia lalani, o Haunakelekele; hookahi no hoku ia, aole no hoi he lehulehu ae, aole no hoi i ikeia kona moolelo. Ka hiku o na inoa o na hoku o keia lalani, oia hoi o Makaimoimo. 8. O Makaamoamo. 9. O Makaalohilohi. 10. O Makaholowaa. Aole nae i ike ia ko lakou mau moolelo.

11. O Kanukuokapuahi. Ua like kona ano me keia kii e kau nei ke nana'ku ka kakou i ka po.

A o ka hoku maluna loa, oia hoi ka mea i kapaia kona inoa o Kanukuokapuahi. [Aole nae i pau pono loa na hoku i ke kauia, aka, pela nae ke ano o ke kii i ka nana aku.]

Eia ka umi kumamalua o na inoa o na hoku o keia lalani, o Kapuahi. 13. O Paeloahiki. 14. O Anianikalani. 15. O Pulelehuauli. 16. O Pulelehuakea. 17. O Pulelehuakawaewae. 18. O Makahaiaku. 19. O Makahaiwaa. 20. Kahaikanai. O keia mau hoku, ua kau pakahi no lakou, aole nae hoi i ikeia ko lakou mau moolelo. Eia ka iwakalua kumamakahi; o Kupualaloakalani ma, aole no i ikeia ko lakou mau moolelo. 22. Ekolu o Humu ma, a o ko lakou nui iho la no ia. O ke kumu i kapaia'i o ka inoa o keia mau hoku, mamuli no ia o kekahi hookelewaa akamai o Hawaii nei ka wa kahiko. Penei e maopopo ai; i ka wa kahiko, kupu ae la ka manao o kekahi alii, e holo i Wailuanui i Kauai. Ia manawa, hoomakaukauia na waa, na kanaka, na kaukaualii, na'lii a me ka Moi. I ke ahiahi oia la, hoomaka na kanaka e holo mai Oahu aku, a o na keiki a Humu, o laua ke holo pu. Ua ao ia kekahi i ke kilo hoku, a ua akamai loa, oia hoi ka hiapo. I ka holo ana o na keiki elua a Humu me na kanaka ma ko lakou waa. I ka holo ana nae a waena o ka moana, nana ae la ua keiki mua nei, ua hala loa ka waa i ka lepo, pane ae la oia me ka olelo ae i ka mea nana e hookele ana ka waa, "Hoihoi ia ae ka waa iluna o Humu ma." Pane mai no hoi ka mea nana e hookele ana ka waa, "ua ike no olua." Me ke kuamuamu aku no hoi i na hua ino. A pela mau no ko laua pane ana, a hiki loa iwaena o ka moana, kua ukiuki loa iho la na kanaka maluna o ka waa, a kiolaia aku la laua iloko o ke kai. Ia laua e lana ana iluna o ka ilikai, pane aku la ke keiki muli i kona kaikuaana, "E make paha auanei kaua, no ka mea, ua pau loa aku nei na auwaa i ka hala mamua o kaua." Pane mai hoi ke kaikuaana, "Au ae paha kaua a kupono malalo o Humu (hoku) ma, a malaila kaua e lana ai." Ae a-e la no hoi kona pokii. Au aku la no hoi laua a kupono malalo o ua hoku nei, a lana iho la laua. O Humu oia no ka makuakane o ua mau keiki nei, he hookelewaa kaulana oia no ke akamai. Ua noho no oia a mahope mai ma ka waa o ke alii; oia hookahi no hoi ka waa i koe mahope mai, aole he waa e ae.

Mamua o ka holo ana mai o ua mau keiki nei, aole no i holo mai ko laua makuakane ma ka waa o ke alii. A hala aku la lakou, a liuliu, holo mai la ko laua makuakane me ke alii. I ka wa a ka makuakane e holo aku nei me ke alii, aia no kana mau keiki e lana ana i ka ilikai. Ia wa koke no ike mai la kana mau keiki i keia mea nui e holo mai ana, alaila, pane ae la ka hanau muli i kona kaikuaana, "E, he waa la, eia'e ke holo pololei mai nei la i kahi a kaua e lana nei." Pane aku la ka hanau mua, "o ko kaua papa (makuakane), ae keia me ke'lii." A hiki mai la ka waa i kahi a laua e lana ana, hookui ae la ka hanau mua i kona mau lima ma ka ihu o ka waa; a lohe ae la ke kanaka ma ka ihu o ua waa nei, pane ae la oia me ka leo nui, "E! He mau kakanaka, eia la ke hookui ae nei malalo o ka ihu o ka waa." A lohe o Humu no keia leo, puiwa koke ae la oia, a hookaa ae la i ka ihu o ka waa i ka makani, me ka manao no nae iloko ona, o kana mau keiki no. Ia manawa, hooiliia ae la hoi ua mau keiki nei iluna o ka waa, a ikeia iho la o na keiki no a Humu. Lele aku la nae o

Humu, a honi aku la i na ihu o kana mau kama aloha, a uwe iho la. A no ko lakou hauwalaau nui, puoho ae la ka hiamoe o ke'lii, a ninau ae la i ke kumu o ko lakou walaau ana. Pane ae la kana hookele oia hoi o Humu, "o kuu mau keiki hoi paha, ua kiolaia iloko o ke kai, a loaa mai la ia kakou." Ninau ae la ke alii ia Humu, "Pehea aku la ko lakou pono?" Pane aku o Humu, "aole lakou e pae i ka Aina, no ka mea, ua hala i ka lepo ko lakou holo ana." Ninau hoi o Humu i kana mau keiki, "Iluna owai ko olua kiolaia ana?" Iluna o Humu ma wahi a na keiki. Pane hou mai ke'lii ia Humu, "E pae pono ana anei lakou i ka Aina?" Aole e pae pono aku lakou, o i holo auanei lakou a launa lihi aku i ka Aina, a pa mai ka makani mai ka Aina mai, hala hou no i ka moana, a o ka make no ko lakou hope;" pela aku o Humu i ke'lii. Pane hou aku o Humu, "Ina no auanei kakou e holo aku a pae i ka Aina, a hele aku e imi ma kahakai, aole no e loaa aku kekahi auwaa, aole no hoi o kekahi kanaka hookahi." Ma ko lakou nei pae ana aku hoi i Wailua, a ninau aku hoi i kamaaina no na auwaa i holo mua aku ai, aole no he waa hookahi i pae aku, aole no hoi he kanaka hookahi a lakou i ike ai mai ka moana aku. Wahi a kamaaina.

Eia hoi ka iwakalukumamakolu o na hoku o keia lalani: Eha Keoe. O ka nui o keia mau hoku, eha no lakou, a o ke kau ana, ua like no ia me keia ano kii e kau nei. Ua kau no hoi kekahi mamua o ke kahi, me ke kowa loihi ma waena, a pela no hoi kekahi mau hoku, e kau ana kekahi ma kekahi aoao, a o kekahi ma kekahi aoao. Eia hoi ka iwakaluakumamaha, o Kaluaokaoka,
25. O Kawaomaka'lii.. 26. O Lehuakona. O ko lakou mau moolelo nae, aole no ia i ike ia.

O keia mau hoku nona na inoa i hoikeia ae nei maluna, he mau hoku no lakou e kokua ana i ka mea hookelewaa. Penei nae hoi e maopopo ai. Ina e manao ana kekahi e holo i Oahu mai Maui aku nei, a i ole, mai Hawaii mai paha, a pae aku i Kauai, alaila, e hoopololei ana no oia i ka ihu o kona waa i kahi a ka hoku e napoo ai, oia no hoi ka lalani hoku i hoikeia ko lakou mau moolelo maluna ae nei. Pela mau no e holo ai a hiki i ka wa e napoo ai kekahi hoku, alaila, e nana ae no i kona hope iho, a pela wale no e holo ai a hiki i kahi e makemake ai. A pela no hoi i ka wa e hoi mai ai, e hoopololei no i ka ihu o ka waa ma kahi e puka mai ai ka hoku, a o ka hope hoi o ka waa, ma kahi e napoo ai ka hoku. Pela mau iho la no hoi e holo ai a hiki wale i kahi e pae ai.

3. O kekahi poai hoku, a me kekahi hoku hele, o Holoholopinaau kona inoa.
Aia ma ia mau hoku kahi nana e hoike mai i ka pomaikai a me ka poino hoi o ke Aupuni. He umikumamalua ka nui o na hoku ma keia poai. O ko lakou kau ana, aia no ia ma ka lalani poepoe. Eia no hoi ka mea e ikeia ai ka pomaikai a me ka poino o ke Aupuni. Ina e kau ana o Holoholopinaau ma ka Hema, a o keia poai hoku hoi ma ka Akau, alaila, hookokoke mau ae kela i na po a pau, a aneane ae e hiki i kahi o keia poai hoku, alaila, hele hou no i kahi ana e makemake ai, i ka Hikina paha, a i ke Komohana paha, a i ka Hema paha, a ma na wahi e ae paha o ka lalani, aole e poino ke Aupuni. Penei no hoi e maopopo ai ka poino o ke Aupuni, e like no me ka mea i hoikeia ae nei maluna, e hele ae ana no oia mai ka Hema ae i na po a pau, a kokoke i kahi o keia mau hoku o kau ana, a komo ae oia mawaena o kekahi mau hoku, a hele iwaho, a komo hou mawaena aku o ka hoku elua, a me ka hoku ekolu a hemo hou iwaho mawaena o ke kolu a me ka ha; a pela mau aku no a pau na hoku he umikumamalua o keia poai. A ma keia hana ana, ua akaka lea i ka poe kilokilo hoku, he poino nui no ia no ke Aupuni holookoa mai o a o, aka hoi, ina e komo hapa ae o Holoholopinaau iloko o kela poai hoku, alaila, e poino hapa no ke Aupuni.

4. O ka Huhui a me na Kao, a me na hoku e ae a pau, ua oleloia, aia a pii mai na hoku a ike ia aku, alaila, pii pu mai me na kikiao makani. O ka nui o na hoku ma ka Huhui, eono lakou, a pela no hoi na Kao, eono no. Ua kau pupupu ka Huhui i kahi hookahi, a o na Kao no hoi, elua lalani e kau hio ana, ekolu ma kekahi lalani, a pela no hoi ma kekahi.

Kupahu.

Ancient Religion.
Part 33.

The names given by the people of old to Stars and about the observing of Stars.
It has been said by the Astronomers of Hawaii, from the beginning, that all of the people knew about the stars, from the people who lived in the presence of the chiefs, all the way to those who were called outcasts (*kauwa kuapaa*). There follows below here, names of some of the stars, their nature, and the things done by, or known about them.

1. Stars which assist the Navigators.
There in the north, is a star called by the foreigners, *Hokupaa Akau*, and known by three names by the Hawaiian Astronomers; they are *Kiapaakai, Noholoa*, and *Kumau*. It was given these names [illegible] because it does not move above [illegible], not from one place to [illegible], it remains in one place [illegible]. (Here, I will) explain how it helps the navigators. Say, if there is a man residing on Hawaii, and he wants to go to Maui, then his task is to make ready the things for the canoe, and when everything is ready, in the evening, he begins to sail from Hawaii, with the nose of the canoe aligned straight on the place where the star, with the three names given above, is situated. That is how he gets straight to the place he desires to sail to. Upon returning to Hawaii, the stern of the canoe is aligned straight where the same star is situated. There are, outside (beyond) this star, known by the three names, seven stars which encircle it, in the day and night, and so on. These stars arise in a crooked alignment. If the seven stars are seen rising above this star, it is at the time that the sun is setting (at its extremity). Such is the knowledge of the Hawaiian Astronomers. When these stars are seen as if encircling it, then the day light is close at hand.

2. Some things which help the Navigators.
There is a place, called by Hawaiian astronomers, *Kuamoo*, with many stars, but as they rise, they are in a circular alignments. There are many stars in one area, a few stars in another area, and one star in another place. All of the stars of this alignment are named, as we look below here. The total of their names is twenty-six. Here is the first: it is *Ikaika,* the name given by Hawaiian astronomers, and it is called Jupiter, by the scientists, also *Kaawela*. Here is its explanation: its name is given because of its bright nature, that is the name (*Ikaika*) made known above. This star is the one that foretold the taking of Kauai, without battle, by Kamehameha I. At the time that Kaumualii ruled as king of Kauai, Kamehameha I was in battle with the king of Maui, and Kamehameha was victorious, it was also the same for Oahu. Kamehameha then resided on Oahu, and there arose in his thoughts the idea of fighting against Kaumualii, the king of Kauai. But before Kamehameha traveled to Kauai, his astronomer sought to discern the signs of the heavens, through the arts of observing the stars. As he observed, he saw this star called *Ikaika*, and the star of Kaumualii, rising together. — At that time the astronomer-seer told Kamehameha, "You shall take Kauai, for it is shown that the land shall be yours; but the lands shall come to you without a war with the king of Kauai. Thus it shall be for you."

Kamehameha then ordered his war canoes to sail to Kauai for battle. When they arrived at Kauai, they made their preparations for battle, thinking that the battle would soon ensue. At the time they began the fight, Kaumualii said, " Return (to Oahu), until you see the black *kapa* cover (me), and the coral is placed in the mouth, then you may fetch your land." It was at that time, that Kamehameha understood the words spoken to him previously, by his astronomer-seer, prior to their sailing to Kauai. Thus fulfilled, were the words spoken to him by the astronomer-seer on Oahu. Here is the name of the second star in this alignment of stars. It is *Mulehu*, but, its not only that one that is named. There are many other names as well, such as *Poloahilani* and *Poloula*. The nature of this star is that it is a star of the blind, it appears to be gray when we look at it in the night. The name of this star

was given for one of the chiefs of Hawaii, that is *Poloahilani*, and his manner of living, for he was a blind chief, with two people who helped to guide him outside. One person grasped him by the right hand, and one also by the left hand. Because this chief was blind, his spirit ascended into the heavens, and rests at the place of the three stars named above. The position of these three stars is that one is between—that is the gray one—with one star on one side, and another star on the other side, like the adjoining image. That is how they look in the night.



This star is associated with Kuakini and his descendents.

Here is the name of the third star in this alignment. It is *Nanamua ma* (and companion). There are two stars, but their story is not known.

Here is fourth of the stars in this alignment, *Nanaakeauhaku*. There are also two stars, but their story is not known.

Here is the fifth set of stars in this alignment, *Kupuku*. There are seven stars altogether, and they are tightly clustered together in one place. Thus the reason for their name, *Kupuku* (standing together), because they close together in one place.

Here is the sixth star in this alignment, *Haunakelekele*. This is one star, there are no others, and its story is not known. The seventh name of the stars in this alignment is *Makaimoimo*. 8. Is *Makaamoamo*. 9. Is *Makaalohilohi*. 10. Is *Makaholowaa*. Their stories are not known. 11. Is *Kanukuokapuahi*. Its nature is like the drawing here, when we see them in the night.

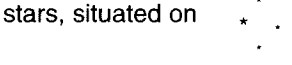


The star at the top, is known by the name, *Kanukuokapuahi*. [That is not all the stars that are set there, but it appears something like the picture when viewed.]

Here is the twelfth of the named set of stars in this alignment, *Kapuahi*. 13. Is *Paeloahiki*. 14. Is *Anianikalani*. 15. Is *Pulelehuauli*. 16. Is *Pulelehuakea*. 17. Is *Pulelehuakawaewae*. 18. Is *Makahaiakau*. 19. Is *Makahaiwaa*. 20. Is *Kahaikahai*. All of these stars are set together, and their stories are not known. Here is the twenty-first, *Kupualaloakalani ma* (and companions), and their story is not known. 22. Is *Humu ma* (and companions), there are three together. The reason that this name is given to them is because of one of the skilled navigators of ancient Hawaii. Here is what is known. In ancient times, the thought arose in the mind of a certain chief to sail to Wailua-nui, Kauai. So at that time, the canoes were made ready, along with the people, the lesser chiefs, the higher chiefs, and the King. On the evening of the appointed day, the people began to sail from Oahu, and the two children of *Humu* went along as well. One of them had been instructed in the skills of astronomy, and was very smart, this was the first-born. The two children of *Humu* went along with the people in their canoes. Having sailed into the mid-sea (between the islands), the elder youth observed that the canoe had traveled past the earth alignment. He then said to the one who was navigating the canoe, "Turn the canoe towards *Humu ma*." The navigator-steersman of the canoe replied "as if you two know." Disparaging words were exchanged between them, and when they reached the middle of the ocean, the men aboard the canoe were enraged, and they threw the two youth off, into the ocean. While the two were floating there on the ocean's surface, the younger brother said to his elder brother, " "Perhaps we two are going to die, for the canoe fleet has passed before us." The elder brother replied, "Let us two swim to a place below the star of *Humu ma*, and there, we two can float." The younger brother agreed. They swam to a point directly below that star, and there they floated. Now *Humu*, who was the father of these youth, was a famous canoe navigator. He had remained behind, in the canoe of the king; it was the only canoe that had remained behind, there were no others.

The youth had gone ahead, they did not sail with their father on the canoe of the king. They had passed by, and their father had sailed with the king. At the time that the father (*Humu*) sailed with the king on his canoe, his two children were already floating on the ocean's surface. A short time later, the two youth saw a great thing sailing towards them, and the youngest one said to his elder, "Say, there is a canoe, coming directly here, to the place where we are floating." The first-born said, "It is our father with the king." When the canoe arrived at the spot where they were floating, the first-born hooked his arm over the nose of the canoe; the men at the front of the canoe heard this and called out in loud voices, "Say, there are men who have latched onto the nose of the canoe." *Humu* heard the voices, and was exceedingly startled, and turned the nose of the canoe into the breeze, thinking that these must be his children. At that time, the two youth boarded the canoe, *Humu* saw them. *Humu* leapt forward and kissed his beloved children, crying. Their loud talking disturbed the sleep of the king, and he inquired why they were talking so. His navigator, *Humu* replied, "These are my two children who were thrown into the ocean, and they have been gotten by us." The king asked *Humu*, "Where are those they were with?" *Humu* relied, "They will not land on the shore, for they passed beyond the position in their sailing." *Humu* then asked his children, "Was it Iluna, who threw you overboard?" It was Iluna, said the youths. The king then asked *Humu*, "Will they land properly on the shore?" (*Humu* responded) "They will not arrive safely, for as they approach the side of the land, the wind will blow from the land and drive them again to the ocean, and thus your people will die." Thus *Humu* spoke to the king. *Humu* then told the king, "If we go and land on the shore, and go search on the beach, we shall not find one of the canoes of the fleet, nor even one of the men." When they landed at Wailua, they asked the natives there if they had seen the canoe fleet, that preceded them, and not one canoe, nor any people had landed. They had not even been seen on the ocean, so said the natives.

Here is the twenty-third set of stars in the alignment, the Four *Keoe*. There are a total of four stars, and they are situated as shown in this diagram. One is set before the other, with a long space between them; there are several stars, situated on one side, and then on the other side, and so on.



Here is the twenty-fourth of the stars in this alignment, *Kaluaokaoka*.
25. Is *Kawaokamaka'lii*. 26. Is *Lehuakona*. Their stories are not known.

All of the stars whose names are known above, are stars which help the navigators. That is how they are known. So if one has the idea of sailing to Oahu from Maui, or perhaps from Hawaii, to land on Kauai, then he shall set the nose of his canoe on the place where the stars set. That is of the alignment of stars, whose stories have been given above. That is how it was done, sail till the decline of certain star. Then you sight the next one in the alignment, and so forth, until you reach the place you desire. It is the same for your return. You set the nose of the canoe at the place where the stars appear, and the stern of the canoe, where the stars set. So it was the custom of traveling and reaching the selected place of landing.

3. Stars in a circle, and the traveling star, Holoholopinaau is its name.
There are among these stars, those by which you may know of blessings or ill-luck for the Kingdom. There are twelve stars in this circle. They rise in a circular alignment. Here is how one may know of the well-being, or the ill-luck of the Kingdom. If *Holoholopinaau* rises on the South, and the circle of stars is to the north, then it shall be drawing nearer to it on each night, and when it is almost to the place of this circle of stars, then you go to the place desired. Perhaps to the East, maybe the West, perhaps the South, or other places of the alignment, and the Kingdom will not have ill-luck upon it. Then, how one will know that ill-luck will come upon the Kingdom, is, as shown above, is if it travels from the South on all nights, and draws near to the place where these stars are situated, and it goes

between them, then goes out, and enters between the third and fourth ones; that is how it is for all of the twelve stars in this circle. Through this action, the astronomers and seers, understood that there would be great trouble befalling upon the entire Kingdom. But, if *Holoholopinaau* only partially entered the circle of stars, then there would be misfortune for only a part of the Kingdom.

4. About *Huhui, Na Kao*, and the other stars, it is said that when the stars ascend, and are seen, then the sudden, stormy winds will blow. There are six stars in the *Huhui*, and six also in *Na Kao*. The stars of *Huhui* are clustered together, and also, those of *Na Kao*. They are in two lines that lean to the side, three on one line, and so on the other side.

Kupahu. [Maly, translator]

"Oihana Kilo Kilo" (1920)

In 1920, W.D. Westervelt published a brief article in the Paradise of the Pacific magazine, describing the *'oihana kilokilo*, explaining why knowledge of the stars was important in Hawaiian navigation practices, and the larger beliefs and customs of the people. Westervelt (Paradise of the Pacific, December 1920:99-101), observed:

Oihana is a word applied to the regular ordinary customary duties of an individual. It belonged also to the family or nation as having their individual customs or duties.

Kilo-kilo is a doubling up of the word *kilo*, which in ancient times meant to "look deeply" or to "look far away." It was applied to the star students who knew the positions of various constellations and could pilot the large canoes for many days in one direction over the great ocean. They were the wonder-men, the sorcerers, the magicians of the past. They were "*Kilo-kilo*," or men who understood mysteries. They prepared a network of strings which outlined to them a kind of map. This they used by placing it in certain relations to the stars which they were sure they knew. Probably the strings were somewhat like the points of a compass, showing the direction the boat should take. Such a net was for a long time in the care of the Hawaiian Board, but when the present building was erected it was lost or broken and thrown away by someone who did not understand its value.

Oihana kilokilo represented the customs of the ancient Hawaiian astronomers and finally came to mean any mysterious or magical customs. The words were applied to the ordinary superstitions of the Hawaiians and meant any sorceries and enchantments practiced among the people or the priests... [page 99]

"Hawaiian Names of Stars and Planets" (1924)

Bishop Museum researcher, Kenneth Emory undertook a project to compile a list of names known to the Hawaiians, for stars and planets. In January, 1924, he completed his notes, observing that he had compiled the list—consisting of 142 names—from previously published sources, native informants, and a manuscript of the *Kumulipo* (from the papers of King Kalākaua and Queen Lili'uokalani), in the collection of the late, Prince Jonah Kūhiō Kalaniana'ole (and turned over to the Bishop Museum in 1922). Emory reported that his list was:

Largely from Thos. G. Thrum's MSS which material is largely from Dibble's History of Hawaii, 1843, and W.D. Alexander's translation of Kamakau's notes, which translation in the Hawaiian Annual for 1891, p. 142. The underscored names are one added from a MSS in Kuhio's collection, dated 1885, and titled "*Na Hoku a me na Lii nona na Hoku o ka Lewa*," (The stars and the chiefs having these stars as their own).

1. *A'a.* Sirius according to Kalokuokamaile of Napoopoo (1924).
2. *Au'a.* Betelgeux according to Kalokuokamaile of Napoopoo (1924).

3. *Anianekalani.*
4. *Aohuku.* Jupiter, see Parker's dictionary under *Kaawela.*
5. *Hakupokano.*
6. *Hanakalani.*
7. *Hanakalauai.*
8. *Haunakelekele.*
9. *Hikikaulia.*
10. *Hikikaulono.*
11. *Hikikaulonomeha.*
12. *Hiku (na).* The Great Dipper. *Hiku kahi, Hiku lua,* etc. 1st star in Hiku, etc.
13. Hinaiaeleele.
14. *Hinamalailena. Ko Hana Hoku* (Star of Hana); star of *alii* Kekaaniau.
15. *Hoku-ao.* The planet Venus when it is the morning star; also *Hokuloa* and *Manalo* (Venus).
16. *Hokulea.*
17. *Hoku Hookelewaa.* Canoe guiding star, often applied to Sirius.
18. *Hokuloa.* Morning star; Venus, when morning star.
19. *Hoku-paa.* North star.
20. *Hokuula.* Aldebaran, also Mars and Mercury?
21. *Holoholopinaau.* 12 stars. Mars according to Parker.
22. *Holu.*
23. *Hooleia.*
24. *Hoomanalonalo.* Star of Puna, Kauai; and Queen Emma. (See *Mananalo*) Jupiter?
25. *Hookelewaa.* See *Hoku hookelewaa.*
26. *Hua.*
27. *Huhui* or *Huihui.* The Pleiades. Full name: *Huihui a Makalii.*
28. *Humu.* Altair. *Humu-ma,* the constellation Aquilla.
29. *Iao.* Eastern Star. Jupiter when a morning star. In the story of Hawaii-loa, he is related as being out on one of his long voyages when Makalii, the principle navigator, said to him, Let us steer the vessel in the direction of *Iao,* the eastern star, the discoverer of land (*hoku hikina kiu o na aina*).
30. *Ihuku.*
31. *Ihumoa.*
32. *Ikaika.* Jupiter
33. *Ikawaolani.*
34. *Ikiiki.* Jupiter.
35. *Kaalolo.* Star of Niihau Island, and of Kalanianaole.
36. *Kaawela.* Mercury. (Jupiter, and Venus when evening stars) Star of the King. Jupiter according to Parker's Dictionary.
37. *Kaaona.* Name of one of the months in the Hawaiian calendar.

38. *Kaekae.*
39. *Kaelo.* Name of one of the months in the Hawaiian calendar.
40. *Kahaikahai.*
41. *Kahoea.* Star of Puna, also of Kawananakoa.
42. *Kahela* or *Kuaia.*
43. *Kekekapue.* Star of Kahoolawe Island, also of Lanihau.
44. *Kailiula.* Star of Kau District, also of Kaiulani.
45. *Kalalani.* Star of Lanai, also of Keaau.
46. *Kaluaokaohe.*
47. *Kamaile mua.* Star of Kona, Oahu, and of chief Auhea.
48. *Kamaile hope.* Star of Koolau, Oahu, and of Kamakahukilani.
49. *Kamaio.*
50. *Kanamee.* Star of Kauai, and of Keliiahonui.
51. *Kanihaalilo.*
52. *Kanoemakalii.*
53. *Kanukuokapuahi.*
54. *Kao.* Red Star (Aldebaran ?) 6 Stars. *Kao Maaiku*, Aldebaran in horns of bull. (*Na Kao* has been called Orion).
55. *Kaoea.* 4 stars. Hanalei, Kauai. Chief Kamauleule.
56. *Kapawa.* A period of time in the early morning.
57. *Kapea.* Cross stars. (Kalokuokamaile)
58. *Kapuahi.*
59. *Kau. Kau* = the Milky Way (also *Leleiona*). North Star which served the ancient Hawaiians as a guide in navigation. *Aia a puka o Kau holo kakou* (When *Kau* appears we sail). See *Hokukelewaa.* (Parker's Dictionary)
60. *Kauakapuu.* Star of Kohala, Hawaii; also for the chief (*kahooilina Moi*).
61. *Kaukamalama.*
62. *Kaulanaakalana.*
63. *Kaulu (Na Hui).*
64. *Kaulia.*
65. *Kaulua.*
66. *Kauluakaoko.*
67. *Kaululena.* Star of Kaupo, and of chief Owana.
68. *Kauopae.* Rigel, at whose appearance in the evening, the people went after the little red shrimp (*opae*) for *opelu* bait.
69. *Kawae.*
70. *Kawaomakalii.*
71. *Kawela.* (Mercury)
72. *Kaweo.*
73. *Kealakaa.*
74. *Keoe* or *Keowe.* (Vega ?)

75. *Kiapaakai.* North Star.
76. *Kokoiki.*
77. *Konamaukuku.*
78. *Kukui.*
79. *Kumu* or *Hokupaa.*
80. *Kumau.* North Star.
81. *Kumuko'a.*
82. *Kupualaloakalani.*
83. *Kupuku* (7 stars)
84. *Lanakamalama.*
85. *Lanikuhana.*
86. *Laelae.*
87. *Lehuakona.*
88. *Lewa.*
89. *Mahapili.* Star of Kekaha, and of the chief, Kekahuna.
90. *Makaalohilohi.* Kalokuokamaile says of this star *Hokualinolino.*
91. *Makahaiaku.* Says Kalokuokamaile, "*I ka wa puka aku keia hoku oia ka wa e holo ai e lawaia aku.*" (When this star comes out, then the *aku* fishermen go out.)
92. *Makaamoamo.* Twinkling eye.
93. *Makahaiwaa.*
94. *Makaholowaa.*
95. *Makaimoimo.*
96. *Makalii.* Pleiades, also applied to Aldebaran in horns of the bull, and the twins.
97. *Makaunulau.* Star of Molokai, and of chief, Koakanu.
98. *Makeaupea.*
99. *Makulu.* Saturn.
100. *Malana.*
101. *Maliu.*
102. *Manalo* or *Hoomanalonalo.* Jupiter. *Mananalo=Hokuloa* or Morning Star according to Parker's Dictionary.
103. *Melemele.*
104. *Mohai.*
105. *Mulehu.*
106. *Na Hiku.* Great Dipper.
107. *Nahuihui* or *Nahui.* Pleiades.
108. *Naholoholo.* Venus when evening star. (Saturn according to Parker)
109. *Na Kao.* Six stars.
110. *Na Lalani o Pililua.*
111. *Nanamua* me *Nanahope.* Castor and Pollux.
112. *Napeha.*

113. *Nauaakeahihaku.*
114. *Newa* [*Newe*]. A southern constellation, possibly the Southern Cross.
115. *Noholoa.* North star.
116. *Naholoholo.* Venus.
117. *Nuuanu.*
118. *Ololu (Omalo).*
119. *Paeloahiki.*
120. *Pauahi.*
121. *Pililua.*
122. *Pipa.*
123. *Polapola. Poloahilani* (same as Poloula).
124. *Poloula* or *Pohina.*
125. *Puanakau.* West Maui star, star of Chiefess Kekuiapoiwa.
126. *Puanene.* Hamakua, Hawaii star; star of Chiefess Likelike.
127. *Pukolua.*
128. *Pulelehuakaaweawea.*
129. *Pulelehuakea.*
130. *Pulelehuauli.*
131. *Puuwepa.*
132. *Ukali.* Mercury, from its following close after the sun.
133. *Ukalialii.*
134. *Uliuli.*
135. *Ulukoa.*
136. *Uu.*
137. *Waileia.* Star of Maui and of Chiefess, Kalola.
138. *Wainaku.* Star of Hilo, and Chiefess, Poomaikalani.
139. *Welo.*

Wehewehe or *Wewehe.* Kalokuokamaile says: "*O ka hoku ia i koe i ka wehewehe kai ao.*" (These are the stars left in the sky after the first light of dawn.)

Kane. "*He hoku maluna o ka mahina a malaila e ike ia ai o Kane ia po.*" (A star above the moon, by it is known the night of Kane.)

Lono. "*Hoku nui loa i ka wanaao. Keia hoku malalo o ka mahina, maopopo ka po ia o Lono.*" (A bright star in the morning. When this star is below the moon, then it is the night of Lono.)

Terms:
Hikialoalo = zenith.
Hoku aea, hoku hele, hoku o kaei = planets.
Hoku lele = comet or meteor; also, *hoku puhi baka* (tobacco smoking).
Hoku welowelo = a comet. [Compiled by K.P. Emory, January1924. BPBM – MS. SC Emory, Grp. 8 Box 4.7, pp. 1-6. Courtesy of B.P. Bishop Museum]

Hawaiians as Navigators and Seamen (1925)

In 1925, the journal of the Hawaiian Historical Society published an article by Samuel Wilder King, in which he discussed the knowledge and accomplishment of Hawaiian navigators and astronomers. King acknowledges the great skill of the ancient Hawaiian navigators, and included a description of their use of stars in their practices:

> I was reading recently an article that advanced the proposition that the man who first made use of a rude paddle to propel a crude raft was essentially a greater inventor than the many who later developed the rowing boat to its present mechanical excellence. So, in other fields the first germ of an idea was the most important, the big step forward, the later improvements following as a matter of course, inevitable as midday after morning. Our complicated modern civilization gives us immense knowledge, the use of all the stored experience of thousands of years of people of many races; but the big new ideas are still few and far between. It is doubtful if we excel our ancestors in intellect, however much we may be their superiors in knowledge.
>
> Judged on their grasp of the fundamentals, the ancient Hawaiians had a splendid foundation in seamanship and navigation. Remote and isolated as they were, and had been for years, what they knew was either part of the scanty heritage brought with them from their ancient home in the west and treasured through all the thousands of miles of eastward migrations, and generations of residence on the fair isles of Polynesia, or was of their own devising. Perhaps some unrecorded Galileo or Lord Kelvin added a mite or two to their original store of knowledge. At any rate we know that the Hawaiians could not benefit from the discoveries and improvements being made in the European world, that the narrow limitations of their islands confined their progress in countless ways, and that the lack of writing made it extremely difficult to standardize their knowledge and keep it clear of error.
>
> When the *Haole* first came to Hawaii it was a source of wonder to them how the Hawaiians got here. Further acquaintance with the meles of old voyages increased the wonder. Finally it was borne upon them that the Hawaiians, like their [page 11] kin throughout Polynesia, were great seamen, with a clear knowledge of the prevailing winds, the moods of the sea, and the signs and portents that foretold the weather. In their canoes, the greatest of which were frail craft compared with the vessels of Cook or Vancouver, they traveled the seas of Hawaii daringly, braving the currents and tempestuous waves of the island channels, and making far trips beyond the horizon. With mat sails and paddles they accomplished voyages upon which we moderns would hesitate to venture. With neither compass nor chart, sextant nor chronometer, but with mind filled with the ancient lore, handed down through the generations, the lore of wind and sea and sky, they set out, and counted not the mischance of failing to make a land-fall.
>
> A priestly astrologer, the *kilo hoku*, would give the more important of the prospective trips a good clearance, or hold the boat for a better day; and mixed with his rites there were always the realties of keen weather observing. Of course the pig must be baked, the *awa* chewed and mixed, the gods propitiated with offerings and prayers, and then the heavens and sea scanned for portents. If the rainbow stood arched in the wrong quarter, if the clouds were flying in scattered fragments, the wind and sea from the wrong direction, the sailing was delayed. But if the indications were fair the astrologer completed the prognosis with an inspired dream, and the voyage was well begun.
>
> The canoe captain, the *hookele*, then took command. He knew the different waves with their specific names, equivalent to our own cross sea, following sea, head sea, etc.; and the winds of many kinds, each with its name and peculiar characteristic; and he knew his boat, and how it should be handled under every condition, even to righting it if overturned.

To make the land-fall desired the *hookele* first located the North Star, in Hawaiian, *Hokupaa*, or fixed star, and kept it on the proper bearing; and then selected from the heavens the steering star, the star from among many that would carry him safely to his port. If the little star near *Na Hiku*, The Dipper, was seen to wink frequently, or if other signs were present, a storm was approaching, and he steered for a safe haven.

In this manner the Polynesians populated every habitable [page 12] rock and coral island in an area of ocean greater than a continent. There is no record of those who failed; but of those who achieved a new land-fall, and carried the news back to their kinfolk, we have some record, fragmentary it is true, because the Polynesians lacked the art of writing. From what we have we can piece together epic poems of great journeys, sagas of our Pacific Vikings less known perhaps than those of their Norsemen brothers of the sea, but of equal daring and romance, a tribute to the virility and courage of that ancient Polynesian race.

Our modern astrologer is the weather bureau, and our modern *hookele* has many aids in his struggle with the elements, but the principles of taking a vessel from port to port are much the same, based on good seamanship and navigation.

For the long trips, the great voyages to the far off islands of the South Pacific, the navigator knew his astronomy, *Ka oihana kilokilo*, and his geography, *kukulu o kahiki*, and became *he hookele-moana*, a deep water sailor. His chart might be the circular base of a gourd, lines burnt in to show the meridian of Hawaii, and the tropics. From *Hokupaa*, the North Star, to *Newe*, the Southern Cross, was the Hawaiian Greenwich; the northern tropic was *Kealanui Polohiwa a Kane*, the black shining highway of the sun; the southern tropic was *Kealanui i ka piko o Wakea*, the highway to the middle of the earth. The east was *Keala ula a Kane*, the red way of the sun; and the west was *Kealanui maaweula a Kanaloa*, the much traveled highway of the Fallen One. In the celestial sphere so bounded moved the stars, *na hoku paa o ka aina*, among them the navigational stars, *na hoku hookele*; and the planets, *na hoku hele*, moving stars. Beyond were strange stars, *na hoku o ka lewa*. Of the planets the Hawaiians knew five; Mars as *Hoku ula*, the Red Star; Venus as *Hoku loa*, the Great Star; Jupiter as *Kaawela*, the Brilliant One; Mercury as *Ukali*, the Sun Follower; and Saturn as *Makulu*.

Of the stars a great many were listed in the old instructions and meles, many not identified today. Besides the North Star and the Southern Cross, Altair, Vega, Sirius, Orion, the Pleiades, the Dipper, Castor and Pollux, and others were known and studied. [page 13]

With this stock of knowledge, the Hawaiians used a calendar based on the moon, knew and corrected its error by reference to the stars, named each month, each night of the month by the characteristics of the moon, and judged the hour closely by the stars at night, or the sun by day.

Thus equipped many brave chieftains of the olden times made the great voyage to Tahiti and back. How they provided sufficient food and water, how they survived storms and calms and submerged reefs and lee shores, is but briefly known from the chants that have come down to us. What captains failed and died unsung will never be known. But we do know of many who succeeded, and brought back new chiefs and priests to Hawaii, new customs and ideas, dances and drums, plants and dresses, and started ferment in Hawaii nei that did not end until Kamehameha the Great ruled supreme over the eight islands.

Of Hawaii specifically, such names as Paao, Kaulu a-Kalana, Paumakua, and the famous old sea-going family headed by Moikeha and including his foster son Laa, named Laa-mai-kahiki, the son Kila, and the grandson Kahai, have come down to us as great

voyageurs of a later period, when Hawaii and the southerly islands revived the old bond, and exchanged ideas and peoples, after several centuries had been allowed to elapse since the original settlers had come north to "Green-backed Hawaii" as they called it.

The exploits of these Hawaiian Vikings surpass in daring and danger that of the Norsemen. Among those who go down to the sea in ships the ancient Hawaiians hold a high and honorable place; and the seamen's bent and flavor holds with their children today. [Journal of the Hawaiian Historical Society, 1925:14]

"The Morning Star Rises"

In 1935, Maud Makemson, PhD., at Vassar College, conducted first-hand research and interviews with elder *kama'āina*, in Hawai'i. The purpose of her work, being to collect Hawaiian lore pertaining to stars, and native practices associated with them as manifested in the life of the people. The research was conducted as a part of a larger program of documenting the scope of Polynesian knowledge of the heavens, demonstrating the continuity of such knowledge across Polynesia, and how localized knowledge diverged from that of the larger social group. In her work, Makemson, had access to several elder native Hawaiians—among whom were George Kalama of Moloka'i, David Malo Kupihea ("Kupehea") of Honolulu, and M.K. Pukui, at Bishop Museum—who still possessed knowledge of Hawaiian skies. She also accessed a wide collection of archival sources—many translated by Mary Kawena Pukui. She cites accounts as those given earlier in this section of the study, and through her combined research, lists the names and character of at least 208 stars and constellations—often giving translations of the Hawaiian names[15], and their corresponding western names—known to the Hawaiian people.

Makemson's research was published under the title "*The Morning Star Rises*" in 1941, and is a significant work in this field. Selected excerpts follow below, focusing on material not previously cited, or expanding upon such information. Makemson reported that:

Among the Hawaiian stars listed by Kamohoula, Auhaele and Paikauhale were said to patronize beggars, vagabonds, and thieves. Two other stars, *Makaha* and *Makohilani*, situated near the Pleiades, were benevolent toward thieves and murderers. The star *Makahai-aku* informed fishermen of the proper time to go out shark *(aku)* fishing.

Kaukamalama, a so-called "royal star" of Hawaiian astrologers, is said to have shone all night during the month *Ikuwa*, October, and to have disappeared on the first night of the following month. *Kaukamalama* may have been situated so far south in the Hawaiian sky that it enjoyed only a short diurnal path and was visible only for a month, but in that case it could not have shone all night long. At any rate, its appearance was the omen of rain, lightning, thunder, earthquake, wind, high surf, and storm. As a Hawaiian sage explained, "the ancient people said that *Ikuwa* was the husband of *Puaikaiaualewa*, who gave birth to men of loud voice, and contentious."

Kamalama, the other "royal star" of Hawaiian astrologers, shone nightly during *Hilinehu*, which was a rainy, windy month but not as violent as the previous one, *Ikuwa*, and was [page 139] the sign of abundant fish *(nehu)* which could be caught with the net during the rule of *Kamalama*.

Kane was a star which appeared above the Moon and was listed by Kamohoula as a "star of the third class." Whether the classification referred to its brightness or its position in the sky was not defined. The interesting fact about *Kane* was that it was visible only at certain times and then only to priests and astrologers. When it was seen, it foreboded the death

[15] We note that readers of Hawaiian will find that some of the translated Hawaiian names may have more appropriate translations. We leave those translations to the readers.

of the king or a high chieftain. The description suggests a variable star such as Mira. [page 140]

Planets or wandering stars were of interest mainly for astrological purposes or as weather indicators, as in the case of Saturn or Jupiter whose misty aspect forewarned of storms. In modern times much confusion prevails regarding the identification of the ancient names with individual planets. *Naholoholo*, for example, was applied to both Venus and Saturn by various Hawaiian authorities, although their natures are quite distinctive. Since the name signifies swift-moving, the identity with Venus is the more logical as Saturn is the slowest of the planets. *Holoholopinaau* was said to be Saturn by one, Mars by another; the name which means "weaving to and fro" is most appropriate to Mars. It is possible, however, that the same name was applied to different planets in the various islands of the same archipelago. [page 192]

Known Hawaiian Names of Planets:

Mercury
Ukali or *Ukali-alii*, Following-the-chief (i.e., the Sun).
Kawela, Radiant.

Venus
Hoku-loa, Great Star.
Hoku-alii, Chiefess-star.
Naholoholo, the Swift-running-one. [page 193]

Mars
Hoku-ula, Red-star; also a name for Alderbaran and other conspicuous red stars.
Holoholo-pinaau, Weaving-to-and-fro.

Jupiter
Ikaika, Brilliant.
Ikiiki, a goddess; a Hawaiian month name and therefore probably a fixed star rather than a planet. [page 194]
Kaawela or *Kawela*, Burning.
Hoomanalonalo.
Iao, Of-the-dawn; Jupiter as morning star.

Saturn
Naholoholo, Swift-running; not applicable to Saturn.
Makulu, Dripping-water; referring to the planet as a weather indictor. [page 195]

Identifying the sources of her Hawaiian information on stars and lore, Makemson, wrote:

In the following pages are to be found names of most of the Polynesian stars which have been remembered until recent years. The Hawaiian list was compiled from native writings of Kamakau, Kepelino, Malo, Kupahu, and the Kumulipo as translated by Liliuokalani and such foreign authorities as Fornander, Dibble, Emerson, and Thrum, from a star list collected by Mary Pukui and E. H. Bryan, Jr., of the Bishop Museum from Hawaiian newspaper articles and other sources, and from another compilation by Professor Donaghho of the University of Hawaii. [page 197]

Aa, Glowing; a Hawaiian star identified as Sirius by Emory.

Aikanaka, Man-eater; a Hawaiian star of the southern sky named for a legendary figure...

Ke Alii-o-kona-i-ka-lewa, the Chief-of-the-southern-expanse; a very bright star which, with the Southern Cross, acted as a guide to Hawaii-loa and his brother on their voyage of exploration to the far southern ocean where they were turned back by ice barriers. It is probably Canopus or Argo... [page 198]

Anianekalani, a Hawaiian star said to be in the Milky Way, named for the father of Hawaii-loa and Ki [Ki'i]. Both Hawaiians and Tahitians call *Anianekalani* the progenitor of their nations, saying, "In his time, the race had come far from its original homeland."

Ao-hoku, Au-huku, and *Au-haku* appear to be variants of a Hawaiian name possibly for Jupiter. [page 200]

Aua is a Hawaiian named for Betelgeuse, according to Emory...

Auhaele is a Hawaiian star, the patron of vagabonds and beggars and associated with *Paikauhale* in the couplet:

> There are the eyes of *Hoku-ula* (red Star)
> *Auhaele* and *Paikauhale*.

Hoku-ula was described as a large, bright, beautiful red star visible in the month of *Welehu* and the three were thought by some to be Altair and its two companion stars in Aquila. The identification is incorrect, since Altair is a white star. *Hoku-ula* is probably Antares in this connection and *Auhaele* and *Paikauhale* are its companions, Sigma and Tau Scorpii. [page 202]

Hakalauai, a Hawaiian star associated with *Hanakauluna* in the southern sky. When these stars rose it was an omen of pestilence and other calamities according to Kamohoula.

Haka-moa, Chicken-roost; A Hawaiian constellation important to the astrologers.

Hakupokano, a Hawaiian star, is an example of stars named for islands to which they had served as guides to the mariner, in the past history of the Polynesians.

Haloa, a Hawaiian star probably in the southern sky. Kamohoula said of it: This is a large star between *Kane* and *Iwikauhikaua*, with which it forms one row. *Haloa*, which means "long taro stalk," was the son of Wakea (Atea, Vatea) and Hoohokukalani... The star was thus named because it was one of the stars known to the people who lived about the time of Wakea and Papa." [page 205]

Hanaia-kamalama, Light of the Heavens; a Hawaiian name for the Southern Cross. According to an old story Hina-hanaia-kamalama was the wife of Aikanaka and fell in love with the moon. As she was about to ascend the Moon, Aikanaka pulled off one of her legs...

Hana-kalanai or *Hana-kalani*, a Hawaiian star...

Hana-kalauai may be a variant of *Haka-kalauai*. It is a geographical name which has come to be applied to a navigation star.

Hana-kauluna, a Hawaiian star. See *Hakalauai*.

Hao, a Hawaiian star and also a place name.

Hauna-kelekele; a single star in the Milky Way found in Kupahu's list of Hawaiian stars. [page 206]

Hiki-analia, a Hawaiian star found in several lists. Ninety-one year old George Kalama of Molokai described it to Kelsey as a medium bright star near the equator, visible from April to September. He said that the first evening rising is accompanied by strong winds; but as it rises higher after sunset the winds become favorable for sailing and the star acts as a guide to the mariner and fisherman.

Hiki-au-moana, Swim-the-ocean, enables the shipwrecked sailor to swim home and is said to be the equivalent in Kauai of *Hiki-analia* in Molokai.

Hiki-kauelia (Liliuokalani) and *Hiki Kauilia* (Kamohoula) are variants of a Hawaiian star name which the latter authority gives as one of the numerous names for Sirius, when used as a guide in navigation.

Hiki-kau-lono-meha, Star-of-solitary-Lono; the Hawaiian name for Sirius when observed for astrological purposes according to Kamohoula. [page 207]

Na Hiku, the Seven; Hawaiian name for the Big Dipper. Donaghho gives the full title as *Na Hiki-ka-huihui-a-Makalii*, the Cluster-of-the-seven-of-*Makalii*. The stars of the Seven are individually designated by numbers: *Kahi, Alua, Kolu, Hana, Lima, Ono,* and *Pau*, "finished," according to Liliuokalani.

Hilinama is a Hawaiian star and month name...

Hilinehu, contracted from *Hilina-ehu*, is the Hawaiian star and month name which is paired with *Hilinama.*

Hinaia-eleele, is a Hawaiian star and month name...Liliuokalani translated it as "Black Hina..."

Hina-lani, Hina-of-the-sky; a Hawaiian star. [page 208]

Hoeu, Stir-up, is a Hawaiian star. Hoeu was a chief of Kula, Maui, who deserted his wife *Kawaunuiola* for another woman. Thereupon his wife placed a strict *tapu* about her house which prevented interruption of her complete seclusion. At mealtimes, she petitioned her absent husband as a god and asked and answered questions until passing neighbors carried news to *Hoeu* that his abandoned wife had secured a new husband. Whereupon *Hoeu* hastened home and a reconciliation was effected.

Hoku-alii, Chiefess Star; a Hawaiian named for Venus.

Hoku-hookelewaa, Star-which-causes-the canoe-to-sail; a Hawaiian named for Sirius, as star of the mariner.

Hoku-iwa, Stars-of the-frigate-bird, is a Hawaiian constellation which guided Hawaii-loa back to Hawaii after a voyage to the south Pacific and must therefore be situated in the northern sky... *Hoku-iwa* is probably the constellation Bootes which passes overhead in the latitude of Hawaii.

Hoku-kea, Stars-of-the-cross; a Hawaiian name for the Southern Cross. In the legend of Hawaii-loa it was by these stars, *Hoku-kea-o-ka-mole-honua*, Star-cross-of-the-barren-land, and by *Ke Alii-kona-i-ka-lewa*, that the course was shaped for the southern ocean.

Hoku-komohana, Star-of-the-setting-Sun; a Hawaiian name for Venus as evening star. [page 209]

Hoku-lea, Star-of-gladness; a Hawaiian star, possibly Arcturus.

Hoku-lei, Star-wreath; a Hawaiian name for Capella or the whole constellation of Auriga. We are told that Hoku-lei was chosen by Pualoa, the "people promoter," and Kawelolani the astrologer from the stars remaining after the people's stars and those of the steersmen had all been enumerated. *Hoku-lei* was one of the wives of *Makalii* (Pleiades), the other being *Hoku-ula*, Alderaban.

Hoku-loa, Great Star; a Hawaiian name for Venus.

Na Hoku pa, Stars-of-the-palisade; a Hawaiian constellation which Kamohoula's translators interpreted as Leo. From the statement that the *Pa* stars were sometimes "paralleled" (i.e., lay on the same diurnal path) with Humu, Altair, 8º north of the equator, it is more likely that they form the head of Cetus.

Hoku-paa, Immovable Star; one of several Hawaiian names for the North Star.

Hoku-poho-ka-Aina, is probably a general Hawaiian term for the star seen over the stern of the canoe when land disappears.

Hoku-ula, Red Star, was applied by the Hawaiians to Aldebaran, Mars, Antares, and possibly Betelgeuse. Kamohoula describes *Hoku-ula* as a very bright star of the month *Welehu*. Since the order of the month names varied considerably in different islands and since the time of night is not specified, the statement is of no value in identifying the star. He also says that *Na Kao-Makalii*, the Darts of *Makalii*, are on the same plane as *Hoku-ula*. *Na Kao* is generally accepted as Orion's Belt which is situated in the same declination as Betelgeuse, a conspicuous red star in Orion.

Hoku-ula is mentioned in the following couplet:

> In the month of *Welehu* my child was born;
> Born was a star, *Hoku-ula* by name.

In another statement that the stars *Auhaele* and *Paikauhale* [page 210] are called the right and left eyes of *Hoku-ula*, reference is undoubtedly made to Antares and its two companions.

Na Holoholo, Run-to-and-fro; a Hawaiian planet, probably Venus.

Holoholopinaau, a Hawaiian name for Mars. The name may also have been applied to a fixed star since Kaleikupua described it as "a land star, a people's star, which travels a regular course during the month *Ikuwa* with its leader *Omao*, which the astrologers observe as they proudly enter the winter season."

Holu, Deep-ocean; a Hawaiian fish god and star of fishermen.

Hoo-kele-ale, Sailing-master; a Hawaiian navigation star.

Hooleia, a Hawaiian star; apparently named for the mother of the famous legendary beauty, Luukia...

Hoo-manalonalo or *Homanalonalo*; a name for Jupiter in Hawaii.

Hua, Fruit or Egg; the Marquesan name for Jupiter as well as a Hawaiian star. It is also the name for the day of the full Moon and a personal and geographical name.

Na Huihui, the Cluster, usually stands for the Pleiades [page 211] in the Hawaiian, the full name being *Na Huihui-a-Makalii*. Kalama and Kamohoula also give *Ka Huihui-pa-ipu-a-Makalii* as a variant, referring to the calabash *ipu* in which Makalii stored the food supply, according to one story.

Humu, a kind of fish, is the Hawaiian name for Altair, in Aquila, while *Humu-ma*, the Humu-cluster, probably includes neighboring stars. The astrologers were said to be "under the influence of *Na hoku a Humu-ma*."

Humu was the name of a Hawaiian navigator known far and wide for his great skill. [page 212]

Ia, Fish; a Hawaiian term for the Milky Way. The phrase *ua huli ka ia,* "the fish has turned," denoted that the hour of midnight had passed.

Iao, Of-the-dawn; a Hawaiian term for Jupiter as morning star.

Ihuku, Peaked-nose (Liliuokalani); a Hawaiian star which Emory suggests may be the same as *Aohuku*, a planet name. Since, however, *ihu* may mean the "bow of the canoe" as well as a "nose," and *ku* is to "stand erect," it is probable that *ihuku* is a general term applied to any guiding star which the steersman in the stern sees standing above the bow.

Ihu-moa, Chicken-nose (Liliuokalani); a Hawaiian star. *Moa* signifies the "stern of a canoe" as well as the domestic fowl.

Ikaika, Brilliant; a Hawaiian name for Jupiter.

Ikiiki, Pinched (for lack of food), is a Hawaiian star and month name...

Iwikauikaua is a Hawaiian star, probably named for the [page 213] son of Makakaualii, although Kamohoula remarked concerning it: "It is not known when this star was first seen and recognized by Hawaiian astrologers, but no doubt it was seen 17 generations ago."

Kaakaa, Radiant, is a Hawaiian star name... said to be a constellation on the border of the Milky Way.

Kaalolo was the tutelary star of Niihau in Hawaii. Donaghho interprets it as any morning star.

Kaaona, a Hawaiian star and month name, said to be called after a brother of Hawaii-loa.

Kaawela or *Kawela*, Radiant; a Hawaiian name for Venus or Jupiter and possibly also for a fixed star.

Kaekae, Smooth and Plump; a Hawaiian star named for one of the men brought by Paumakua from a distant foreign land. In a legend related by Fornander they are described as "white men and sorcerers." The time was about A.D. 1100.

Kaelo, a Hawaiian star and month name... The Hawaiian *Kaelo* may stand for Betelgeuse, a brilliant red star, since it "blazes in the *Makalii* or winter season."

Kahaikahai is the twentieth star in the *Kuamoo* or Milky Way listed by Kupahu and may have been named for the legendary character Kahai...

Kahai-lono is classified by Liliuokalani as one of the Hawaiian "stars of fighting omen." [page 214]

Kahela; a Hawaiian "people's star," presiding over the month *Ikuwa*.

Kahiki-nui, a Hawaiian navigation star said to be named for one of the eight steersmen of Hawaii-loa. It was also an ancient geographical name.

Kahoea; tutelary star of Puna, Kauai.

Kaholo, the Coconut-fiber-lashing-of-the-royal-canoe, is a star of Puna.

Kailiula, Red Skin (Liliuokalani); a tutelary star of Kau, Hawaii.

Kakae, a Hawaiian star; possibly a variant of Kaekae.

Kalaniopuu is said to be an alternative name for Kawela. [page 215]

Kalua-okaoko is a star in the Milky Way known to the Hawaiians of old.

Kamahana, a Hawaiian star; probably a variant of *Mahana*, Gemini.

Ka Maile-mua, the First Wreath; a Hawaiian star name.

Ka *Maile-hope*, Last Wreath. Taken with the preceding name this suggests a pair of bright stars such as Castor and Pollux or Alpha and Beta Centauri. They were patron stars of Oahu.

Kamaio, a Hawaiian star.

Ka Maka-ululau, the Star-of-innumerable-breadfruit...

Ka Malama, the Light; a "royal" star of Hawaii.

Ka Malie, Calmness, or *Ka-malie-mua*, First Calm, is a Hawaiian star, evidently the token of quiet seas...

Kanamee was the tutelary star of King Kaumualii of Kauai. A conjunction between Jupiter and *Kanamee* foretold the fall of Kauai to King Kamehameha. *Kanamee* must thus be a star close to the ecliptic.

Kane is a sacred Hawaiian star name for the great Polynesian deity. It could only be seen by priests and astrologers and then only rarely and its appearance was the portent of great misfortune. The description suggests a variable such as Mira or Algol, or even a nova.

Kanihaalilo, a Hawaiian star.

Kanikaniaula is a Hawaiian star, named for the woman who is credited with introducing the first feather cape from [page 216] Hawaii to Maui. Although descended from a line of chiefs, she concealed her high rank when she settled in Maui and married a lowly man

from the back country who was unaware of her lofty station. Legend also attributes to her, the erection of a unique pyramidal tomb built of poles.

Ka-noe-Makalii, the Eyes of *Makalii*, is a Hawaiian star whose parents were *Hoku-ula*, Aldebaran, and *Makalii*, Pleiades.

Ka-nuku-o-kapuahi, the Land-of-sacred-fire, is the Hawaiian term for the Hyades. Mr. Kupehea of Honolulu believes the name to be modern.

Na Kao, the Darts; the Hawaiian name for the Belt and Sword of Orion, stars much used in inter-island navigation... Liliuokalani translated *Na Kao*, the Goat, an obvious anachronism.

Kaoea, Darts-thrown-upward; a Hawaiian constellation presiding over the destiny of Hanalei, Kauai.

Kaopua, listed by Donaghho as a Hawaiian star, may be a variant of *Kauopua*.

Kapawa or *Kapawe* is found in more than one Hawaiian star list, but is also a term for a period of the night.

Ka-pea, the Cross; a Hawaiian name for Crux... [page 217]

Kapuahi, Sacred Fire; a Hawaiian star possibly Aldebaran in the constellation *Ka Nuku-a:-kapu-ahi*, the Hyades.

Kupua-lalo-a-kalani, Wizard-in-the-lower-heavens; a Hawaiian star name...

Kau, Summer or Dry Season; a Hawaiian star of the northern sky, which served as guide to mariners. "When *Kau* appears we sail." *Kau* was also a name for the Milky Way.

Kau-aka-puu, Dawn-suspended-destiny; a Hawaiian star which presided over the fortunes of Kohala.

Kaua-mea, Sacred Circlet; a Hawaiian constellation, possibly Corona Borealis...

Kau-ano-meha, Standing-alone-and-sacred; one of the many Hawaiian names for Sirius.

Kau-kalia, Sojourning; a Hawaiian star which was the patron of foreigners.

Kau-ka-malama, Suspended Light; a Hawaiian "royal" [page 218] star paired with *Kamalama*. As a month-ruling star it was said to be the cause of *Ikuwa*, being such a "bursting, contentious month."

Kaulana-o-ka-la, Resting-place-of-the-Sun, does not sound like a star name but is found in Hawaiian lists.

Kaulia; a Hawaiian "people's star," serving as ruler of the month *Ikiiki*.

Kaulua; one of the many Hawaiian names for Sirius... It is also a Hawaiian month name.

Kaulua-ihai-mohai, Flower-of-the-heavens (Liliuokalani); a Hawaiian star listed in the Creation Chant; possibly the full name for Sirius.

Kaulua-koko, Brilliant-red-star, is in the same zone of the Hawaiian sky as *Humu*, Altair, and is probably Betelgeuse.

Kaulua-okaoka, Star-dust; a Hawaiian star or perhaps a star cloud.

Kaulua-lena, Yellow Star; a Hawaiian astrological name for Sirius, and also the name of a wind.

Kaulua-mohai; a Hawaiian star, possibly the same as *Kaulua-ihai-mohai*.

Kauopae, Shrimp Star; a Hawaiian name for Sirius as patron of shrimp fishing.

Kauopua; a Hawaiian navigation star.

Kawai, the Sea; a Hawaiian navigation star. [page 219]

Kawa-o-Makalii; Precipice of *Makalii*; a Hawaiian constellation in the Milky Way.

Kawau; a Hawaiian star.

Kawaunuiaola, a Hawaiian star shining in the month Hilinama, named for the wife of Hoeu in the legend previously cited. "At the end of its course in benefiting the people, *Kawaunuiaola* disappears and *Hookelewaa* (Sirius) then appears."

Kawela, a name for Jupiter in the Hawaiian Islands. See *Kaawela*.

Kaweo, an unknown Hawaiian star.

Ke Ala-kea, the Shining Road; a Hawaiian star probably used in navigation.

Keawe; a star in the southern Hawaiian sky named for an ancient king.

Kehepue; a Hawaiian star name, possibly a variant of Kekekapue.

Kehooea; a Hawaiian star.

Kekai-hili; a star of the southern sky of Hawaii.

Keke-kapue, a Hawaiian astrological star.

Ke-lala-kea; a Hawaiian star; possibly misspelled for Ke-ala-kea.

Keoe or *Keoea*; a Hawaiian name which Alexander believes was applied to Vega; but Kupahu describes it as a group of four stars forming a diamond. Hence it probably stood for the entire constellation of Lyra, in which Vega is situated. *Kehooea* may be a variant of *Keoea*.

Keola; patron star of Lanai in the Hawaiian group.

Kiki-ula, Red Skin; a Hawaiian star.

Kiaha, Radiant; a Hawaiian name for the Big Dipper (Donaghho). [page 220]

Kiopaa, "eternally fixed in the heavens to guide the sea man" (Kepelino); one of the Hawaiian names for the North Star.

Koko-iti, Little Blood (Liliuokalani); the bright star or comet which heralded the birth of Kamehameha I of Hawaii. It was named for a district in the northern part of the Island.

Kona-maukuku, Their Spikes (Liliuokalani); a well known Hawaiian star. See *Kukui-a-kona-maukuku*. [page 221]

Kukui, Torch; a Hawaiian star... *Kukui* may be an abbreviated form of *Kukui-a-kona-maukuku*.

Kukui-a-kona-maukuku; a Hawaiian star or constellation name.

Kumau, Standing-perpetually; a Hawaiian name for the North Star.

Kuaie, a month-ruling Hawaiian star also called *Kahela*.

Kumukoa; a Hawaiian star of the astrologers observed in the morning sky during the month *Hilinehu*.

Kupua-lalo-a-kalani is evidently the same as *Kupua-* [page 222] *lalo-a-kalani*...

Kupuku, Cluster; described by the Hawaiian sage Kupahu as "seven stars placed in a cluster together in one place."

Laelae, Brightness; a Hawaiian star.

Lalani, the Heavens; a Hawaiian expression for the Milky Way, and also said to be the name of a single star, the patron of Lanai.

Na Lalani-a-Pililua; a Hawaiian double star. Mr. Kupehea interprets *pililua* as "two close friends."

Lani-kuhana, Sky-standing-erect; a Hawaiian star name.

Lana-kamalama, Floating Light; a Hawaiian star perhaps associated with *Kamalama* and *Kau-kamalama*.

Lealea; a Hawaiian star, named for Lea the goddess of shipbuilders.

Lehua-kona, *Lehua*-of-the-south; a Hawaiian star in the Milky Way. It may stand for Antares...

Lena, Glowing; a Hawaiian star... It is also found in the compound name *Kaululena*.

Lono; a bright star named for the Hawaiian god *Lono* (Maori Rongo). The statement, "When this star is below the Moon it is the night of *Lono*," indicates that *Lono* may be the name of any bright star below the Moon on the night of *Lono*, when the Moon is in the waning crescent phase, since no single star could regularly enjoy that distinction. [page 223]

Mahana or *Na Hoku-mahana*, Summer or Stars of Summer; a Hawaiian name for Castor and Pollux which are also known as *Nana-mua* and *Nana-hope*.

Maha-pili, Twins; a double star said to have been observed by Hawaiian astrologers...

Mahau, Twins; a Hawaiian name for Gemini.

Na Ma-hoe, the Canoe-paddle-cluster; said to be another name for Castor and Pollux in the Hawaiian Islands. George Kalama declared that when these stars rise in the east a few hours after sundown, the wind is favorable for inter-island voyages. On the course from Kauai to Hawaii, he said, the bow of the canoe was pointed directly between these stars. Since such a course must lie almost due southeast, the bow-guiding stars [page 225] must have been situated far south of the celestial equator and could not possibly have been Castor and Pollux; but these could have served as guide stars over the stern of the canoe, when near the western horizon.

Maiao, Toward-the-dawn; a Hawaiian navigation star said to be named for one of Hawaii-loa's eight steersmen.

Maia-ku, Stand-bravely; Hawaiian name for the Belt of Orion, also called the Darts.

Maka-alohilohi, Sparkling-eyes; a Hawaiian star. Maka found in many compound names as a synonym for *hoku,* "star," had the original meaning of "point," "eye."

Maka-amoamo, Twinkling-eyes; a Hawaiian star or constellation in the Milky Way... [page 226]

Makaha; a Hawaiian star which Kamohoula paired with *Makohilani* as the patrons of thieves and murderers. They are situated near the Pleiades.

Maka-hai-aku was the sign to Hawaiian fishermen that it was the season for shark, *aku,* fishing.

Maka-hai-a-waa; a Hawaiian star of the *waa,* "canoe."

Maka-holo-waa, Star-of-the-sailing-canoe; a Hawaiian star in the Milky Way, according to Kupahu. Kalama declared that it was visible after sunset the year round, indicating a position within 20º of the north pole. It is probably another name for the North Star.

Maka-ihu-waa, Star-of-the-bow-of-the-canoe; a Hawaiian navigation star said to appear only at times, and to be accompanied invariably by a long, sharp-pointed cloud. The name suggests the star Ihu-ku. Kalama declared that if the star were above the horizon in the evening or morning sky, its position was an indication of weather conditions. If cloud and star were in the south and west it was a sign of calm weather; if in the east or north, a storm was brewing and the canoe remained on shore. This statement is unintelligible except on the suppositions that *Maka-ihu-waa* could be any bright star accompanied by a long sharp cloud, situated in the direction toward which the canoe-men wished to sail.

Maka-imoimo, Twinkling-eyes; a Hawaiian constellation in the Milky Way.

Makaio-lani, Sacred-star-of-heaven...

Makalii, High-born stars; the Hawaiian form of the common Polynesian name for the Pleiades. Kepelino remarked, [page 227] however, that the chief officer of Hawaii-loa's ship gave his name to several stars or constellations and other authorities attach the name *Makalii* to the Hyades and to Gemini.

Makalu appears to be a variant of Makulu, a Hawaiian name for Saturn.

Maka-unulau, Star of Unulau; a Hawaiian star named for one of the navigators of Hawaii-loa. The following lines are from a chant translated by Fornander:

Arise! Arise! Arise!
Hiki Lii (the Pleiades rise)!
Maka-unulau is up,
The star at the end of the land.

Makea-upea, a Hawaiian star or constellation.

Makohilani; a Hawaiian star coupled with *Makaha.*

Makua-kau-mana, Ancestor-girded-with-power; a star in the great Hawaiian constellation known as the Double Canoe, said to be situated below the Pleiades...

Makulu; a Hawaiian name for Saturn.

Malana, Unsteady (Liliuokalani); a Hawaiian star.

Maliu; a Hawaiian star and geographical name...

Malu-lani, Celestial Shadow; a Hawaiian star of the southern sky. *Malu* conveys a sense of the "presence and power of the god." [page 228]

Mananalo; a Hawaiian name for Venus, according to Alexander. [page 229]

Maui, south of the Pleiades, was a star highly esteemed by astrologers of the island of Maui in the Hawaiian group. The hero Maui has been commemorated in such constellations as the Pukapukan Te Kau-o-Maui, the fishhook with which Maui dragged up innumerable islands.

Maukuku; a Hawaiian star name doubtless related to Kona-maukuku. [page 234]

Melemele is a Hawaiian star, possibly Betelgeuse. Kamohoula states that *Melemele* is a "male" and the neighboring *Polapola* a "female" star. [page 235]

Mohai; a Hawaiian star listed in the *Kumulipo* and also found in the compound names *Kauluomohai* and *Kaulua-ihai-mohai.*

Mulehu is one of three Hawaiian stars forming a [page 236] triangle, the others being *Poloula* and *Poloahilani.* Of the last, which was named for a blind king of Hawaii, Kupahu remarks: "The character of this star is blindness, and it shows a whiteness when observed in the night. *Poloahilani* had two attendants to guide him in and out, one to hold him by the right hand, the other by the left. Through the blindness of this king his misfortune is applied to the heavens and placed with those stars of three names mentioned above. This star applied to Chief Kuakini and his descendants."

The three stars may well be Alpha, Beta and Gamma Cassioppeiae. Alpha appears a little in advance of the other two as befitting a chief, and varies half a magnitude in brightness, a phenomenon which may have suggested dimness of vision.

In the legend of Hawaii-loa *Mulehu* is given as an alternative name for Venus, the westward guiding star which led that intrepid explorer to the "land of the people of up-turned eyes."

Naholoholo, Weave-to-and-fro; a Hawaiian name for Venus or Saturn, applying more appropriately to the motion of the former.

Nana; a Hawaiian star name equivalent to the Tuamotuan Ngana and the Tahitian Ana, a "star."

Nana-hope, Last *Nana*; a Hawaiian name for Pollux.

Nana-mua, First *Nana*; a Hawaiian name for Castor. [page 237] Castor and Pollux together were known as *Nana-mua-ma*. In Molokai, according to information received by Kelsey from Kalama, *Nana-mua* and *Nana-hope* were two names for a single star and testified that it "witnessed the last of night and the first of day."

Napehe; a Hawaiian navigation star, tenth in the list of thirteen steersmen's stars given by Kaleikupua. [page 238]

Newa, Newe, and *Newenewe* are Hawaiian names for the Southern Cross.

Noho-loa, Eternal; a Hawaiian name for the North Star.

Nuu-anu, Frozen land; a Hawaiian star and geographical name.

Ololu; a Hawaiian star listed in the *Kumulipo...*

Omao; a Hawaiian star and a bird of the thrush family.

Omao-ku-ululu was a mystical land "on the borders of the world."

Paao; a Hawaiian star mentioned by Kamohoula as one of the large group resembling a double canoe. Paao was a famous priest who conveyed a colony from Central Polynesia to Hawaii during the Middle Ages. [page 239]

Pae-loa-hiki, Long-shining-threshold; said to be a Hawaiian star in the Milky Way but it is more likely the name for the entire Galaxy analogous to the Pae-roa-o-Whanui of the Maori.

Pai-kau-hale; a Hawaiian star name... See *Auhaele* with which *Pai-kau-hale* is associated.

In Hawaii the constellation *Na Hoku-pa* appears to be the head of Cetus.

Pauahi; a star of the Hawaiian astrologers which "emerges in the early morn, the morning star being high, during the month *Kaulua*."

Pili-lua, Two-friends-close-together; the Hawaiian form of Pipiri or Pipili, whose myth is told throughout the Polynesian area. The Hawaiian pair of stars was supposed to bring the *opelu* fish to local waters.

Pipa, Sneak (Liliuokalani); a Hawaiian star.

Pohina, Confusion; an alternative name for *Poloula* in the Hawaiian Islands.

Polapola is a Hawaiian star and geographical name. Kamohoula believed it to be in Orion. Since the name is the same as Porapora in the Society group, *Polapola* may have served as guide star on the voyage from Hawaii to this island, in which case it must be situated much farther south than Orion, page 244] *Polapola* and his companion *Melemele* may therefore be names for Alpha and Beta Centauri.

Poloahilani or *Polohilani*; a Hawaiian star associated with *Mulehu* and named for one of Hawaii-loa's mariners. The name means "shining in the heavens..."

Polo-ula, Shining-red; a star of Oahu also known as *Pohina*. [page 245]

Puana-kau, Suspended-blossom; a Hawaiian name for Rigel, the tutelary star of West Maui.

Puanene; a Hawaiian star of destiny.

Pu-koloa, Wild-duck-overhead; a Hawaiian constellation...

Pulele-hua-kea is the Hawaiian name for the Greater Magellanic Cloud.

Pulele-hua-uli, Dark-scattering-mist; the Lesser Magellanic Cloud in Hawaii.

Pulele-hua-kawaewae; the Hawaiian name for Coalsack. [page 247]

Puwepa, a Hawaiian star. [page 248]

Ukali or *Ukali-alii*, Following-the-chief, i.e., the Sun; a Hawaiian name for Mercury.

Uliuli, Blackness; a Hawaiian star in the southern sky. *Uliuli*, like *Polapola* and *Melemele*, were names of lands formerly occupied by the Polynesians in their long migration (Malo). *Uliuli* was also the name of a *tapu* imposed by King Kualii, the breaking of which was punishable by death.

Ulukoa or *Uluoa*, Associated-with-rejoicing; a Hawaiian navigating star... [page 265]

Unulau, Pull-off-leaves; a Hawaiian star and the name of a wind. The star was said to have been named for one of the eight steersmen of Hawaii-loa. *Unulau* was also a geographical name. [page 265]

Wehewehe; a Hawaiian month-ruling star. Makemson, 1941:268]

Mauna Kea, Pā i ka Lani
(Mauna Kea, Touching the Heavens)

It is noted here, that while conducting this study, no specific archival references to *kilo hōkū* on Mauna Kea were located. The association of the gods and deity whose forms are seen in the heavens and whose names are commemorated at locations on Mauna Kea is noteworthy, and may be viewed as manifestations of the cultural attachment and values placed by Hawaiians on the *Mauna a Kea*, and the *kino lani* (heavenly bodies). It is very likely that practices of the native practitioners of the *'oihana kilokilo* and the *kilo hōkū* occurred on Mauna Kea, but, they were either unwritten, or await being brought to light once again.

While today, Mauna Kea is valued as an astronomical center—and this may be rooted in earlier native practices—the ancient Hawaiian practitioners were mindful of their foundation, the *papa honua* (earth) upon which they stood. As noted in the traditions cited above, these islands, the children of the native gods and creative forces of nature, also gave birth to, and life to the *kānaka* (people). Naturally, one could not look heavenward, without first looking down, and being mindful of the responsibility (*kuleana*) that people have to care for the *papa honua*. This is a custom which is of value to all who cherish and touch Mauna Kea.

Native lore and the on-going beliefs of cultural practitioners address Mauna Kea (*Mauna a Kea*) as the *piko* (in this case, not only the summit, but the umbilical cord) that connects Hawai'i, the first-born child of the creative forces of nature, to the heavens. In interviews conducted by Maly in 1999, with native Hawaiian practitioner and educator, Pua Kanaka'ole-Kanahele, readers were provided with detailed narratives of the spiritual significance of Mauna Kea—the Mountain of Wākea, in Hawaiian traditions of creation. It was observed that Mauna Kea is considered to be *kupuna* (elder), the first born, and is held in high esteem. In native traditions, Mauna Kea is identified as "*Ka mauna a Wākea*" (The Mountain of Wākea–traditional god and father of Hawai'i–who's name is also written "Kea"). Mauna Kea is the source of a high sense of spirituality. It is the *'aha ho'owili mo'o* (genealogical cord that ties earth to the heavens) (MKAC meeting Dec. 1, 1998 and interview of December 11, 1998; in Maly 1999).

Kūpuna, who have been interviewed by Maly between 1999 to 2005, shared the view that Mauna Kea is sacred, and that until the development of the observatories, it was a pure and sanctified place, tied to the heavens. It was for this reason that the *piko* of new-born children were taken to the summit region of Mauna Kea. Collectively, the *kūpuna* lament the changes that have occurred on Mauna Kea since the development of the observatories (cf., interviews with Elizabeth Lindsey-Kimura, Teddy Bell, Elizabeth Ruddle-Spielman, and Irene Lindsey-Fergerstrom).

III. Historical Accounts of the 'Āina Mauna Recorded by Natives, Foreign Residents and Visitors (1778-1899)

The historic records of native writers share that in the Hawaiian mind, Mauna Kea—from shoreline to the dense forests and lofty peaks—was a source of awe and inspiration. The natural resources and mountain itself, were believed to be manifestations of various creative forces of nature, and were revered. Though on a different level, the natural beauty of Mauna Kea and the *'āina mauna* also inspired foreign visitors of the eighteenth and nineteenth centuries to wax poetically. In the journals of many eighteenth and nineteenth century visitors, readers can find descriptions of the natural environment and glimpses into the native history of the mountain. Selected narratives penned by a number of early foreign visitors in letters and journals, and the observations of historians, describing first-hand and eyewitness accounts of travel across the mountain lands, and traditions learned from native guides, are cited below. The accounts are presented in chronological order by date of observations and travel to the *'āina mauna*.

The Journal of Captain James Cook (1778-1779)

The earliest written descriptions of Mauna Kea and the mountain lands, recorded by a foreigner are found in the Journals of Captain James Cook and his officers (Beaglehole 1967). Cook and his crew visited the Hawaiian Islands in 1778 and 1779, though none of them traveled to the interior lands or ascended Mauna Kea. Although brief, the narratives are notable because they describe the mountain slopes and summit, and present us with one of the earliest maps of the island.

> [December 1, 1778] ...At 7 PM we were close up with the North side of [O'why'he] where we spent the night standing off and on.
>
> Wednesday 2nd. The 2nd in the Morning we were surprised to see the summits of the highest [mountains] cover[ed] with snow; they did not appear to be of any extraordinary height and yet in some places the snow seemed to be of a considerable depth and to have laid there some time... [Cook in Beaglehole 1967:476]
>
> Mon. 7 . . . There are hills in this island of a considerable height whose summits were continually covered with snow [Mauna Kea and Mauna Loa], so that these people know all the climates from the Torrid to the Frigid Zones... [Cook in Beaglehole 1967:478]

In the same time period, Captain King describes, what is believed to be the summit peaks of Mauna Kea from the northwestern side of the island of Hawai'i:

> ...the inland country rises gently at first but afterwards abruptly to a mountain, which is broken at the top [presumably Mauna Kea], which must be very high, since we think we can discern a good deal of Snow upon it, some say the appearance is only Clouds hanging on the top, & is also cut into deep Glens. [King in Beaglehole 1967:501]

In March 1779, Cook's officers, Clerke and King, provided additional descriptions of the mountains of Hawai'i. King's narrative is of particular interest, because he makes specific use of the name Mauna Kea (Mouna Kāā) in his narrative. Clerke observed:

> ...This isle is one continued Mountain on which are Peaks of various heights, particularly two of vast elevation which were covered with snow all the time we were about the neighbourhood [Mauna Kea and Mauna Loa]; the great altitude of these snow Peaks was by no means striking to the eye, I suppose from the vast base they stood upon, for they must have been of great height as we have seen them very clearly at 26 leagues distance, and then they appeared very high and prominent... [Clerke in Beaglehole 1967:591]

King noted:

> On the NE side is Amacooa [Hāmākua] & A-heedoo or O'heeroo [Hilo], the Snowy mountain which makes in 3 peaks & is called Mouna Kāā (or Mountain Kāā) separates them... [King in Beaglehole 1967:605].

The Journal of William Ellis (1823)

In 1823, British missionary William Ellis, and members of the American Board of Commissioners for Foreign Missions (A.B.C.F.M.) toured the island of Hawai'i seeking out community centers in which to establish church strongholds for the growing Calvinist mission. In Ellis' Journal (1963), we find the first Hawaiian tradition written in reference to Mauna Kea (Mouna-Kea). Following a sermon in the village on Hilo Bay, Ellis learned of a native account of "*kai a kainarii*" in which an ocean flood had inundated all land except for the summit of Mauna Kea (Ellis 1963:321; see account earlier in this study).

Ellis also described his impressions of the mountain lands—their breadth, the nature of the forests and summit of Mauna Kea, and he also recorded that the natives traveled to the mountain lands. Ellis (1963) observed:

> On approaching the islands, I have more than once observed the mountains of the interior long before the coast was visible, or any of the usual indications of land had been seen. On these occasions, the elevated summit of ***Mouna Kea***, or ***Mouna Roa***, has appeared above the mass of clouds that usually skirt the horizon, like a stately pyramid, or the silvered dome of a magnificent temple, distinguished from the clouds beneath, only by its well-defined outline, unchanging position, and intensity of brilliancy occasioned by the reflection of the sun's rays from the surface of the snow.
>
> The height of these mountains has been computed by some navigators who have visited the Sandwich Islands, at 12,000, and by others at 18,000 feet. The estimate of Captain King, we think exceeds their actual elevations, and the peaks of ***Mouna Kea***, in the opinion of those of our number who have ascended its summit, are not more than 1,000 feet high. But admitting the snow to remain permanent on the mountains of the torrid zone at the height of 14,600 feet, the altitude of ***Mouna Kea*** and ***Mouna Roa*** is probably not less that 15,000 feet.
>
> The base of these mountains, is, at the distance of a few miles from the seashore, covered with trees; higher up, their sides are clothed with bushes, ferns, and alpine plants; but their summits are formed of lava, partly decomposed, yet destitute of every kind of verdure.
>
> There are few inland settlements on the east and north-west parts of the island, but, in general the interior is an uninhabited wilderness. The heart of Hawaii, forming a vast central valley between ***Mouna Roa***, ***Mouna Kea***, and ***Mouna Huararai***, is almost unknown, no road leads across it from the east to the western shore, but it is reported by the natives who have entered it, to be "Bristled with forests of *ohia*," or to exhibit vast tracts of sterile and indurated lava... (Ellis 1963:3-4)

Reverend Joseph Goodrich, who accompanied Ellis on part of his journey around Hawai'i ascended to the summit of Mauna Kea from both the Kawaihae-Waimea route, and from Waiākea. On the first trip from Kawaihae-Waimea, Goodrich commented on the numerous wild cattle found on the mountain lands, and also reported on a "heap of stones" on the summit peak, which he presumed was made by a "former visitor" (Goodrich in Ellis, 1963:290). Goodrich reached the snow line and:

> ...directed his steps towards a neighbouring peak, which appeared to be one of the highest; but when he had ascended it, he saw several others still higher. He proceeded

towards one, which looked higher than the rest, and bore N. E. from the place where he was. On reaching the summit of this second peak, he discovered a heap of stones, probably erected by some former visitor... (ibid.:290)

In Goodrich's description of the journey by Dr. Blatchely, Mr. Ruggles and himself across the mountain lands of Pi'ihonua and Humu'ula, to the summit of Mauna Kea, he described the various conditions of the landscape at elevational zones, commented on the presence of wild cattle, sheep, dogs and goats. There was also further discussion on traditions associated with Mauna Kea, as "the abode of the gods," and it was observed that it was the custom of natives they encountered, to refuse to travel to the summit of Mauna Kea:

Other Trips to Mauna Kea

...Dr. Blatchely and Mr. Ruggles ascended Mouna-Kea, from Waiakea bay. After travelling six days, they reached the summit of the mountain, where, within the circumference of six miles, they found seven mountains or peaks, apparently 800 or 1000 feet high; their sides were steep, and covered with snow about a foot thick. The summit of the mountain appeared to be formed of decomposed lava, of a reddish brown colour. The peak in the centre, and that on the western side, are the highest.

The following observations respecting a subsequent visit to this mountain from Waiakea, contained in a letter from Mr. Goodrich to Professor Silliman, of New Haven, are copied from the Philosophical Magazine for September, 1826.

Description of Hilo Slope of Mauna Kea

"There appear to be three or four different regions in passing from the sea-shore to the summit. The first occupies five or six miles, where cultivation is carried on in a degree, and might be to almost any extent; but, as yet, not one-twentieth part is cultivated.

The next is a sandy region, that is impassable, except in a few foot-paths. Brakes, a species of tall fern, here grow to the size of trees; the bodies of some of them are eighteen inches in diameter." [Ellis 1963:291]

"The woody region extends between ten and twenty miles in width.

The region higher up produces grass, principally of the bent kind.

Strawberries, raspberries, and whortleberries flourish in this region, and herds of wild cattle are seen grazing. It is entirely broken up by hills and valleys, composed of lava with a very shallow soil. The upper region is composed of lava in almost every form, from huge rocks to volcanic sand of the coarser kind. Some of the peaks are composed of coarse sand, and others of loose stones and pebbles. I found a few specimens, that I should not hesitate to pronounce fragments of granite. I also found fragments of lava, bearing a near resemblance to a geode, filled with green crystals, which I suppose to be augite."

Wild Sheep, Dogs and Goats

"Very near to the summit, upon one of the peaks, I found eight or ten dead sheep; they probably fled up there to seek a refuge from the wild dogs; I have heard that there are many wild dogs, sheep, and goats. Dogs and goats I have never seen. I was upon the summit about 2 o'clock p.m., the wind S.W., much resembling the cold blustering winds of March, the air being so rare produced a severe pain in my head, that left me as I descended."

Legends of Mauna Kea

In the native language, the word *kea*, though seldom used now, formerly meant, white. Some white men, who are said to have resided inland, and to have come down to the sea

shore frequently in the evening, and to have frightened the people, were called *na kea*, (the whites).

The snow on the summit of the mountain, in all probability, induced the natives to call it ***Mouna-Kea***, (mountain white), or, as we should say, white mountain. *They have numerous fabulous tales relative to its being the abode of the gods, and none ever approach its summit—as, they say, some who have gone there have been turned to stone.* We do not know that any have ever been frozen to death; but neither Mr. Goodrich, nor Dr. Blatchely and his companion, could persuade the natives, whom they engaged as guides up the side of the mountain, to go near its summit.

We could not but regret that we had no barometer, or other means of estimating the actual elevation of this mountain, either here or at Waiakea. [Ellis 1963:292]

Mauna Kea and the Mountain Lands Described by J.F. Goodrich (1823-1825)

The October 1826 edition of the American Journal of Science (Series I, Volume XI), published excerpts of letters from Joseph Goodrich, describing travel around the island of Hawai'i, and to Mauna Kea and the mountain lands. Goodrich, a graduate of Yale, with an interest in geology and mineralogy, arrived in the Hawaiian Islands, in April 1823. Shortly after his arrival, he traveled to the island of Hawai'i as a member of the party on the tour of William Ellis. Subsequent to the tour, in 1824, Goodrich settled in Hilo, where he remained until 1836. Goodrich's first ascent of Mauna Kea was made in August of 1823, and the second, in April of 1824. Goodrich provided readers with important descriptions of the landscape, including the extent of the cultivated and forest zones, from the shore to the mountain regions, and the conditions on the higher mountain slopes and summit region of Mauna Kea (Mouna Kea). Excerpts from the American Journal of Science, and his letter to Professor Silliman follow, below:

Soon after the arrival of this second Missionary family, a tour round the island was resolved upon, with particular reference to the great objects of the Mission. Messrs. Ellis, Harwood, Thurston, Stewart, Bishop, and Goodrich, [Page 1] were charged with the execution of this duty, which they performed with zeal and ability. The result of their observations is detailed in a little volume, ably drawn up by Mr. Ellis, and entitled "A Journal of a Tour Around Hawaii, the Largest of the Sandwich Islands." Besides many interesting statements relative to the paramount objects of the enterprise, it contains a great number more relating to the natural history of the island. From this part of the work, we intend to quote the most important passages, and we conceive that we cannot better introduce them than by the following letter from Mr. Goodrich to the Editor, which, although dated a year ago, has been received only within a few days.

Letter from Mr. Joseph Goodrich, one of the American Missionaries in the Sandwich Islands.

Waiakea, (Hawaii) April 20th, 1825.
To Professor Silliman, New-Haven, (CT.)

My Dear Sir,

I confess I have remained silent quite too long, in not answering your kind request on the eve of my embarkation, although I am better able to state facts now than at any former period. The station which I am called to occupy, on the N. E. Side of Hawaii, (Pronounced Harwye,) at the head of a safe and commodious harbor, yet but little known to foreigners. About forty miles in the interior, in a southwesterly direction, is a burning volcano, that has been in a state of activity from time immemorial. The oldest natives can give no account of a time when it was not burning; they say it is more active now than it was twelve or fifteen years since...

...The summer after my arrival, I spent about ten weeks in making a tour of this Island, in company with several other members of the Mission family. A journal of that tour will probably be published in America. The Island of Hawaii, from the north point to the southern, including all the west side of the Island, is little else than one entire mass or sheet of lava, which has run down from the mountains at different periods. Some of the currents of lava are so recent, that there is no vegetation to be seen upon them; but others are of a much more ancient date, so that bushes and even trees have sprung up among the beds of lava... ...There are four high [page 3] mountains in the Island, one back of Toaehae, and another back of Kairua, upwards of 7000 feet high, called Hualulae [Hualalai]; the two others are vastly higher, namely; ***Mouna Kea***, to the northward and eastward part of the Island, estimated to be upwards of 18,000 feet high, and ***Mouna Roa***, in the south-western part, probably near the same height.

I have been twice to the summit of ***Mouna Kea***. The first time I was at the highest peak about three o'clock at night, in the month of August; the thermometer stood at 27 deg, 5 below the freezing point. I passed over several banks of snow, that lay to the northward of the highest peaks, (this mountain rises much more abruptly than Mouna Roa), and the change was so great in passing from a torrid to a frigid zone, that it was under the necessity of travelling all the time I was up there to prevent freezing. The second time that I ascended was in April last. There appear to be three or four different regions in passing from the sea shore to the summit. The first occupies five or six miles, where cultivation is carried on, in a degree, and might be to almost any extent; but as yet, not one twentieth part is cultivated. The next is a sandy region, that is impassable, except in a few foot paths. Brakes, a species of fern, here grow to the size of trees, the bodies of some of them are eighteen inches in diameter. The woody region extends between ten and twenty miles in width. The region higher up produces grass, principally of the bent kind. Strawberries, raspberries, as large as butternuts, and whortleberries flourish in this region, and herds of wild cattle are seen grazing. It is entirely broken up by hills and vallies, composed of lava, with a very shallow soil. The upper region is composed of lava in almost every form, from huge rocks to volcanic sand of the coarser kind. Some of the peaks are composed of coarse sand, and others of loose stones and pebbles. I found a few specimens that I should not hesitate to pronounce fragments of granite. I also found fragments of lava, bearing a near resemblance to a geode, filled with green crystals, which I suppose to be augite. [page 4]

Very near to the summit, upon one of the peaks I found eight or ten dead sheep; they probably fled up there to seek a refuge from the wild dogs; I have heard that there are many wild dogs, sheep and goats. Dogs and goats I have never seen.

I was upon the summit about 2 o'clock P.M., the wind S.W., much resembling the cold blustering winds of March with you, the air being so rare that it produced severe pain in my head, that left me as I descended. Much more might be said, that I must omit for want of room... [page 5, Goodrich Journal in Collection of Bernice Pauahi Bishop Museum]

Prior to their ascent of Mauna Kea, the party visited Kilauea—where they saw flocks of *nēnē*, and were informed that many geese lived on the higher mountain lands, though they were never seen on the coast. Silliman also reported that when Goodrich ascended Mauna Kea, he found a cairn of stones on the summit peak. The account of the ocean flood, and the survival of two individuals on the summit of Mauna Kea was also recorded by Goodrich—

On the 25th of August, Mr. Goodrich commenced his ascent up Mouna Kea. The soil was formed of decomposed lava and ashes. At noon he dismissed his native companion, and taking his great coat and blanket, began to ascend the more steep and rugged parts. The way was difficult, on account of the volcanic rocks and stunted shrubs that covered the

sides of the mountain. On his way up he found a number of red and white raspberry bushes, loaded with delicious fruit. At 5 P.M. having reached the upper boundary of the trees and bushes, that surround the mountain, he erected a temporary hut, kindled a small fire, and prepared for his night's repose. The thermometer, shortly after sun setting, stood at 43º, and the magnet, though it pointed north when held in the hand, was drawn two or three degrees to the eastward, when placed on the blocks of lava; owing, probably, to the great quantity of iron in the mountain. [page 37]

After a few hours rest, he arose at eleven o'clock at night, and the moon shining brightly, he resumed his journey towards the summit. At midnight he saw the snow about three miles distant, directed his steps towards the place, and reached it about one o'clock on the morning of the 26th. The snow was frozen over, and the thermometer stood at 27º.

He now directed his steps towards a neighbouring peak, which appeared one of the highest, but when he had ascended it, he saw several others still higher. He proceeded towards one which appeared highest, and bore north-east from the place where he was. On reaching the summit of this second peak, he discovered a heap of stones, probably erected by some former visitor. From this peak Mouna Roa bore south by west; Mouna Ruarai, west by south; and the Island of Maui, north-west. The several hills or peaks on the summit of Mouna Kea, seemed composed entirely of volcanic matter; principally cinders, pumice, and sand. Mr. Goodrich did not discover any aperture or crater on either of the summits he visited. Probably there is a large crater somewhere on the summit, from whence the scoria, sand and pumice, have been thrown out. The whole of the summit was not covered with snow. There were only frequent patches, apparently several miles in extent, over which the snow was about eight inches or a foot in thickness. The ocean to the east and west was visible, but the high land on the north and south, prevented its being seen in those directions.

Mr. Goodrich commenced his descent about three o'clock, and after travelling over large beds of sand, and cinders, into which he sunk more than ankle deep at every step, he reached, about sunrise the place where he had slept the preceding evening. The descent in several places, especially over the snow, was steep and difficult, the utmost caution was necessary to avoid a fall. On his way down, he saw at a distance, several herds of wild cattle, which are very numerous in the mountains, and inland parts of the island.

The natives said they were informed by their fathers, that all the land had once been overflowed by the sea, except a small peak on the top of Mouna Kea, where two human beings were preserved from the destruction which overtook the rest... [page 38, Goodrich Journal, in collection of Bernice Pauahi Bishop Museum]

The Journal of C. S. Stewart (1823-1825)

In April 1823, New England missionary, C. S. Stewart (1970) sailed into Hilo Bay. His description of Hilo with the backdrop of Mauna Kea (Mouna-Kea), is reminiscent of the scene described in the accounts of Kūkahau'ula cited earlier in this study:

Friday, April 25. The appearance of Hawaii, this morning was exceedingly beautiful. We were within a few miles of the shore; and the whole of the eastern and northern parts of the island were distinctly in view, with an atmosphere perfectly clear, and a sky glowing with the freshness and splendor of sunrise. When I first went on deck, the gray of the morning still lingered on the lowlands, imparting to them a grave and somber shade; while the region behind, rising into broader light, presented its precipices and forests in all their boldness and verdure. Over the still loftier heights, one broad mantle of purple was thrown; above which, the icy cliffs of MOUNA-KEA...blazed like fire, from the strong reflection of the sun-beams striking them long before they reached us on the waters

below. As the morning advanced, plantations, villages, and scattered huts were distinctly seen along the shore... [Stewart 1970:87]

In the evening Hawaii and Mouna-kea again, at a distance, afforded another of the sublimest of prospects;—while the setting sun and rising moon combined in producing the finest effects on sea and land. The mountains were once more unclouded, and with a glass we could clearly discern immense bodies of ice and snow on their summits... [Stewart 1970:89-90]

In June 1825, Stewart returned to Hilo with Lord Byron, who had returned the bodies of Liholiho (King Kamehameha II) and his wife Kamāmalu to Hawai'i from England where they had died. In viewing the district of Hilo, with the back drop of Mauna Kea, from the deck of the H.B.M. Ship Blonde, Stewart recorded:

The land rose gradually from the cliff, to the distance of ten or fifteen miles, to a heavy wood encircling the base of ***Mounakea***. Though in a state of nature, this large district had the appearance of cultivation, being an open country covered with grass, and beautifully studded and sprinkled with clumps, and groves, and single trees, in the manner of park scenery, with a cottage here and there peeping from beneath the rich foliage. The mountains were entirely covered with clouds, or the prospect would have been rendered more delightful from their sublimity... [Stewart 1970:361]

Botanist, James Macrae and Party Travel to Mauna Kea in 1825

In 1824, Liholiho (King Kamehameha II), his wife, Kamāmalu, and a group of retainers and foreign advisors, traveled from Hawai'i to England. Liholiho and his wife died there, and in May of 1825, their bodies were returned to Hawai'i by Lord Byron (Stewart 1970:338). While preparing for the return voyage to England, Lord Byron had the H.M.S. Blonde port in Hilo Bay for refitting. Several individuals from the Blonde recorded important descriptions of localities visited on the island of Hawai'i as a result of the stop over. One of the crew members, being James Macrae, a botanist, penned detailed narratives of the journey from Hilo, along the coast to Laupāhoehoe, and from there up the mountain trail to the summit of Mauna Kea (Macrae, 1922). Through Macrae's writings, we are provided descriptions of the forests on the slopes of Mauna Kea; the native trail leading upland through Laupāhoehoe; bullock hunting being undertaken by natives and foreigners on Mauna Kea and the mountain lands; the first recording of the Mauna Kea Silver-sword; and that wild dogs were driving sheep to the summit region of the mountain.

The following narratives are excerpted from Macrae's longer narratives:

Arrives at Hilo. Prepares for Ascent of Mauna Kea.

June 12. Sunday. Strong E.N.E. breezes and cloudy. At 10 a.m., church service, the queens, chiefs and missionaries present. Shortened sail and came to anchor in 6 fathoms. I got Lord Byron to gain Queen Kaumanna's [Kaahumanu] consent for me to have 7 or 8 natives to accompany me to ***Mouna Kaah*** [***Mauna Kea***]. After her usual "hesitation to consider," she said I might have as many as I wanted. I also asked her for a hut on shore to which to remove my traps tomorrow, where Mr. Forder will live till I return and where he can dry what plants I may find necessary to send home while on my journey. She desired that I should be informed that she did not know of a hut, but when she went on shore she would enquire of the chiefs.

Rev. Mr. Goodrich, Missionary.

June 13. Went on shore to find the huts of the only two foreigners at this place, besides the missionaries, to procure one of these men as a guide to ***Mouna Kaah***. I met Mr. Goodrich, one of the missionaries from Woahoo [Oahu], who told me that both of the persons of whom I was in search had left the place a fortnight ago, to kill wild cattle near

Mouna Kaah, and would probably not return for some weeks. He said that rather than I should be disappointed, he would willingly accompany me. His kind offer I accepted.

It was thought best to go the first part of the journey by canoe, and to save 30 miles of travel over many deep ravines and large rivers. We might return by land if we wished. For this water plan we had again to apply, through Lord Byron, to Queen Kaumanna for a canoe and also extra natives to man it. This Lord Byron, in his usual pleasant manner, promised to do when he found her (Queen Kaumanna) in such humour as likely not to refuse him, she at present being rather sulky from accounts received of some persons on shore having acted wrongly in her absence.

Lord Byron gave Mr. Talbot, fourth lieutenant, and Mr. Wil- [page 45] son, purser, permission to accompany me on my journey, and also acquainted me that Queen Kaumanna had promised me the canoe and natives for the next day. At noon I went on shore to choose a suitable hut, and met Mr. Goodrich, who went with me to look at the huts round the bay, all pleasantly situated under the shade of breadfruit trees, which in places form woods by themselves, and grow to a great height, producing plenty of fruit, although they possess but little variety and are generally of the small kind...

...The whole of the E. side of Owhyee [Hawaii], which is divided into two districts, belongs to Kaumanna and Pio. When at Heddo [Hilo], their place of residence to receive the rents, is near the east side of the bay, and consists of no more than two huts, one of which is given to Lord Byron as a residence while here.

Returning on board, I heard that the canoe and natives would not be ready until tomorrow. Mr. Young this evening gave me some account of Mr. Menzies' journey to ***Mouna Roah***,[45] next highest to ***Mouna Keah*** to which I am going. During the 26 years that Mr. Young has been on the island, he has never seen ***Mouna Kaah*** [Keah] free from snow, but has not seen snow on ***Mouna Roah*** in summer, and on this he bases his theory of the greater height of ***Mouna Kaah***. [page 46]

June 14. Went on shore with my traps, taking Mantle and another lad Trounce with me. They both belonged to the ship, and are allowed to me as long as I need them. I found that the hut promised me by Manaware was now refused, and only part of another offered, at the other side of the bay, and inhabited by a chief. My traps and provisions now being landed on the beach and surrounded by crowds of natives who would not have hesitated to make free with what they could lay hold of, I begged to be allowed to put them in a corner of his Lordship's house. Lord Byron told me it would make no difference to him leaving any of my things there if I liked till I returned, but if I wanted a place for them and Mr. Forder, I could have the tent put up near his hut for his servants, and this I accepted.

I went with some of the missionaries to Queen Kaumanna's hut to ask her whether I could depend upon the canoe for tomorrow. I found her, as usual, lying on the floor with her face downwards, and several natives round her brushing the flies away from her body. She hesitated in giving an answer until she had surveyed me from head to foot, and then said when she saw one of the chiefs, she would let me know. So I got Mr. Young, who had more influence with her than the missionaries, to tell her I would pay what money she wanted. This offer had the desired effect, for she instantly sent across the bay to the head chief, and when he came it was settled at once that I should have the canoe and natives without paying at all. I sent word to Talbot and Wilson to have everything ready on board

[45] Archibald Menzies, a Scottish surgeon and naturalist, was the first white man to ascend to the top of Hualalai and the first white man and probably the first human being to reach the summit of Mauna Loa. For an account of his trips up these mountains, see "Hawaii Nei 128 Years ago," Honolulu 1920.

for the morrow's start when I came alongside in the canoe. I dined at 4 p.m. with Lord Byron, the surgeon, chaplain and painter, who are his usual companions while on shore. Mr. Forder joined me at sunset, and we took up our abode in Lord Byron's servants' tent.

Start for Mauna Kea.

June 15. Fine day after a showery night during which the rain poured through the old tent. Mr. Goodrich arrived at daylight with the double canoe and natives, and we immediately began to embark our provisions, etc., for our journey. It was 6 o'clock, however, before we got alongside the ship, for Messrs. Talbot and Wilson, who were ready waiting for us. There were now 17 on board the canoe, eleven natives and six of ourselves. We started with the well wishes of all on board the Blonde for [page 47] our journey of 30 miles to ***Lapahoi***[46] on the E. side of the island.

Favourable light east breezes, which freshened every hour until we landed in a narrow creek at 11 o'clock a.m. The creek was full of rocks, and open to a high surf that is generally found on this coast, and which at all times, except early in the morning, makes landing very difficult and dangerous, as we ourselves experienced. We had the greatest difficulty to prevent our canoe from being dashed on shore, owing to the surf washing over us every minute and filling the canoe with water so fast as to render our efforts in baling it out useless. We got into dry clothes as far as possible and dried our firearms, and then found that the 40 lbs. of salt meat which I had for my share of the provisions was missing, but nothing else.

Laupahoehoe.

Lapahoi [***Laupahoehoe***] is a small stony flat with a few huts and sweet potatoes and taro patches scattered over it. It lies at the extremity of a deep ravine, the declivities on either side nearly 500 feet in height and extending to the sea beach, terminating in a rocky precipice. The coast all the way to ***Lapahoi*** was intersected by many deep ravines, many of which had large rivers forming beautiful waterfalls that fell over the outward cliffs into the ocean, the angry surf of which broke a long way up upon the rocks underneath.

On the upper part of the inclines a species of pandanus grew plentifully. It is commonly used by the natives for making mats for the floors of their huts. It forms thick plantations here, giving the coast a pleasant appearance with their green bushy tops hanging pendant over the rocks where underneath in many places small subterranean streams fall down at no great distance from each other. This species of pandanus is nowhere so plentiful in the Sandwich Islands as on the island of Owhyee. It is cultivated elsewhere frequently for its leaves for mats and pillows for the natives. The tea tree is also plentiful here in the valleys along the coast.

Climbing Mauna Kea.

By noon we had finished taking some refreshments and dividing our baggage into loads for the natives to carry. We [page 48] proceeded on our journey, leaving behind us six natives with orders to remain four days with the canoe in case we might return in that time and select to go home by water. The other five we took with us, making with ourselves eleven. On the summit above ***Lapahoi***, we stopped to draw breath, and then every step became more interesting as we followed the narrow path to the woods above, which were yet four miles away. As we went along, the few native huts on either side were fast disappearing. The whole face of the country from the coast to six miles inland produced various fine prospects which reminded us of home, and if only cultivated, would produce an equal return of crops to any land of similar climate. But it is not even pastured by live stock, being covered with long grass and short stumpy tree ferns belonging to the Cyathea tribe, whose roots afford food for the swine about the huts of the natives.

[46] Laupahoehoe.

These same huts are often inhabited by four generations. huddled together at night time like so many dumb animals, and often without sufficient shelter over them to protect them from the cold heavy dews that invariably fall here at night. We reached the outskirts of the woods between three and four in the afternoon, having on our way crossed three narrow deep ravines, thickly covered with wood, mostly *metrosideros, aleurites*, and a species of *rhus*, but without water except during heavy rains.

Our guide (Mr. Goodrich) recommended us to take up our quarters in these huts for the night, as these were the last inhabited ones on our way to the mountain where we had any chance to procure food to eat now and also to take with us, which on account of our loss on landing in the surf, we should now need.

When about to enter the largest of the huts to prospect its condition, Mr. Goodrich was accosted by a smiling young woman, the wife of one of those Europeans who had come to kill wild cattle. She informed us that she had only left the Europeans yesterday morning, and that they had shot two bullocks the day before. We went and took possession of the cleanest part of the hut for our accommodation, without leave, as is customary with these people themselves, while Mr. Goodrich went in search of a young pig or fowls. All that he could procure, in spite of offering money and looking glasses, were a couple of fowls, owing to the price put upon their pigs, being nearly triple their worth.

Mr. Wilson was found in the midst of a crowd of natives, highly amused and viewing them with surprise. I went to the [page 49] wood, while supper was being prepared, to look for plants, and found several species of ferns not seen before, and a few plants. I only got as far as the outskirts of the wood and the trees, which were of moderate size, consisted mostly of metrosideros and aleurites, with many ferns growing beneath their shade. In addition to the different species of metrosideros in variety of colours of the flowers as well as foliage already met with at Woahoo, there still appears in this island many which will add to their number, one particularly with straw-coloured flowers and white underneath the leaves, met with this evening, although sparingly, adds to my former collection.

When I got back, I found my three fellow travellers sitting on a mat, each holding a piece of fowl in one hand a clasp knife in the other, busy eating in the presence of a number of natives, some of whom had in their hands a light made from the kernels of the *kukui* or candle nut tree (aleurites) several nuts being passed through on a splinter of bamboo cane which gave a greater light than two or three common sized candles.

At 9 p.m. we retired to rest in a corner of the hut on a clean mat brought with us for the purpose, the rest of the hut being filled with the usual medley of men, women, children and dogs.

June 16. Fine but somewhat foggy. Got up at daylight, took the temperature of the air, which stood at 64. We were all ready to start at 5 a.m. in spite of the heavy dew which was still on the grass and bushes, and we were soon wet through by it up to our knees. We entered the wood about a mile from the edge of a small ravine, by a narrow path, where on either side grew a number of strong, healthy banana trees without cultivation and many of them having large bunches of fruit.

John Young and Isaac Davis's First Battle.

Mr. Goodrich informed us that it was at this ravine that Mr. Young and Mr. Davis had fought their first battle in the service of Tamahamaah [Kamehameha] and defeated upwards of 10,000 of the enemy with only 300 on their own side, before their leader came up to their assistance with the main body of the army. The description related to us of this engagement was that when King Tamahamaah had conquered the south side of Owhyee,

he soon after, with his army, marched round to the opposite side of the island by the east, taking with him Young and Davis for the first time, [page 50] to whom he gave command of the chief part of his army. The chief of the Heddo part of the island was prepared to meet Tamahamaah in order to defend his proportion of the island from being subjected to the other's power, but on seeing the superior force of Tamahamaah, this chief kept retreating to the west till overtaken by Young and Davis, who were nearly a day's journey in advance of the main body of the army. The attack took place early in the afternoon from the opposite sides of the ravine in the wood, when after several hours engagement, it was decided in favor of Young and Davis, who alone had firearms. These two killed the enemy in vast numbers from the crowded manner in which they stood to oppose them, being unacquainted with the destructive effects of firearms.

This battle gave Tamahamaah the conquest of Owhyee.

We halted at 9 a.m. for refreshment, having travelled four miles through the wood, and I had the opportunity to ramble a little out of the path while the others rested. The trees now became more lofty, particularly a species of acacia used by the natives for canoes. Ferns of all kinds and sizes covered the ground beneath the trees, and a good many grew as parasites on the tree trunks. A noble species of *Cyathea*, equally numerous with the rest, often attained the height of 25 feet. *Metrosideros* with red bunchy flowering tops, covered with many red birds sucking their blossoms, were here much larger and taller than any seen on Woahoo. *Besterias* of various coloured flowers, and some of a climbing nature, and a numerous tribe of Psychotrias, both shrubby and succulent, as also many lobelias and other plants, aided by their variety to enliven our journey in spite of the many difficulties encountered from trees fallen across the path every other short distance, that had to be scrambled over. The path being slippery from the night rains occasioned many falls.

Wild Raspberries and Strawberries Plentiful.

After travelling another nine miles, we halted to fill our calabashes, this being the last place where we could obtain water till our return from ***Mouna Kaah***. Here again, I took the temperature of the air. It had risen to 69. Towards the end of the wood the path became steeper. Here we found raspberries and strawberries of various kinds covered with fruit which we all ate eagerly to quench our thirst. The raspberries were very large and [page 51] flat at both ends, but round in the middle and not unpleasant in flavour. The strawberries were small and great quantities of fruit grew around us on every side and looked like a neglected garden.

Bullock Hunters.

We reached the end of the wood by 1 p.m., having travelled twelve miles, and above 12,000 feet above sea level. Here we found the two Europeans' temporary hut. They had been killing some of the wild cattle that had originally been introduced by Capt. Vancouver from the N.W. Coast of America and since suffered to remain unmolested for over 20 years. Since the death of King Tamahamaah the government has killed and salted many of the cattle for the supply of its small fleet. In the hut we found both the Europeans at home, asleep, and dressed in the costume of the country. There were also twenty natives, men, women and children outside, some asleep and others roasting pieces of flesh on a stick stuck in the ground slanting over the fire. Both the white men were well known to our guide, and being told of the object of our visit, offered to supply us with what beef we wanted. While the natives were cooking food for us we learned from these two half-naked foreigners, who could speak but little English, although one was a Welshman and the other a Prussian black-smith, and both for some time had been in the English navy, that they had succeeded in shooting several cattle, but with some difficulty, for the cattle often in droves of twenty were always sensible of any person approaching them. If unsuccessful

in killing them with the first shot, it was absolutely necessary to have a place of retreat for their own safety, as they invariably pursued their destroyers with a kind of furious madness while they appear in sight.

Two days before, they had killed an old black bull, which they thought was one of the original number brought from California by Vancouver, from part of the right ear being cut off for a mark. They had been told that this had been put upon the cattle when landed thirty years ago. They have now increased to some hundreds, but it is curious that they have never been seen more than a few miles downwards in the wood from the mountain, and then only in warm weather for the sake of shade and water. Neither has a young one ever been got hold of and [page 52] domesticated, although often attempted, for the mother living with her young, always seeks some retired place till the young ones are old enough to protect themselves.

I placed all the specimens I had collected since the commencement of our journey, in paper to be left till my return, and then went into the wood to look for more. Took the temperature of the air at 3 p.m., and found it was at 69, being the same as at 10 a.m. coming through the wood. Our guide told us we must travel at least 6 miles further towards the mountain to be able to gain the summit at an early hour tomorrow, before the horizon rose to prevent us from seeing the ship at anchor in the harbour. So waking my sleeping companions, we started on our next stage. However, a native unfortunately dropped a calabash of strong brandy and water (two gallons) being the last of my share of the spirits brought on the journey. We had scarcely travelled three miles when a thick fog commenced to roll in over the country which was covered with tufts of dry grass and full of cattle tracks. The soil was chiefly composed of sandy, pulverized lava, with numerous beds of strawberries growing on same. Raspberries grew in great abundance by the sides of the small ravines made by the torrents of water from the melted snow running here at certain seasons. They were of a better flavour than those in the upper part of the wood, being here more exposed to the sun.

By 6 p.m. we had travelled another two miles, when the fog became so thick that we were scarcely able to see ten yards ahead of us, and we were drenched and shivering with cold and almost beyond any vegetation to shelter us for the night. So we cut down boughs of *Acacia* and a species of *Sophora* and erected a hut. This we accomplished in little more than half an hour, and getting plenty of firewood kept a fire burning all night near where we lay. I rambled about till dark among cranberry bushes cutting specimens. The temperature at 7 p.m. was 52.

Too Cold for Natives.

Got up at 2 a.m., started at 3 and began our journey to the mountains leaving the natives behind, who feared the cold and did not want to accompany us. At 5 a.m., daylight began to appear and by then we had travelled three miles over sandy pulverized lava, sinking over our ankles at every step. [page 53]

The Silver Sword Plant.

The last mile was destitute of vegetation except one plant of the Syginesia tribe, in growth much like a Yucca, with sharp pointed sliver coloured leaves and green upright spike of three or four feet producing pendulous branches with brown flowers, truly superb, and almost worth the journey of coming here to see it on purpose.[47] The majestic clouds rising

[47] The Silver Sword plant of Hawaii was first brought to the knowledge of the botanical world by Dr. W.J. Hooker, who described it from specimens collected by David Douglas when he ascended Mauna Kea in 1834. See "David Douglas, Botanist at Hawaii," Honolulu 1919. Macrae climbed Mauna Kea in 1825, i.e., nine years ahead of Douglas, and must be credited with having been the first botanist to notice and collect the silver sword plant. Some modern writers persist in stating that the silver sword plant is found on Maui only. This is not the case, as it also grows on the high mountains of Hawaii.

on the horizon at day-break encircled us all round like an immense wall with towers of various forms and sizes on their tops. They lay at unequal distances along the horizon, gradually rising and changing into fresh shapes at every moment that had the finest effect imaginable.

Talbot and Wilson Unable to Proceed.

The temperature had now fallen to freezing point. Messrs. Talbot and Wilson, overcome by the cold, became so sleepy as to be unable to proceed. We waited by them for some time trying to rouse them without avail, so leaving one of the lads with them, my guide and I with the other lad started out afresh so as to reach the summit and see the ship, we having promised Lord Byron to light a fire that he might see through his glasses how far we had got. As we advanced, every step became steeper and more difficult. All vegetation had ceased, even the yucca-looking plant, but we got up the mountain by 6 a.m., and saw the ship looking to us down there like a 50-ton vessel. Here we collected enough stumps and leaves to light a fire, remaining by it for half an hour, and our companions not overtaking us, we kept on our way, at times over hard uneven lava, at others over sandy lava.

Reaches Main Plateau of Mauna Kea.

The mountain now became divided into several high conical sandy hills with several old small volcanic craters on their sides, forced above the sand for some yards in height and bleached nearly white from long exposure. The air became warmer and more pleasant as the sun rose above the horizon, but we had [page 54] constantly to rest from the difficulty of breathing after stopping to rest. At 8 a.m. we saw the lad, left with Talbot and Wilson, coming after us. Thinking he might have a message from them, we waited, but he had left the others still asleep, and only came to beg to be allowed to return, as he had been so cold waiting by the sleeping men. Giving him some refreshment and spirits, we sent him back to try and meet Talbot and Wilson. The temperature had now risen to 46, the sun shining brightly. We resumed our journey by the bottom of the sandy conical hills, the surface over which we travelled constantly changing and more uneven, sometimes being lava sand intermixed with small broken stones about the size of brickbats, and at other places having to scramble over large sharp-edged granite stones of several tons weight, which have beyond a doubt, been thrown up by some previous convulsion. We came in sight of the snow after 11 a.m. Our guide seemed to suffer more than the lad and myself from headache and inclination to vomit, and we had yet two miles to go over a still more rugged surface to reach the snow.

Mr. Goodrich Collapses.

At a quarter mile from the summit where the snow lay, our guide collapsed and begged us to get him some snow for his thirst.[48] The lad Mantle held out better than I had expected.

Macrae and Boy Mantle Reach Summit.

At 12:30 I reached the snow on the summit, which lay on porous lava of a sponge color, and in places on sand of a red color intermixed with red and black cinders like the conical

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[48] Rev. Joseph Goodrich, who, on this occasion, was unfortunately laid up with mountain sickness, had on 26th August, 1823, reached the summit of Mauna Kea. This is the first recorded instance of the ascent of this mountain, although Mr. Goodrich mentions that on reaching the top of one of the terminal cones that encircle the main plateau of Mauna Kea, he discovered a heap of stones, probably erected by some former visitor. Who this former visitor was is unknown, but he was probably one of the white men that in the early years of the nineteenth century got a living by shooting wild bullocks that roved on the side of Mauna Kea. It is very unlikely that any native had reached the top of the terminal cones on the summit, owing to being unprovided with warm clothing to resist the great cold and also to the fact that the natives had a superstitious dread of the mountain spirits or gods. About six months after the date of the first ascent of Mauna Kea by Mr. Goodrich, the peak was scaled by Dr. Abraham Blatchley and Mr. Samuel Ruggles, both connected with the American Mission.

hills we had passed. Some of these cinders had common quartz and two or [page 55] three other kinds of minerals that I am as yet unacquainted with, very often bedded in one lump of lava. The snow in some parts was about three feet deep, congealed into solid ice, excepting from two to three inches at top of rough particles of loose snow. The whole appeared to be melting fast through the porous lava like a sieve, which prevented our being able to fill our vessels with water. We therefore filled our handkerchiefs with snow, taking mouthfuls at the same time to quench our thirst. I sent Mantle with some snow to our guide, and remained to take the temperature in the sun and in the shade. In the former it was 92, and in the latter, in holes beneath the snow, 44. I stayed about an hour admiring the scenery. For a space of about 12 miles around the top of the mountain, it was dreary to a degree, but below that, the pasture where the wild cattle fed had a pleasing effect. The forest which encircles the island of Owhyee below the pasture land, was hidden in fog, so that I only saw about 20 miles in a direct line, but the high land like Mouna Roa and other hills could be easily distinguished above the fog, although none of them were covered with snow.

Sheep Killed off by Wild Dogs.

I saw many skeletons of some kind of animal, devoid of all flesh, but apparently not long dead, and on rejoining our guide, was informed that the wild dogs had almost exterminated the sheep that Vancouver had brought with the cattle, pursuing them beyond the line of vegetation, where they became bewildered and died for want of food.

Begins Return Journey.

It being now after 2 p.m., and still feeling unwell from the same causes as our guide, we left this interesting place and travelled slowly downwards, finding our few specimens of minerals, etc., almost twice their real weight. In this hobbling manner, scarcely able to drag our limbs for the last four miles, we reached our hut, where we found that the lad sent back in the morning to Messrs. Talbot and Wilson had not met them. So fearing they might have succumbed to the cold in their sleep, and knowing they had no provisions, we much repented having left them; but to our joy, in about half an hour, we heard them calling not far distant. When they came to the hut they did not appear so fatigued as we ourselves, in spite of the want of food. They had [page 56] slept for about an hour, then awoke and tried to follow us, but not finding any of our tracks, they gave up the idea of following us, and made for the first of the highest hills. The snow we had brought with us served us well with water, for the natives left behind had drunk all that we left of the latter article except about a pint. The natives rubbed our thighs and legs for us, a practice they often do for themselves in such circumstances. They call it *lummi lummi* [*lomilomi*]. The temperature at 7 p.m. was 50 and at 10 p.m. 48.

We calculated the summit of Mouna Kaah from Byron's (or Heddo) Bay to be about 70 miles by the common path, but in a direct line perhaps only half that distance. We judged the peak could not be under 18,000 feet above sea level.[49] The land along the sea coast from Byron's Bay to upwards of 40 miles to the west and about 6 miles in breadth, was free from wood excepting by the sides and bottoms of the ravines. The forest that surrounds the central part of the island begins here, at the distance of 5 or 6 miles from the coast, and stretches back for a depth of 12 miles, intersected with deep valleys and large rivers of fine water. The outskirts of the forest nearest the sea are chiefly handsome coloured flowering species which entirely disappear after 5 or 6 miles towards the centre of the wood. The commonest species of *metrosideros* often attains a height of 40 feet and are thick in proportion. The wood is hard and durable.

[49] Mauna Kea is 13,825 feet high.

The upper parts above the forest resemble pasture land for 7 miles farther, and are thinly covered with low growing shrubs and abundance of strawberries and raspberries. At a higher elevation, vegetation ceases for the last eight miles towards the summit. The clouds generally rise on the mountains of Owhyee and the other islands in the morning and disperse towards evening. Rain often falls at night and also in the daytime some distance from the peaks, while on the coast the sun may be shining and there is no appearance of rain.

June 18. Got up at daylight, being disturbed in the night by the howling of wild dogs which caused us to keep our fire burning. At six set out on our homeward way, and unknown to us, the natives at once set fire to our discarded hut, a common custom our guide told us. At 12 we had travelled 6 miles and reached the Prussian and Welshman's hut. These men had seen no wild cattle since we left them, the only animals observed having been [page 57] a wild dog and cat. The dog seemed to be the same kind as the domesticated native one of which they eat the flesh, and the cat appeared like the European breed. After a breakfast of plenty of slices of roast beef and abundance of water, my companions spread their mats in the shade and slept till noon. I shifted my specimens that had been left here into dry papers, and gathered others, including strawberry and raspberry plants to take with me to England. At 2 the whole camp was on the move for ***Lapahoi***, where we had left the canoe and the natives. On reaching the first hut, we found only the two foreigners, the rest having gone on to ***Lapahoi***. They promised to have a fire ready for us to dry our clothes at, but although I gave them each a dollar on starting they had nothing ready for us and did not get us any food till 9 p.m.

Natives Object to Sunday Travel.
June 19. Hazy, light showers. Sunday, and on that account the natives refused to accompany me to join the other part of my party with their loads, and said, the missionaries had ordered them not to.

Game of Noa
The blacksmith, however, promised to accompany me with his own people at 11 a.m., but instead of doing so, went and played and gambled at Nooah. This game is one of their most ancient and frequently played pastimes. It consists in placing in a row, five small *tapa* bags stuffed with cotton or the down of ferns, underneath one of which is hidden a stone so as to deceive the parties playing which of the bags it was put under.

The players are seated around in a circle, each armed with a small wand in his hand with which he strikes the bag he supposes the stone to be under. There are generally ten players with different coloured rags tied to their wands. I have been told that at this game they gamble their hogs and all their possessions, even their wives, and are very strict in paying their debts of honor.

Leaving them gambling, I left with the two lads and two natives for ***Lapahoi***, and joined my party there about 3 p.m. They were just about to start for home, having expected me in the morning. The canoe had not waited for us as ordered but had returned home the second day after we started for the mountain. We therefore had to go home by land, and took up our [page 58] quarters for the night about 7 p.m. after having crossed a number of deep ravines, wading through rivers, at times up to our middle... [page 59]

...We arrived opposite the ship at 5 p.m. very tired from our many climbs up and down, since we left ***Lapahoi*** on Sunday, distant 40 miles... [Macrae, 1922:60]

Goodrich's Account of Travel From Hilo Bay to The Mountain Lands in 1829

During Joseph Goodrich's twelve year residency in Hilo, he made several trip across the mountain lands, either to visit the mountain summits, to go bullock hunting, or while traveling between the Hilo mission station, and other stations on the island. In 1829, Goodrich wrote to the mission headquarters, describing activities in which he had participated (some of which were being criticized by other brethren). His letter included a description of the trails taken from Hilo to the mountain lands, and observations of the nature of the landscape around Mauna Kea. Goodrich also reported that the right to hunt bullocks was controlled by Governor Kuakini, at the time:

Saturday, November 22nd, 1829
Journal at Byron's Bay
Joseph Goodrich; to Jeremiah Evarts:
...May 12th, 1829.
By the request of the Gov. together with a desire to ascend the mountain directly from the bay at this place, & also to kill 2 or 3 beef for our own use and that of the Gov., & farther to take up some turnips & set out in a colder climate to see if they would not then go to seed upon the mountains for they do not go to seed down near the shore. Set out about day light to ascend to the higher regions, course about west, the distance from the shore to the woody region is about 5 miles the region that is principally used for the cultivation of *talo*, potatoes, sugar canes, bananas &c. about 3 miles in the woods is one of the highest cataracts in this part of the island. I judge it to be 100 & 90 or 50 feet high in the heavy rains an immense body of water rushes down with tremendous violence at other times the stream of water is quite small, a little farther up the whole bed of the river under ground for about 40 or 50 rods about mid way of which is a dark & dismal hole 30 or 40 feet to the water called by the natives Puka o Maui [page 12] the door, hole or entrance of Maui one of their former gods, the oven of this deity according to the natives is about a mile from the south west shore of the bay it is an old crater 60 or 70 feet deep & about 1/3 of mile in circumference, I now occupy it as pasture for my cows there are 3 craters that are directly back of me another in a right line the lower one is the oven, here he used to cook his food as the natives say.

The road or path more properly lay along the river Wailuku, sometimes it led into the woods, then to the margin again into the woods & back to the river the bed composed entirely of lava, the path was sometimes one side & the other continually crossing & recrossing the woody region, is very timbered many of the trees are 2, 3 & 4 in diameter, the timber consists chiefly of *ohia* & *koa* the former is a species of the apple tree of these islands, the latter seems to be an inferior kind of mahogany, some of makes good furniture, it is also the kind of timber out of which their canoes are made. The ascent in the woody region is very gradual above the woods it is much more abrupt after traveling hard all day with very short spells of resting, about sunset we got through the woods, leaving all the natives behind who did not arrive till the next day. The woods terminate very abruptly they are so thick of trees & under brush that are almost impassable a few rocks only can be seen ahead, on emerging from the woods a wide extended plain presents itself along the side of ***Maunakea***, the plain is 6 or 8 miles wide interspersed with clumps and groves of *koa* trees of stinted growth [page 13] resembling orchards of apple trees with numerous herds of wild cattle grazing in almost every direction. The plain if I may so call it for so it appears at a distance is broken into ridges & valleys, & very stony, the rocks all volcanic, the whortleberry & strawberry here abounds to perfection in the season of them which is from July to Nov or even later especially the whortleberry. In reaching the place of our lodging I found a large fire prepared by Honolii who had proceeded me in opening the path to the mountain, the fire was barely acceptable as I was wet & cold, having traveled most of the way among the clouds which do not commonly extend higher up than the woody region, & are perpetually distilling their water in the woody region below. It was in a cave where we took up our lodgings, in some parts it was quite spacious, in others so

low that we could not sit upright. The place where I laid my head was about 18 inches high, it however was a very comfortable resting place. Early in the morning set out in pursuit of a bullock, they were to be seen in almost every direction. I directed my course toward 2 bulls that were near the skirts of a small grove of *koa* trees, in about half an hour I shot at one who went a few rods & fell dead the other went but a few rods farther & stood watching his fallen companion. I did not succeed in getting near to him but shot at a long distance, the gun being an indifferent one liable of execution & he made off with himself. I sometimes wish that I had a good rifle, as the chiefs had given me [page 14] permission to kill a bull whenever I am so disposed. I have availed myself of the right of killing one or two about twice in the course of a year, the greatest objection to killing oftener is the badness of the road through the woody region, the natives are from a day & a half to two days in coming down with a load of beef. For several succeeding days I was unable to kill any in consequence of the mountain being enveloped in clouds, at length the mountain became clear from clouds I started early in the morning & in about an hours time I was treading frozen ground being near the upper extremity of the region of vegetation, when I soon succeeded in killing a fine cow & towards night I killed another for the Gov. The cows are far better beef than the bull, the latter are uniformly dry or lean, while the cows are almost always as fat as stall fed beef. There is not much danger in killing wild cattle provided I have a good rifle, but with a poor one like the one that I have, it is rather disagreeable shooting & sounding so that they either chase in or I must them & frequently loose them after all. Having spent 4 or 5 days I could not well spare the time to ascend the mountain so we returned having obtained a good supply of beef... [page 15; A.B.C.F.M. Collection, Houghton Library, Harvard]

Gerrit P. Judd's Account of a Visit to the Summit of Mauna Kea And Travel Across Plateau Lands between Mauna Kea and Mauna Loa in 1830

Gerrit P. Judd, was a doctor attached to the Sandwich Island Mission Station, at Honolulu. Because of his medical expertise, he was frequently in the company of the *ali'i* and made tours around the islands. In April, 1830, while on a visit to Waimea, Judd and a native guide, John Honolii, walked to the upper region of Mauna Kea (not reaching the summit). On his return, he brought back snow, which he gave to Governor Kuakini, the first touched by the governor. Later, in June and July of the same year, Judd again traveled across the mountain lands. His narratives describe travel around the Hāmākua-Laupāhoehoe trail to Hilo Bay, skirting the upper forest lands, and travel across the saddle lands between Mauna Kea and Mauna Loa, from the upper region of Keauhou, Ka'ū.

Honolulu, August 19th, 1830
Gerrit P. Judd;
to Jeremiah Evarts, Esqr.
Missionary Rooms, Handover St., Boston:
...[March] 19th. Gov. Adams arrived with all his train, he intends spending some months with us, to catch wild cattle... [page 4]

[April] 4th Sabbath. Gov. Adams having commenced his buildings at Aalii for the sake of being near the wild cattle, & erected large Ranai proposed to hold public worship there. Mr. R. attended today he reports a congregation in the forenoon of 4,000.

[April] 23. Yesterday morning the weather being clear and inviting I set off in company with John Honolii and other natives to visit the top of ***Mauna Kea***. I rode a mule furnished me by the Governor. We ascended until about 2 P.M. when we were overtaken with a violent thunderstorm. We were compelled to take shelter in a cave and the storm continuing to rage, we remained all night. Arose early this morning, left the mule & proceeded on foot. The atmosphere was clear, we had a delightful view of the scenery below, which certainly surpasses anything I have seen before. Clouds soon obscured our sight for the rest of the day. [page 6] Reached the snow about noon, ascended a short distance, but found myself

too much fatigued to ascend the summit. There was indeed little inducement, the prospect was so obscured by clouds. I therefore descended bringing with me a large bundle of snow. Arrived at the cave at 5 P.M. bestrode the mule & reached home about 9 o'clock in the evening. There is little vegetation on this side of the mountain except coarse grass which is plenty, two thirds of the distance. The ascent is not difficult, the cattle ascend to the snow in search of water.

24th. Sent the bundle of snow to Gov. Adams who had never before seen any except on the distant mountain top, he appeared much gratified with tasting & handling it... [page 7]

[July] 3rd. Returned from my visit [to Kilauea]. I left home early on the morning of the 24th travelling towards the eastern side of ***Mauna Kea***, my route the two first days was through thick woods frequented only by sandalwood cutters & wild cattle until I arrived at ***Laupahoehoe***. I then proceeded along the sea shore to Hilo a distance of about 20 miles. The country here is extremely fertile, but rather unpleasant, on account of the almost incessant rains, that it is well watered you will believe when I tell you that I crossed more than 50 streams with banks from one to five hundred feet high on each side. I was forced to ford many that were 2 or 3 feet in depth at the most shallow part that could be found. In one instance was ferried across in a canoe... [page 9]

[June 31; departing from Kilauea] Parted with Mr. & Mrs. Andrews about noon on Thursday in order to return to Waimea by a direct rout over the unfrequented country between ***Mauna Roa & Mauna Kea***. *I found this journey excessively fatiguing. We travelled over rough lava without a path sleeping on the ground & in the huts of sandal wood cutters, without much food or water. The south & western sides of* ***Mauna Kea*** *are altogether unlike the North & East.* The former dry and barren, the latter rich with wooded & susceptible of cultivation one third of the distance upwards... [page 10; A.B.C.F.M. Collection, Houghton Library, Harvard]

The Journal of Hiram Bingham (notes of 1830)

In 1830, Reverend Hiram Bingham and family visited Waimea, and in September they were joined by members of the royal household. It was during the September visit that Kauikeaouli (Kamehameha III) and party, in the company of Bingham, traveled to the summit of Mauna Kea, via the Waimea-Waiki'i-Kalai'eha route. Bingham's journal includes descriptions of the Waimea region, including the community, industry, and landscape, and also documents the royal visit to Mauna Kea:

...Crossing over to Kawaihae...we ascended at evening to the new inland station [Waimea]. When we had escaped from the oppressive heat on the shore, and reached the height of about 2000 feet, we were met by a slight rain and a chilly wind, which made our muscles shiver... ...as we came within some twenty-five miles of the snows of the mountain... ...The full-orbed moon looked serenely down from her zenith upon the hoary head of ***Mauna Kea***, and the ample and diversified scenery around. The babbling brook [Waikōloa], the sound of a small cataract in a glen, the rustling in the tops of the trees, at a little distance, the scattered huts of the natives in the settlement, while their occupants were hushed at midnight, and the hospitable light of a fire and lamp, beaming from a glass window of the missionary cottage pitched near the north side of the plain, over against ***Mauna Kea***...

...Riding out one day to call on Gov. Adams, who had done liberally for the station by the erection of the buildings, I was delighted, on my way to his temporary residence, with the grandeur and beauty of the scenery around me. The clear rippling streams that wind their way along the verdant plain, through alternate plats of shrubbery, grass, *kalo*, sugar-cane, bananas, flowering bushes, and wild vines, occasionally crossed my path. Beyond the scattered cottages, the wild cattle were grazing unrestrained on their own unenclosed

territories bordering on the mountain. The green hills and mountains of Kohala, crowned with trees and shrubbery, and their sides partly cultivated and partly covered with grass of spontaneous growth, rose on the north side of the plain. The distant hoary Mauna Loa appeared in the south. Much nearer, on the south-east, the majestic ***Mauna Kea*** lifted his snowy summit in his ample form, exhibiting his peaks and precipices and piles of scoria and gravel, and his rocks and forests; and in the south-west, Hualalai, another volcanic mountain, with its terminal quiescent crater [page 374], presented no mean height and dimensions, being 9000 feet high, and forty miles long... [page 375]

Ascent of Mauna Kea.

...The king set out with a party of more than a hundred, for an excursion further into the heart of the island, and an ascent to the summit of ***Mauna Kea***. To watch over and instruct my young pupil, and to benefit my health, I accompanied him. The excursion occupied nearly five days, though it might have been accomplished much sooner. Crossing in a southerly direction the plain of Waimea, some on horseback and some on foot, the party ascended a small part of the elevation of the mountain, and being in the afternoon enveloped in dense fog, they halted and encamped for the night. The next day they passed over the western slope of the mountain to the southern side, thence eastward along a nearly level plain, some seven thousand feet above the level of the sea, to a point south of the summit, and encamped out again, in the mild open air. In the course of this day's journey, the youthful king on horseback, pursued, ran down, and caught a yearling wild bullock, for amusement and for a luncheon for his attendants. A foreigner lassoed and killed a wild cow.

The next day was occupied chiefly in ascending in a northerly direction, very moderately. Our horses climbed slowly, and by taking a winding and zigzag course, were able, much of the way, to carry a rider. Having gained an elevation of about ten thousand feet, we halted and encamped for the night, in the dreary solitudes of rocks and clouds. When the night spread her dark, damp mantle over us, we found ourselves in the chilly autumnal atmosphere of the temperate zone of this most stupendous Polynesian mountain. Below us, towards Mauna Loa, was spread out a sea of dense fog, above which the tops of the two mountains appeared like islands. We found it a pretty cold lodging place. Ice was formed in a small stream of water near us, during the night. *As the company were laying themselves down, here and there, upon the mountain side, for sleep, I observed that the king and Keoniana, subsequently premier, and a few others, having found a cave about four feet high, ten wide, and eight deep, made by a projecting rock, which would afford a shelter from a shower, and partially from wind and cold, had stretched themselves out to sleep upon the ground in front of it. I was amused to see that their heads protruded somewhat more than six feet from the mouth of the cave, and asked, "Why do you not* [page 377] *sleep under the rock, which is so good a sleeping house for you?" Keoniana, always ready, replied, "We don't know at what time the rock will fall." Whether the apprehension that the firm rock might possibly fall upon the head of the king that night or their unwillingness that any ignoble foot should walk above it, or some other fancy, were the cause of his declining the shelter, did not appear.*

In the morning we proceeded slowly upwards till about noon, when we came to banks of snow, and a pond of water partly covered with ice. In his first contact with a snow bank, the juvenile king seemed highly delighted. He bounded and tumbled on it, grasped and handled and hastily examined pieces of it, then ran and offered a fragment of it in vain to his horse. He assisted in cutting out blocks of it, which were wrapped up and sent down as curiosities to the regent and other chiefs, at Waimea, some twenty-eight miles distant... [page 378]

...We descended hastily to the north-west, about twelve miles, sometimes taking leap after leap boldly down steep places of fragmentary scoria and gravel, and sometimes advancing cautiously among rocks, shrubs, trees, and wild cattle. Towards midnight we came to the place of the king's party, near the plain of Waimea, and the next day returned to the station there. As we crossed the plain, we witnessed several striking exhibitions of seizing wild cattle, chasing them on horseback, and throwing the lasso over their horns, with great certainty, capturing, prostrating, and subduing or killing these mountain-fed animals, struggling in vain for liberty and life... [Bingham 1969:379]

Bingham's record for 1830 also includes descriptions of visits to Kīlauea, and a subsequent journey overland to the plateau lands between Mauna Loa and Mauna Kea, on their way to Waimea. The trip took the group past Kalai'eha, and in the shadow of "Waihalulu" (Waikahālulu) Gulch where water was found. The narrative then describes travel through the Pōhakuloa vicinity and past Waiki'i, and on out to the Waimea plain:

...After spending about thirty hours at Pele's chief seat, we set off, towards evening, on the 21st, to cross the wilderness to Waimea, which required the time of a little more than two days and two nights. Walking till late, we laid ourselves down where we could find a place. The next day we continued our journey northwardly, towards ***Mauna Kea***, lodging out in the wilderness, in the same manner, at night, the majestic mountain being half a day's walk to the north of us.

Rose at four o'clock from our mountain couch, — a day's journey from any human habitation; saw lightning at a great distance at sea – our elevation being 4000 or 5000 feet; packed our sleeping *kapa*; offered our morning sacrifice in these solitudes of the centre of Hawaii, and as the day dawned, set forward on our journey. We passed over several large tracts of lava, of different kinds, some smooth, vitreous, and shining, some twisted and coiled like huge ropes, and some consisting of sharp, irregular, loose, rugged volcanic masses, of every form and size, from an [page 393] ounce in weight, to several tons, thrown, I could not conceive how, into a chaos or field of the roughest surface, presenting a forbidding area, from one to forty square miles in extent, and though not precipitous, yet so horrid as to forbid a path, and defy the approach of horses and cattle. In the crevices of the more solid lava we found the *ohelo*, somewhat resembling the whortleberry, nourished by frequent showers and dew. *At ten o'clock, we halted for breakfast; raised a smoke, as a signal for the horse keeper, at the watering-place, at the south base of* ***Mauna Kea,*** to approach, and moved on, till twelve o'clock, when I was very glad to see and mount the horse sent over from Waimea to meet me. Our company having become considerably scattered, and pressing on, under a mid-day, tropical sun, were soon collected together by the loud shout, "Here's water," made by the keeper of the horse, who had very considerately brought us a calabash from ***Waihalulu***, cold and sweet, for the refreshment of our weary and thirsty travellers. We drank round, and this gourd bottle soon sounded empty. I mounted and set forward with comfort and revived courage, leaving most of the company to proceed at their leisure.

One of the keepers of the horse wishing to accompany me, girded up his loins, and like Elijah before Ahab, ran cheerfully before me, westward, along the south side of ***Mauna Kea***, about ten miles, then northward, over its undulated, western slope, about the same distance. We halted on the ridge, half an hour, then pressed on till six o'clock, when the sun, having finished his daily race, sank with great grandeur and beauty into the western waters of the vast Pacific, sending back a pleasant farewell to the clouds that hung over Hualalai, Mauna Loa, and ***Mauna Kea***, the three Hawaiian mountains, and shooting upwards his diverging rays with peculiar beauty, after the last limb of his broad, golden disk had disappeared. About seven, we reached Waimea, thus completing my excursion of about 175 miles, with improved health for resuming the labors of the station... [Bingham 1969:394]

"Hua Hekili" A Hail-storm on Mauna Kea in 1830

In 1830, Goodrich again returned to the summit of Mauna Kea, this time, in the company of natives. On the trip, they experienced a hail storm, the hail being called "*hua ke hekili*" (fruit of thunder). Goodrich searched for, but did not find the pond, Waiau, though they did find a stream fed by the melting snow. Goodrich also reported that on the flat lands between Mauna Kea and Mauna Loa, they found many huts, formerly used by the sandal wood cutters:

Byron's Bay, Hawaii
December 30, 1830
Joseph Goodrich; to Jeremiah Evarts:

Being favoured with an associate Mr. Andrews & wife who came up here to spend a season to assist in labouring for the good of souls here, having had a previous request to visit the brethren at Waimea. I thought it desirable to improve the earliest opportunity to comply with their request. I left home the latter part of May in company with 7 or 10 natives. We went directly up the mountain till we reached the upper region of vegetation, then turning to the left of the mountain, as we were passing along to the south east of the summit being probably 12000 feet above the level of the sea, we came in contact with a hail storm. Being the first that I had seen since passing Cape Horn. Here it was quite amusing to see the natives to use their endeavors to catch it as it fell, some with their hats & some with the tops of their callabashes held out to catch it, but they were disappointed for some time saying that it went into their hats or callabashes but that it flew directly out again. At last having collected some they commenced eating them or here they expressed surprise, exclaiming, "*huihui eha loa ka niho*" it was very cold & hurt the teeth. They call hail stones, *hua ke hekili*, a fruit/eggs of thunder. One asked me, "*No ke aha la e noho wale no ke anuanu maluna o ka mauna?*" Why does cold dwell or stay only upon the top mountain? One says that he has no hands, another that his feet are thick, another that [page 1] his nose is numbed. *We descended again into the valley between the mountains, having* ***Mauna Kea*** *on our right, Mauna Loa on the left. Some part of the way is sandy, interspersed with trees & shrubberies & many huts of the sandal wood cutters, though these inhabitants have previously left them. Their present occupant disputed our entrance and we much preferred to recline out in the sun, than to contend with so many formidable oppressors.*

The valley between the mountains is probably 8,000 or 10,000 feet above the level of the sea. Mauna Loa presents a most appalling aspect scarcely any is to be seen but black & weary looking lava; currents of rough & black looking lava commenced at the top of Mauna Loa, & I should think after running a distance of 50 miles or more, fell into the sea Kawaihae. We arrived at Waimea & found all comfortable; after the sabbath we commenced our return. Designing to ascend the summit in search of the pond of water of which I had frequently heard, we followed the same route very nearly that I pursued the first time that I ascended the mountain. When a tour of the island was made by a deputation from the mission. We discovered nothing very special except a beautiful stream of water murmuring from the mountain, it was occasioned by the melting of the snow & had its head in the pond of water for which I was looking, but having no guide we passed within about a half a mile of it as I afterward was informed we have since seen it. It is 40 or 50 rods in circumference as Mr. Bingham has been up there & seen it, I presume that he has given a particular account of it, it is therefore unnecessary for me to do it. I also saw as below fragments of granite imbeded in lava, this cohesion of almost all of it was very feeble which was probably destroyed by the action of volcanic fires. In traveling on the loose masses & fragments of lava, the sound under foot would very nearly resembles that of traveling over plates of iron; solid mound precipices slags, cinder, scoria & sand [page 2] compose the principal part of the summit of ***Mauna Kea***, while Mauna Loa is composed almost entirely of black compact lava of a hard infused mass of jet black appearance, while some inclines to an ebony colour. I find it very interesting to ascend the

summit being afflicted with a severe pain in the head. The natives also complaining of the same, several times, while in the upper regions. I have been attacked with violent vomiting of bilious matter, all these complaints to subside as we descend the mountain... [page 3; A.B.C.F.M. Collection, Houghton Library Harvard]

Mauna Kea and the Mountain Lands Described by David Douglas in 1834

In January 1834, naturalist David Douglas visited the island of Hawai'i, and ascended Mauna Kea. The records of the trip kept by Douglas (published in the Hawaiian Spectator of 1839) provide us with detailed descriptions of the journey from Hilo Bay to the mountain, with discussions on the natural environment, make up of the forests, and changes in the landscape as the elevation was increased. A number of plants collected by Douglas, were subsequently named for him, though his place in history on the mountain lands is more readily remembered by the fact that he died on the mountain while on his second visit to the island. While walking the old mountain trail, skirting the forest zone between Humu'ula and the Waipunalei-Laupāhoehoe boundary, Douglas apparently fell into a dug-out trap meant to catch wild bullocks, and was killed by a trapped animal. The location of this accident was at a place named Keahua-ai, and is in the vicinity of the place known today as "Kaluakauka," The Doctor's Pit, or Douglas Pit (see Register Map No. 667).

Douglas wrote the following account of his first trip to Mauna Kea and the mountain lands:

> ...On Tuesday, the 31st of December, we stood in for the island of Hawaii, and saw ***Mauna Kea*** very clearly, a few small stripes of snow lying only near its summit, which would seem to indicate an altitude inferior to that which has been commonly assigned to this mountain.
>
> My object being to ascend and explore ***Mauna Kea***, as soon as possible, I started on the 7th January, 1834, and, after passing for rather more than three miles over plain country, commenced the ascent, which was however gradually entering the wood. Here the scenery was truly beautiful. Large timber trees were covered with creepers and species of *Tillandsia*, while [page 399] the Tree Ferns gave a peculiar character to the whole country. We halted and dined at the saw-mill, and made some barometrical observations, of which the result is recorded, along with those that occupied my time daily during the voyage, in my Journal.
>
> Above this spot the Banana no longer grows, but I observed a species of *Rubus* among the rocks. We continued our way under such heavy rain, as with the already bad state of the path, rendered walking very difficult and laborious; in the chinks of the lava, the mud was so wet that we repeatedly sank in it, above our knees.
>
> Encamping at some small huts, we passed, an uncomfortable night, as no dry wood could be obtained for fuel, and it continued to rain without intermission. The next day we proceeded on our way at eight o'clock, the path becoming worse and worse.
>
> The large Tree Ferns, and other trees that shadowed it, proved no protection from the incessant rain, and I was drenched to the skin the whole day, besides repeatedly slipping into deep holes full of soft mud. The number of species of *Filices* is very great, and toward the upper end of the wood, the timber trees, sixty or seventy feet high, and three to ten inches in circumference, are matted with Mosses, which together with the *Tillandsias* and Ferns, betoken an exceedingly humid atmosphere. The wood terminates abruptly; but as the lodge of the cattle hunter was still about a mile and a half farther up the clear flank of the mountain, situated on the bank of a craggy lava stream, I delayed ascertaining the exact altitude of the spot where the woody region ends, (a point of no small interest to the Botanist) until my return, and sat down to rest myself awhile, in a place where the ground was thickly carpeted with species of *Fragaria* [*'ōhelo papa*] some of which were in

blossom, and a few of them in fruit. Here a Mr. Miles, part owner of the saw-mill that I had passed the day before, came up to me; he was on his way to join his partner, a Mr. Castle, who was engaged in curing the flesh of the wild cattle near the verge of the wood, and his conversation helped to beguile the fatigues of the road, for though the distance I had accomplished this morning was little more than [page 400] seven miles, still the laborious nature of the path, and the weight of more than 60 lbs. on my back, where I carried my barometer, thermometer, book and papers, proved so very fatiguing, that I felt myself almost worn out. I reached the lodge at four, wet to the skin, and benumbed with cold, and humble as the shelter was, I hailed it with delight. Here a large fire dried my clothes, and I got something to eat, though, unluckily, my guides all lingered behind, and those who carried my blanket and tea kettle were the last to make their appearance. These people have no thought or consideration for the morrow; but sit down to their food, smoke and tell stories, and make themselves perfectly happy.

The next day my two new acquaintances went out with their guns and shot a young bull, a few rods from the hut, which they kindly gave me for the use of my party. According to report, the grassy flanks of the mountain abound with wild cattle, the offspring of the stock left here by Capt. Vancouver, and which now prove a very great benefit to this island. A slight interval of better weather this afternoon afforded a glimpse of the summit between the clouds, it was covered with snow. *At night the sky became quite clear, and the stars, among which I observed Orion, Canis minor, and Canopus, shone with intense brilliancy.*

The next day the atmosphere was perfectly cloudless, and I visited some of the high peaks which were thinly patched with snow. On two of them which were extinct volcanoes, not a blade of grass could be seen, nor any thing save lava, mostly reddish, but in some places of a black color. Though on the summit of the most elevated peak, the thermometer under a bright sun, stood at 40º, yet when the instrument was laid at an angle of about fifteen degrees, the quicksilver rose to 63°, and the blocks of lava felt sensibly warm to the touch. The wind was from all directions, east and west, for the great altitude and the extensive mass of heating matter completely destroyed the Trade wind. *The last plant that I saw upon the mountain was a gigantic species of the Compositoe (Argyrophyton Douglasii, Hook. Ic. Plant. t. 75.,) [hinahina, 'āhinahina] with a column of imbricated sharp pointed leaves, densely [page 401] covered with a silky clothing. I gathered a few seeds of the plants which I met with, among them a remarkable Ranunculus, which grows as high up as there is any soil.* One of my companions killed a young cow just on the edge of the wood, which he presented me with, for the next day's consumption.

Night arrived only too soon, and we had to walk four miles back to the lodge across the lava, where we arrived at eight o'clock, hungry, tired and lame, but highly gratified with the result of the day's expedition.

The following morning proved again clear and pleasant, and every thing being arranged, some of the men were despatched early, but such are the delays which these people make, that I overtook them all before eight o'clock. They have no idea of time, but stand still awhile, then walk a little, stop and eat, smoke and talk, and thus loiter away a whole day.

At noon we came up to the place where we had left the cow, and having dressed the meat, we took a part and left the rest hanging on the bushes. We passed to the left of the lowest extinct volcano, and again encamped on the same peak as the preceding night. It was long after dark before the men arrived, and as this place afforded no wood, we had to make a fire of the leaves and dead stems of the species of *Compositoe* mentioned before, and which together with a small *Juncus*, grows higher up in the mountain than any other

plant. The great difference produced on vegetation by the agitated and volcanic state of this mountain is very distinctly marked. Here there is no line between the *Phenogamous* and *Cryptogamous* Plants, but the limits of vegetation itself are defined with the greatest exactness, and the species do not gradually diminish in number and stature; as is generally the case on such high elevations.

The line of what may be called the Woody Country, the upper verge of which the barometer expresses 21, 450 inch.; therm. 46º, at 2 P.M., is where we immediately enter on a region of broken and uneven ground with here and there lumps of lava, rising above the general declivity to a height of three hundred to four hundred feet, intersected by deep chasms, which [page 402] show the course of the lava when in a state of fluidity. This portion of the mountain is highly picturesque and sublime. Three kinds of timber of small growth, are scattered, over the low knolls, with one species of *Rubus* and *Vaccinium*, the genus *Fragaria* and a few *Gramaineoe Filices* and some alpine species. This region extends to bar. 20,260 inch.; air 40º, dew point 30º. There is a third region, which reaches to the place where we encamped yesterday, and seems to be the great rise or spring of the lava, the upper part of which, at the foot of the first extinct peak is bar. 20,010 inch., air 39º.

At six o'clock the next morning, accompanied by three Islanders and two Americans, I started for the summit of the mountain; bar. at that hour indicated 20,000 inch., therm. 24º, hygr. 20º, and a keen west wind was blowing off the mountain, which was felt severely by us all, and especially by the natives, whom it was necessary to protect with additional blankets and great coats. We passed over about five miles of gentle ascent, consisting of large blocks of lava, sand, scoriae, and ashes, or every size, shape and color, demonstrating all the gradations of calcination from the mildest to the most intense. This may be termed the Table land or Platform, where spring the great vent holes of the subterranean fires or numerous volcanoes. The general appearance is that of the channel of an immense river heaved up. In some places the round bowlders of lava are so regularly placed, and the sand is so washed in, around them, as to give the appearance of a causeway, while in others, the lava seems to have run like a stream. We commenced the ascent of the Great Peak at nine o'clock, on the N. E. side, over a ridge of tremendously rugged lava, four hundred and seventy feet high, preferring this course to the very steep ascent of the south side, which consists entirely of loose ashes and scoriae, and we gained the summit soon after ten. Though exhausted with fatigue before leaving the Table Land, and much tried with the increasing cold, yet such was my ardent desire to reach the top, that the last portion of the way seemed the easiest. This is the loftiest of the chim- [page 403] neys; a lengthened ridge of two hundred and twenty-one yards two feet, running nearly strait N. W.

To the north, four feet below the extreme summit of the Peak, the barometer suspended, the cistern being exactly below, and when the mercury had acquired the temperature of the circumambient air, the following register was entered: at 11 hrs. 20 min.; bar. 18-362 inch.; air 33º; hygor. 0" 5. At twelve o'clock the horizon displayed some snowy clouds; until this period, the view was sublime to the greatest degree, but now every appearance of a mountain storm came on. The whole of the low S. E. point of the island was throughout the day covered like a vast plain of snow, with clouds. The same thermometer, laid on the bare lava, and exposed to the wind at an angle of 27º, expressed at first 37º, and afterwards, at twelve o'clock 41º, though when held in the hand, exposed to the dew it did not rise at all. It may well be conjectured that such an immense mass of heating material, combined with the influence of internal fire, and taken in connexion with the insular position of ***Mauna Kea***, surrounded with an immense mass of water, will have the effect of raising the snow line considerably; except on the northern declivity, or where sheltered by large blocks of lava, there was no snow to be seen; even on the top of the ***cairn***, where

the barometer was fixed, there were only a few handsful. One thing struck me as curious, the apparent non-diminution of sound; not as respects the rapidity of its transmission which is, of course, subject to a well known law. Certain it is, that on mountains of inferior elevation, whose summits are clothed with perpetual snow and ice, we find it needful to roar into one another's ears, and the firing of a gun, at a short distance, does not disturb the timid Antelope on the high snowy peaks of N. W. America. Snow is doubtless a non-conductor of sound, but there may be also something in the mineral substance of ***Mauna Kea*** which would effect this.

Until eleven o'clock, the horizon was beautifully defined on the whole N. W. of the island. The great dryness of the air is evident to the senses, without the assistance of the hygrometer. Walking with my trousers rolled up to my knees, and without shoes, I [page 404] did not know there were holes in my stockings, till I was apprised of them by the scorching heat and pain in my feet, which continued throughout the day, the skin also peeled from my face. While on the summit I experienced violent head ache, and my eyes became blood shot, accompanied with stiffness in their lids.

Were the traveler permitted to express the emotions he feels when placed on such an astonishing part of the earth's surface, cold indeed must his heart be to the great operations of Nature, and still colder towards Nature's God, by whose wisdom and power such wonderful scenes were created, if he could behold them without deep humility and reverential awe. Man feels himself as nothing—as if standing on the verge of another world. A death like stillness of the place, not an animal nor an insect to be seen—far removed from the hustle and bustle of the world, impresses on his mind with double force the extreme helplessness of his condition, an object of pity and compassion, utterly unworthy to stand in the presence of a great and good, and wise and holy God, and to contemplate the diversified works of His hands.

I made a small collection of geological specimens, to illustrate the nature and quality of the lavas of this mountain, but being only slightly acquainted with this department of Natural History, I could do no more than gather together such materials as seemed likely to be useful to other and more experienced persons. As night was closing and threatening to be very stormy, we hastened towards the camp, descending nearly by the same way as we came, and finding my guide Honori and the other men all in readiness, we all proceeded to the edge of the woody region, and regained the lodge, highly gratified with the result of this very fatiguing day's excursion. Having brought provision from the hill, we fared well.

January the 13th. The rain fell fast all night, and continued accompanied by a dense mist, this morning, only clearing sufficiently to give us a momentary glimpse of the mountain, covered with snow down to the woody region. We also saw Mauna Roa, which was similarly clothed for a great part of its height. Thankful had we cause to be that this heavy rain, [page 405] wind and fog did not come on while we were on the summit, as it would have caused us much inconvenience and perhaps danger.

The same weather continuing until the 15th, I packed up all the baggage and prepared to return. It consisted of several bundles of plants, put into paper and large packages tied up in *Koa* baskets, which are manufactured from a large and beautiful tree, a species of *Acacia*, of which the timber resembles mahogany, though of a lighter color, and is beautiful, and said to be durable: also some parcels of geological specimens, my instruments, etc. At seven A.M. I started, having sent the bearers of my luggage before me, but I had hardly entered the wood by the same path, as I took on my ascent, when the rain began to fall, which continued the whole day without the least intermission; but as there was no place suitable for encamping, and the people, as usual, had straggled away from one another, I resolved to proceed. The path was in a dreadful state, numerous

rivulets overflowed it in many places, and rising above their banks, flashed in foam through the deep glens, the necessity for crossing which impeded my progress in no slight degree. In the low places the water spread into small lakes, and where the road had a considerable declivity, the rushing torrent which flowed down it, gave rather the appearance of a cascade than a path. The road was so soft that we repeatedly sank to the knees and supported ourselves on a lava block, or the roots of the trees. Still, violent as was the rain, and slippery and dangerous the path, I gathered a truly splendid collection of Ferns, of nearly fifty species, with a few other plants, and some seeds, which were tied up in small bundles, to prevent fermentation, and these protected by fresh *Koa* bark. Several beautiful specimens of Mosses and Lichens were also collected; and spite of all the disadvantages and fatigues that I underwent, still the magnificence of the scenery commanded my frequent attention, and I repeatedly sat down in the course of the day under some huge spreading Tree Fern, which more resembled an individual of the Pine than the Fern tribe, and contemplated with delight the endless variety of form and structure that [page 406] adorned the objects around me. On the higher part of the mountain, I gathered a Fern identical with the *Asplenium viride* of my own native country, a circumstance which gave me inexpressible pleasure, and recalled to my mind many of the happiest scenes of my early life.

In the evening I reached the saw-mill, when the kind welcome of my mountain friend, Mr. Miles, together with a rousing fire, soon made me forget the rain and fatigues of the day. Some of the men had arrived before me, others afterwards, and two did not appear till the following day; for having met with some friends, loaded with meat, they preferred a good supper to a dry bed. My guide, friend, and well disposed fellow, arrived in great dismay, having in the dark, entered the river a short distance above a chain of cataracts, and to avoid these, he had clung to a rock till extricated by the aid of two active young men. Though he escaped unhurt, he had been exposed to the wet for nearly ten hours. A night of constant rain succeeded, but I rested well, and after breakfast having examined all the packages, we quitted the saw mill for the bay, and arrived there in the afternoon, the arrangement and preservation of my plants affording me occupation for two or three days. It was no easy matter to dry specimens and paper during such incessantly rainy weather. I paid the whole of the sixteen men who had accompanied me, not including Honori and the king's man, at the rate of two dollars, some in money, and some in goods; the latter consisted of cotton cloth combs, scissors and thread, etc.; while to those who had acquitted themselves with willingness and activity, I added a small present in addition. Most of them preferred money, especially the lazy fellows. The whole of the number employed in carrying my baggage and provisions, was five men, which left eleven for the conveyance of their own tapas and food. Nor was this unreasonable for the quantity of food which a native will consume in a week, nearly equals his own weight! A dreadful drawback on expedition. Still though the sixteen persons ate two bullocks in a week, besides what they carried, a [page 407] threatened scarcity of food compelled me to return rather sooner than I should have done, in order that the calabashes might be replenished. No people the world can cram themselves to such a degree as the Sandwich Islanders; their food is however, of a very light kind, and easy of digestion... [Douglas in Hawaiian Spectator, 1839:408]

Having completed his trek to both Mauna Kea and Mauna Loa, Douglas also visited Kilauea and then returned to O'ahu. In July of 1834, Douglas returned to Hawai'i for a second trip to Mauna Kea. This trip was made via Waimea-Laumai'a mountain trail, and was the last trip he made. Circumstances around his last days and death, were written up by reverends Joseph Goodrich and John Diell, published in the Missionary newspaper, *Ke Kumu Hawaii* on November 26, 1834:

Death of Mr. Douglas.

The following letter has been kindly furnished for publication. It may be proper to remark that Mr. David Douglas, whose untimely and tragical death his friends and the community

sincerely deplore, was born at Perth, Scotland, and had travelled in various parts of the world as a naturalist connected with the Horticultural Society of London. It is supposed his age was about 40 years.

The body was examined at Honolulu, Aug. 3, by a number of medical gentlemen, and from the marks found on it, they were unanimous in the opinion that his death was accidental.

Hilo, Hawaii, July 15, 1834.
To Richard Charlton, Esq., his Britannic Majesty's Consul at the Sandwich Islands;

Dear Sir,—Our hearts almost fail within us, as we undertake to perform the melancholy duty which devolves upon us to communicate the painful intelligence of the death of our friend Mr. Douglas, and such particulars thus far, as we have been able to gather.

The tidings reached us when we were every moment awaiting his arrival, and expecting to greet him with a cordial welcome. But alas! He whose ways and thoughts are not as ours, saw fit to order it otherwise; and instead of being permitted to welcome the living friend, our hearts have been made to bleed as we have performed the offices of humanity to his mangled corpse. Truly, we must say that the ways of the Lord are mysterious, and his judgments past finding out. But it is our unspeakable consolation to know that those ways are directed by infinite wisdom and mercy, and that though clouds and darkness are round about Him, yet righteousness and judgment are the habitation of his throne.

But we proceed to lay before you as full information as it is in our power to do at the present time, concerning, this distressing [page 13] event. As Mr. Diell was standing in the door of Mr. Goodrich's house yesterday morning, about 8 o'clock, a native came up, and with an expression of countenance, which indicated but too faithfully that he was the bearer of sad tidings, inquired for Mr. Goodrich; in seeing him, he communicated the dreadful intelligence that the body of Mr. Douglas had been found on the mountains, in a pit excavated for the purpose of taking wild cattle, and that he was supposed to have been killed by the bullock which was in the pit when Mr. Douglas fell in. Never were our feelings so shocked, nor could we credit the report till it was painfully confirmed as we proceeded to the beach, whither his body had been conveyed in a canoe by the native who informed us of his death. As we walked down with the native, and made further inquiries of him, he gave, for substance, the following relation.

That on the evening of the 13th inst. the natives who brought the body down from the mountain, came to his house at ***Laupahoihoi***, about twenty-five or thirty miles distant from Hilo, and employed him to bring it to this place in his canoe. The particulars which he learned from them, were as follows:

That Mr. Douglas left Kohala point last week, in company with a foreigner (an Englishman) as a guide, and proceeded to cross ***Mauna Kea*** on the north side; that on the 12th inst. he dismissed his guide, who cautioned him, on parting, to be very careful lest he should fall into some of the pits excavated for the purpose mentioned above; describing their location as being near the places to which the cattle resorted to drink. That soon after Mr. Douglas had dismissed his guide, he went back a short distance to get a bundle which he had forgotten, and that as he was retracing his steps, at some fatal moment he fell into one of the pits, into which a bullock had previously fallen. That he was found dead in the pit by those same natives, who, ignorant at the time, of his passing, were in pursuit of bullocks, and on coming up to this pit, found a small hole in one end of the covering of it. At first they conjectured that a calf had fallen in, but on further examination, discovered traces of a man's steps, and soon afterwards saw his feet in the pit, the rest of his body

being covered with dirt and rubbish. They went immediately in pursuit of the guide, who returned, shot the bullock in the pit, took out the body, and hired the natives at the price of four bullocks, which he killed immediately, to convey the body to the sea shore. He himself accompanied them and procured the native who related the affair to us, to bring the body to this place, promising to come on himself immediately, and that he would bring the compass, watch, which was somewhat broken but still going, some money found in Mr. Douglas's pockets, and the little dog, that faithful companion of our departed friend. Thus for the report of the natives who brought the body in his canoe, and who professed to relate the facts to us as he learned them from the natives who came down from the mountain. We do not stop, at present, to examine how far it is consistent or inconsistent with itself, as we have not the means of making full investigation into the matter.

On reaching the canoe, our first care was to have the remains conveyed to some suitable place where we could take proper care of them, and Mr. Dibble's family being absent, it was determined to convey the body to his house. But what an affecting spectacle was presented, as we removed the bullock's hide in which he had been conveyed! We will not attempt to describe the agony of feeling which we experienced at that moment. Can it be he? can it be he? we each exclaimed, can it be the man with whom we parted but a few days before, and who then was borne up with so high spirits and expectations, and whom, but an hour before, we were fondly anticipating to welcome to faithfully contained in the familiar article of dress, in the features, and in the noble person before us. They were those of our friend.

The body, clothes, &c. appeared to be in the same state they were in when taken from the pit. The face was covered with dirt, the hair filled with blood and dirt, the coat, pantaloons and shirt considerably torn. The hat was missing. On washing the body, we found it in a shocking state; there were ten or twelve gashes on the head, a long one over the left eye, another rather deep, just above the left temple, a deep one behind the right ear, the left cheek bone appeared to be broken, and also the ribs on the left side, the abdomen was much bruised and also the lower part of the legs.

After laying him out, our first thought was to bury him within Mr. Goodrich's premises; but after we had selected a spot, and commenced clearing away the ground, doubts were suggested by a foreigner who was assisting us, and who has for some time been engaged in the business of taking wild cattle, whether the wounds on the head could have been inflicted by a bullock. Mr. Goodrich said that the same doubts had arisen to his own mind, while examining the body. The matter did not seem clear; many parts of the story appeared dark. How was is that Mr. Douglas was alone, without any guide, whether foreigner or native? Where was John, Mr. Diell's colored man, who left Honolulu with Mr. Diell, and who, on missing a passage with him from Lahaina, embarked with Mr. Douglas, as we are informed by the captain of the vessel in which Mr. Douglas sailed from Lahaina to Kohala Point, and there left the vessel with Mr. Douglas, on the morning of the 9th inst. in order to accompany him across the mountain to Hilo? How was it that Mr. Douglas should fall into a pit when retracing his steps after he had once passed it in safety? And if a bullock had already fallen into it, how was it that he did not see the hole necessarily made in the covering?—These difficulties occurred to our minds, and we thought it due to the friends of Mr. Douglas, and to the public, whom he had so zealously and so usefully served, that an examination should be made of his body by medical men. The only way to have this effected, was by preserving his body, and it could be examined here. The former method seemed most desirable; accordingly we had the contents of the abdomen removed, the body filled with salt placed in a coffin which was then filled with salt, and the whole enclosed in a box filled with brine. Some fears are entertained whether the captain of the native vessel will carry the body to Honolulu, this will be determined in the morning. After the body was laid in the coffin, the members of the mission family and

several foreigners assembled at the house of Mr. Dibble, to pay their tribute of respect to the mortal remains of the deceased, and to improve the affecting Providence to their own good. Prayers were offered, and a brief address made, and we trust that the occasion may prove a lasting blessing to all who were present. After the services were concluded, the body was removed to a cool native house, where it was enclosed in the box.

16th. As neither the guides nor any other natives have arrived, we have employed two foreigners to proceed to the place where with directions to find the natives who discovered the body, and to go with them to the pit, and after making as full inquiries as possible, to report to us immediately.

So far as we can ascertain, the guide is an Englishman, a convict from Botany Bay, who left a vessel at these islands some years ago; he has a wife and one child with him, and to this circumstance, in part, may be attributed his delay.

There are two native vessels in port, besides the one about to sail to day; by these vessels we shall keep you apprized of all the information we can obtain, and hope that some clear light may yet be shed on a subject now involved in much darkness.

Mr. Goodrich has just returned from the vessel about to sail. The application to convey that remains of Mr. Douglas to Honolulu, we fear will prove unsuccessful, as the vessel is filled with wood, canoes, food, &c. It is barely possible, however, that the captain may yet consent to take the body on board. But if not, it will remain with yourself to determine what course shall be pursued. Should you deem it advisable to come up in person, we think that the body will be in a state of preservation that will admit of it being examined upon your arrival.

In the mean time, until we have advices from yourself, we shall endeavor to procure as full information as it is in our power to obtain. It may be well to mention, that the principal part of Mr. Douglas's baggage, his trunks, instruments, &c. are in possession [page 14] of Mr. Goodrich, who will take all proper care of them, subject to your order.

3 o'clock, P. M. Edward Gurney, the Englishman spoken of before, has arrived. Our minds are greatly relieved as to the probable way in which the fatal event was brought about.

He states, that on the 12th inst. about ten minutes before six o'clock in the morning, Mr. Douglas arrived at his house on the mountain, and wished him to point out the road to Hilo, and to go a short distance with him. Mr. Douglas was then alone, but said that his man had given out the day before; (this man was probably John, Mr. Diell's colored man.) After taking breakfast, Edward accompanied Mr. Douglas about three fourths of a mile, and after directing him in the path, and warning him of the traps, went on about half a mile further with him. Mr. Douglas then dismissed him, after expressing an anxious wish to reach Hilo by evening, thinking that he could find out the way himself.

Just before Edward left him, he warned him particularly of the three bullock traps, about two miles and a half ahead; two of them directly on the road, the other on one side.

Edward then parted with Mr. Douglas, and went back to skin some bullocks which he had previously killed. About 11 o'clock, two natives came in pursuit of him, and said that the European was dead, and that they had found him in the pit in which the bullock was. They mentioned that as they were coming up to this pit, one of them observing some of the clothing on the side exclaimed Lole, but in a moment afterwards, discovered Mr. Douglas within the cave trampled under the feet of the bullock. They went back immediately for Edward, who left his work, ran to the house for a musket and ball, and hide, and on

Appendix G. Archaeological Inventory Survey, Maunakea Summit Area

Preface

The Archaeological Inventory Survey for the Thirty-Meter-Telescope (TMT) Observatory Project, Maunakea, Kaʻohe, Ahupuaʻa, Hāmākua District, Hawaiʻi Island, TMK: [3] 4-4-015:009 por. has been updated since the Draft EIS was completed. This report addresses only the Project facilities in the Mauna Kea Science Reserve (MKSR); potential Project facilities in Hale Pōhaku are discussed in a separate report in Appendix H. The Archaeological Inventory Survey report has been updated to address comments on the report received from State of Hawaiʻi Department of Land and Natural Resources, State Historic Preservation Division, in a letter dated October 7, 2009. That letter, and responses to comments in the letter, is included in Chapter 8, Volume 2, of the Final EIS. Changes made to this technical report since the Draft EIS was completed are not illustrated as they are within this preface and the body of the Final EIS. Substantial changes to the Archaeological Inventory Survey report include the following:

- The Project effect has been modified from "no historic properties affected" to "effect with treatment/mitigation commitments."
- A discussion concerning effects to both the Mauna Kea Summit Region Historic District and Kūkahauʻula Historic Property have been added.
- Treatment/mitigation commitments have been updated.

Within the body of this Final EIS, historic and archaeological resources are discussed in Section 3.3, Archaeologic/Historic Resources..

Archaeological Inventory Survey for the Thirty-Meter-Telescope (TMT) Observatory Project, Maunakea, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island TMK: [3] 4-4-015:009 por.

Prepared for

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Prepared by

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(Job Code: MAUNAKEA 1)

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Management Summary

Reference	Archaeological Inventory Survey for the Thirty-Meter-Telescope (TMT) Observatory Project, Maunakea, Ka‘ohe Ahupua‘a, Hāmākua District, Hawai‘i Island TMK: [3] 4-4-015:009 por.
Date	April 2010
Project Number (s)	Cultural Surveys Hawai‘i Inc. (CSH) Job Code: MAUNAKEA 1
Investigation Permit Number	The fieldwork component of the archaeological inventory survey was carried out under archaeological permit number 08-14, issued by the Hawai‘i State Historic Preservation Division / Department of Land and Natural Resources (SHPD/DLNR), per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282.
Project Location	The approximately 12-acre Project area consists of two discreet parcels and a road corridor located on the northern plateau of the Maunakea summit area. The Project area is depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993).
Land Jurisdiction	The Mauna Kea Science Reserve is owned by the State of Hawai‘i, and leased to the University of Hawai‘i (UH) for use as a scientific complex.
Agencies	Hawai‘i State Historic Preservation Division / Department of Land and Natural Resources
Project Description	The proposed TMT Observatory Project involves the construction of a 30-meter diameter telescope and associated infrastructure on a 5-acre site within Area E of the Astronomy Precinct. The Project also includes construction of an Access Way, consisting of a 0.6-mile long road and utility corridor from existing facilities to the TMT Observatory. In addition, the Batch Plant Staging Area, consisting of a 4-acre area near the summit, would be temporarily used as a staging area during Project construction. Minimally, land disturbing activities would include grading of the TMT Observatory site, Access Way, and Batch Plant Staging Area, and excavations associated with building construction and installation of subsurface utilities.
Project Acreage	Approximately 12 acres

Area of Potential Effect (APE) and Survey Acreage	The 44-acre survey area for the current study included: Area E of the Astronomy Precinct - 38 acres; the approximately 0.4-mile long portion of the Access Way south of Area E - 1.5 acres; and the Batch Plant Staging Area - 4 acres. Subsequent to the survey, a 5-acre area within the northern portion of Area E was selected as the proposed location of the TMT Observatory. The area of potential effect (APE) is defined as the entire approximately 12-acre Project area.
Historic Preservation Regulatory Context	At the request of PB, CSH conducted an archaeological inventory survey investigation for the proposed TMT Observatory Project. This archaeological inventory survey report was prepared to support the proposed project's historic preservation review under Hawai‘i Revised Statutes (HRS) Chapter 6E-8/42 and Hawai‘i Administrative Rules (HAR) Chapter 13-275/284. In consultation with the Hawai‘i State Historic Preservation Division (SHPD), the archaeological inventory survey investigation was designed to fulfill the State requirements for an archaeological inventory survey per HAR Chapter 13-13-276. It is also intended to support any Project-related historic preservation consultation with stake-holding State or County agencies and interested Native Hawaiian and community groups.
Fieldwork Effort	The CSH field crew included: David W. Shideler, M.A.; Todd Tulchin, B.S.; Trevor Yucha, B.S.; and Lehua Ka‘uhane, B.A., under the overall supervision of Hallett H. Hammatt, Ph.D. Fieldwork was conducted on August 26, 2008 and required 4 person-days to complete.
Number of Historic Properties Identified	Two
Historic Properties Recommended Eligible to the National/Hawai‘i Registers of Historic Places	SIHP # 50-10-23-21438, Pu‘u Kūkahau‘ula State Historic Property is a contributing component of the Mauna Kea Summit Region Historic District. SIHP # 50-10-23-26869, Mauna Kea Summit Region Historic District, recommended National/Hawai‘i Register-eligible under Criteria A, B, C, D, and E.
Effect Recommendation	The Access Way portion of the Project area traverses a portion of the SIHP # 50-10-23-21438 Pu‘u Kūkahau‘ula State Historic Property. The entire project area is located within the SIHP # 50-10-23-26869 Mauna Kea Summit Region Historic District. Due to the potential adverse effect on significant historic properties, CSH's project-specific effect recommendation is "effect, with proposed mitigation commitments."

Mitigation Recommendation	The main form of mitigation is in the locating of the TMT Observatory off of the summit and well away from all known archaeological sites. Keeping the TMT Observatory and appurtenances more than 200 feet away from all known sites is a major form of mitigation. Similarly, the fact that the TMT Observatory will not be visible from the actual summit is suggested to be a major form of mitigation of impact to both the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438) and the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869). The probability of any unmarked burials or human skeletal remains being present is regarded as very low inasmuch as: a) burials near the summit have only been reported at cinder cones (primarily on the south and east sides of the summit), b) most reports of burials are at lower elevations, c) no burials have been encountered during development thus far in the Astronomy Precinct, d) there are no burial markers or surface indicators of burials present, and e) the absence of caves in the area and the general desert pavement geology would not be conducive for burial location selection. However, in the unlikely event that cultural resources, including human skeletal remains or other significant cultural deposits, are encountered during the course of Project-related construction activities, all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

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Section 1 Introduction

1.1 Project Background

At the request of PB Americas, Inc. (PB), Cultural Surveys Hawai‘i Inc. (CSH) completed an archaeological inventory survey for the proposed Thirty-Meter-Telescope (TMT) Observatory Project, Ka‘ohe Ahupua‘a, Hāmākua District, Hawai‘i Island TMK: [3] 4-4-015:009 por**.** The approximately 12-acre Project area consists of two discreet parcels and a road corridor located on the northern plateau of the Maunakea summit area (Figures 1-3). The Project area is depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993).

The Mauna Kea Science Reserve is owned by the State of Hawai‘i, and leased to the University of Hawai‘i (UH) for use as a scientific complex. The proposed TMT Observatory Project involves the construction of a 30-meter diameter telescope and associated infrastructure on a 5-acre site within Area E of the Astronomy Precinct. The Project also includes construction of an Access Way, consisting of a 0.6-mile long road and utility corridor from existing facilities to the TMT Observatory. In addition, the Batch Plant Staging Area, consisting of a 4-acre area near the summit, would be temporarily used as a staging area during Project construction. Minimally, land disturbing activities would include grading of the TMT Observatory site, Access Way, and Batch Plant Staging Area, and excavations associated with building construction and installation of subsurface utilities.

The 44-acre survey area for the current study included: Area E of the Astronomy Precinct - 38 acres; the approximately 0.4-mile long portion of the Access Way south of Area E - 1.5 acres; and the Batch Plant Staging Area - 4 acres. Subsequent to the survey, a 5-acre area within the northern portion of Area E was selected as the proposed location of the TMT Observatory. The area of potential effect (APE) is defined as the entire approximately 12-acre Project area.

At the request of PB, CSH conducted the present archaeological inventory survey investigation, and a companion Cultural Impact Assessment study (Cruz et al. 2009) for the proposed TMT Observatory Project. This archaeological inventory survey report was prepared to support the proposed project’s historic preservation review under Hawai‘i Revised Statutes (HRS) Chapter 6E-8/42 and Hawai‘i Administrative Rules (HAR) Chapter 13-275/284. In consultation with the Hawai‘i State Historic Preservation Division (SHPD), the archaeological inventory survey investigation was designed to fulfill the State requirements for an archaeological inventory survey per HAR Chapter 13-13-276. It is also intended to support any Project-related historic preservation consultation with stake-holding State or County agencies and interested Native Hawaiian and community groups. For more detailed accounts of the project area’s cultural history the reader is referred to the companion Cultural Impact Assessment study (Cruz et al. 2009) and the thorough work of Maly 1997 and Maly and Maly 2005.

1.2 Scope of Work

The following scope of work satisfies the State requirements for an archaeological inventory survey, per HAR Chapter 13-13-276:

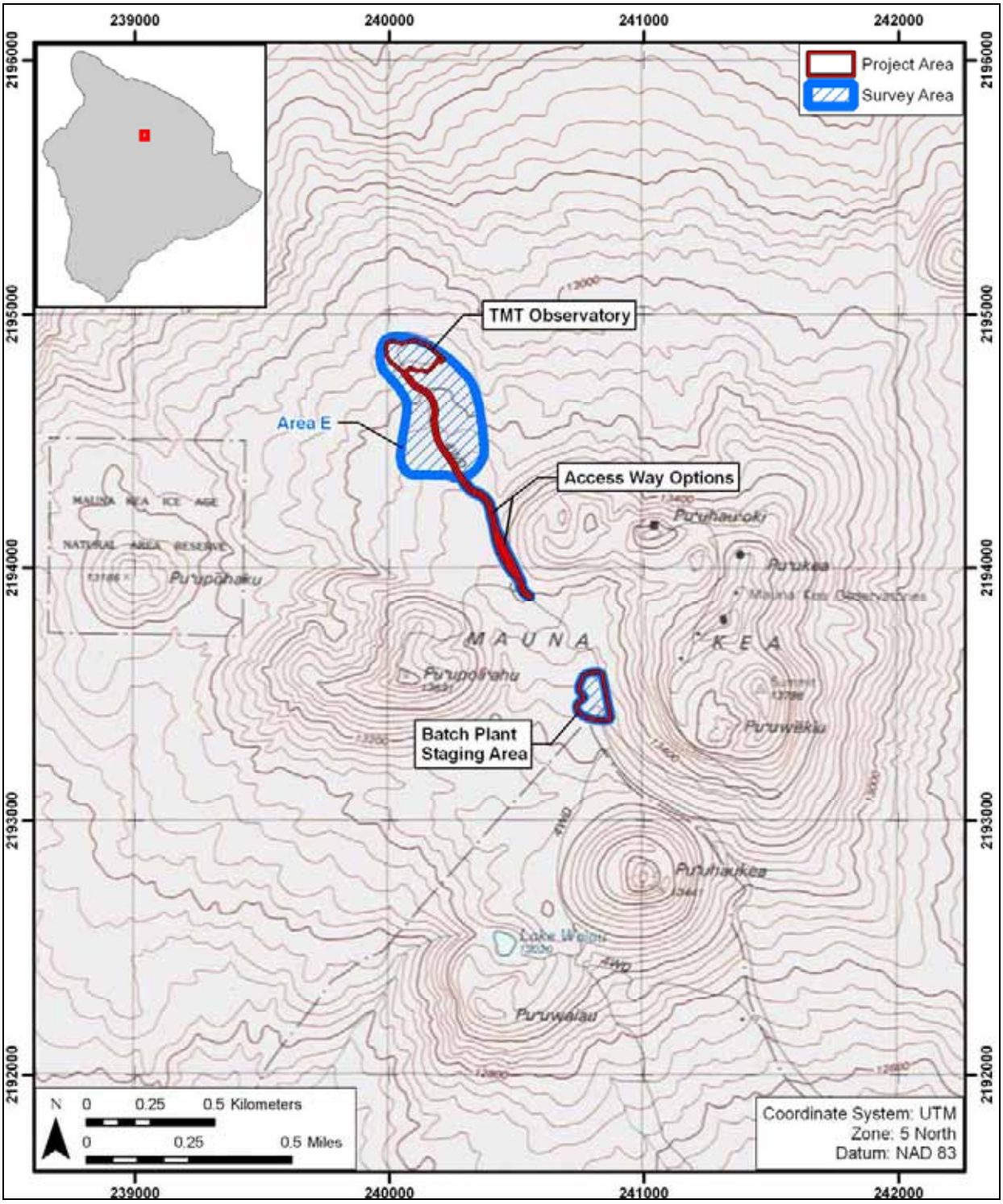

Figure 1. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing the locations of the Project area and survey areas

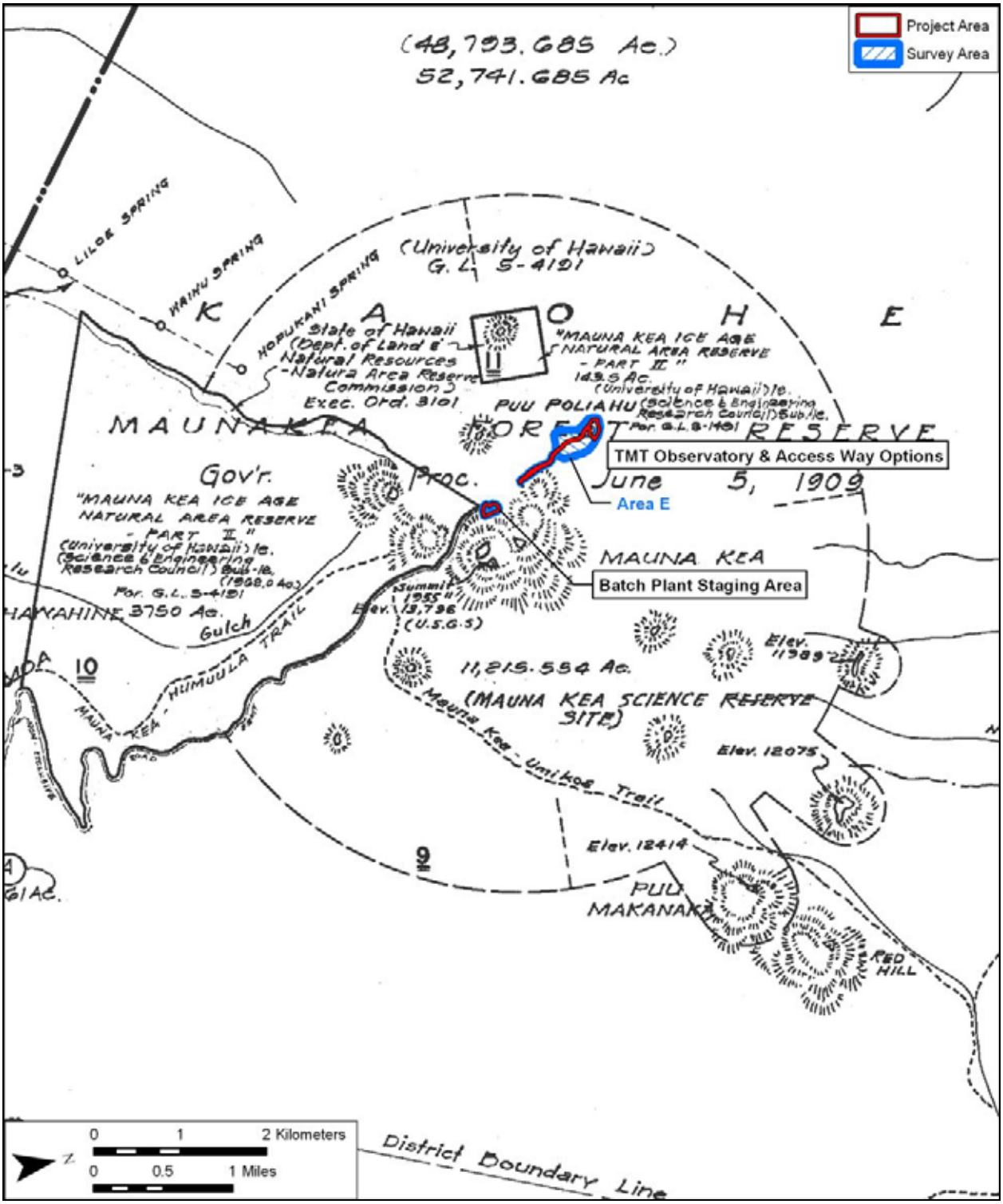

Figure 2. Portion of Tax Map Key (TMK) 4-4-015, showing the locations of the Project area and survey areas

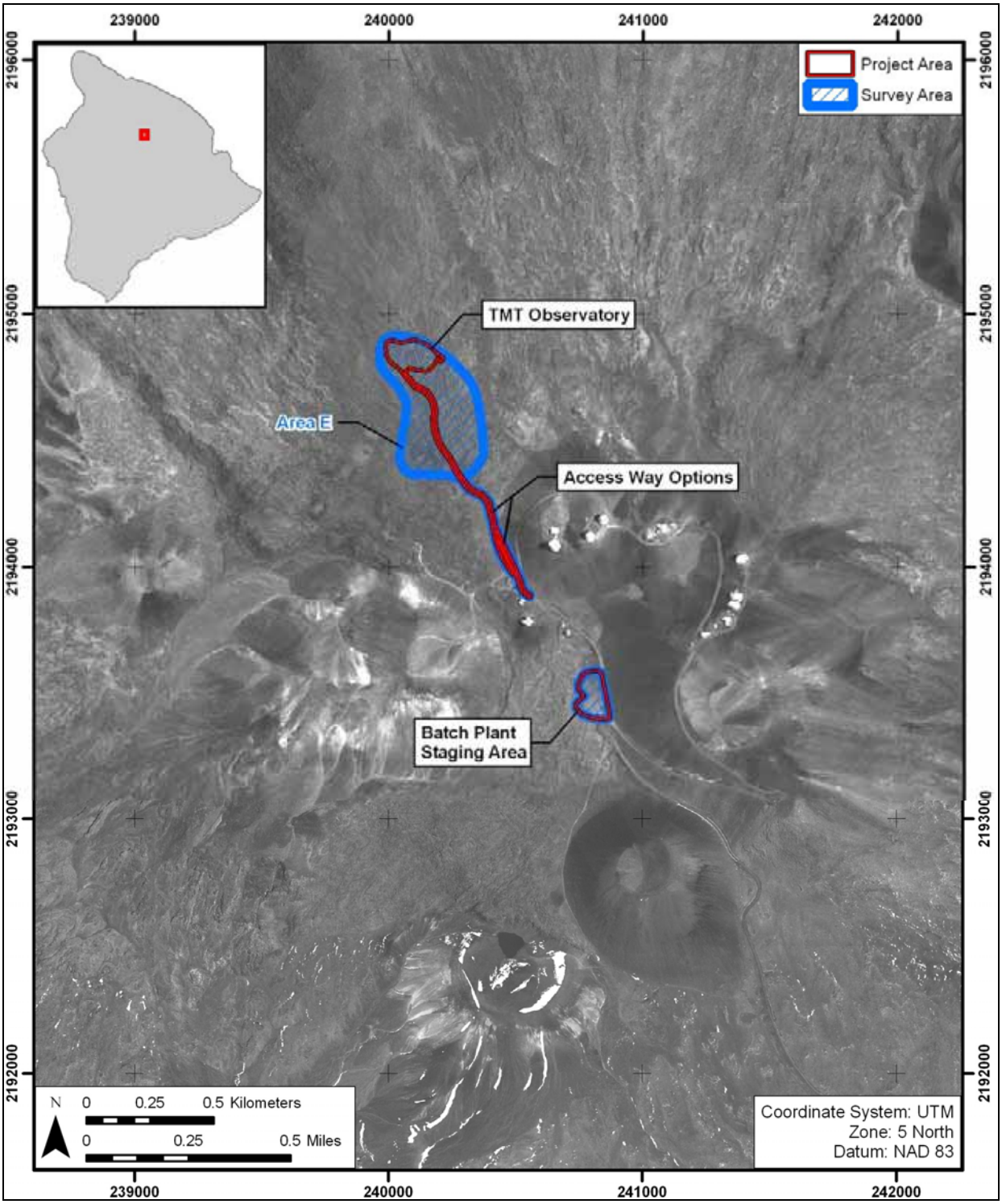

Figure 3. Aerial photograph (source: U.S.D.A. 2000), showing the locations of the Project area and survey areas

1. Historic and archaeological background research, including a search of historic maps, written records, Land Commission Award documents, and the reports from prior archaeological investigations. This research focused on the specific Project area's past land use, with general background on the pre-contact and historic settlement patterns of the *ahupua‘a* and district. This background information was used to compile a predictive model for the types and locations of historic properties that could be expected within the Project area.
2. A complete (100% coverage) systematic pedestrian inspection of Area E of the Astronomy Precinct, the Access Way, and Batch Plant Staging Area to identify any potential surface historic properties. Surface historic properties were recorded with an evaluation of age, function, interrelationships, and significance. Documentation included photographs, scale drawings, and, if warranted, limited controlled excavation of select sites and/or features, and location of historic properties with GPS survey equipment.
3. As appropriate, consultation with knowledgeable individuals regarding the Project area's history, past land use, and the function and age of the historic properties documented within the Project area.
4. As appropriate, laboratory work to process and gather relevant environmental and/or archaeological information from collected samples.
5. Preparation of this archaeological inventory survey report, including the following:
    a) A Project description;
    b) A section of a USGS topographic map showing the survey area boundaries and the location of all recorded historic properties;
    c) Historical and archaeological background sections summarizing prehistoric and historic land use of the Project area and its vicinity;
    d) Descriptions of all historic properties, including selected photographs, scale drawings, and discussions of age, function, laboratory results, and significance, per the requirements of HAR 13-13-276. Each historic property was assigned a Hawai‘i State Inventory of Historic Properties (SIHP) number;
    e) If appropriate, a section concerning cultural consultations [per the requirements of HAR 13-276-5(g) and HAR 13-275].
    f) A summary of historic property categories, integrity, and significance based upon the Hawai‘i Register of Historic Places evaluation criteria;
    g) A Project effect recommendation;
    h) Treatment recommendations to mitigate the Project's potential adverse effect on historic properties identified in the Project area that are recommended eligible to the Hawai‘i Register of Historic Places.

This scope of work includes full coordination with the State Historic Preservation Division (SHPD), and County relating to archaeological matters. This coordination takes place after consent of the landowner or representatives.

1.3 Environmental Setting

1.3.1 Natural Environment

The proposed TMT Observatory site and Access Way are located on a gently sloping plateau area northwest of the Maunakea summit cone, Pu‘u Wēkiu (13,796 ft. elevation). The Batch Plant Staging Area is located immediately west of Pu‘u Wēkiu. Elevations within the Project area range from approximately 13,120-13,410 ft. above mean sea level. In general, the summit region of Maunakea is arid, with an average annual rainfall of less than 15 inches (380 mm). Most of the precipitation is in the form of freezing fog and snow. The monthly average temperature ranges from 25-60 degrees Fahrenheit, with winter storms often depositing up to several feet of snow in the higher elevations.

The primary geological activity shaping the Maunakea summit terrain is glaciation. Several main glacial features present on the summit region include glacial striations on bedrock outcrop, the sculpted configuration of cinder cones, and the formation of Lake Wai‘au and Pōhakuloa Gulch as a result of glacial melt water. The summit region’s ground surface is generally characterized by rubbly ground moraine deposits and Hawaiite *‘a‘ā* flows of Late Pleistocene origin, partially mantled by cinder, coarse ash, and spindle bombs from the similar-age Pu‘u Hau Oki and Pu‘u Wēkiu cinder cones (McCoy 1982: A-29). Sediments within the Project area consist primarily of Very Stony Land (rVS) (Figure 4). Very Stony Land is described as a “miscellaneous land type consisting of very shallow soil material and a high proportion of *‘a‘ā* lava outcrops” (Sato et al. 1973). Sediments within the southern portion of the Access Way consist of Cinder Land (rCL). Cinder Land is described as “a miscellaneous land type consisting of bedded cinders, pumice, and ash” (Sato et al. 1973).

Vegetation is almost non-existent in the summit region of Maunakea, with the tree line located at approximately 9,000 foot elevation. The highest major vegetation zone, known as the Alpine Scrub Zone, generally ends at approximately 11,300 feet elevation. Plants in the so-called Alpine Stone Desert Zone of the summit region are mostly limited to small lichens and mosses.

1.3.2 Built Environment

The Project area is located within the Astronomy Precinct of the Mauna Kea Science Reserve. At present, there are eleven astronomical observatories within the precinct, including large telescope domes, radio dishes, and associated infrastructure. Lands within the Project area are undeveloped, with the exception of an existing unpaved 4-wheel drive road that traverses the central portion of the survey area.

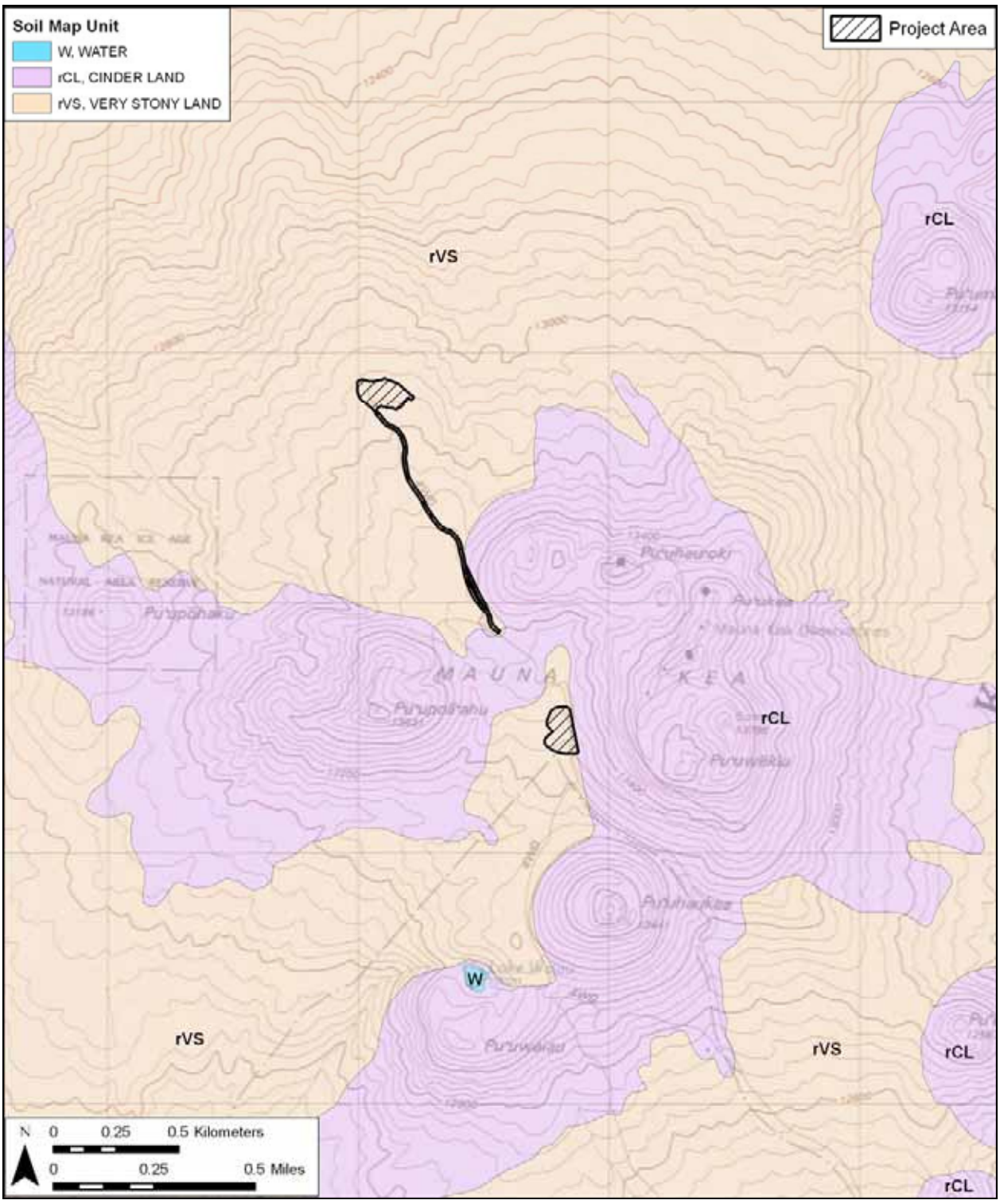

Figure 4. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993) with overlay of the Soil Survey of the Island of Hawai‘i (Sato et al. 1972), showing sediment types within the Project area

Section 2 Methods

2.1 Field Methods

The fieldwork component of the archaeological inventory survey was carried out under archaeological permit number 08-14, issued by the Hawai‘i State Historic Preservation Division / Department of Land and Natural Resources (SHPD/DLNR), per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282. The CSH field crew included: David W. Shideler, M.A.; Todd Tulchin, B.S.; Trevor Yucha, B.S.; and Lehua Ka‘uhane, B.A., under the overall supervision of Hallett H. Hammatt, Ph.D. Fieldwork was conducted on August 26, 2008 and required 4 person-days to complete.

The archaeological inventory survey fieldwork consisted of a complete (100% coverage) pedestrian inspection of Area E of the Astronomy Precinct, the Access Way, and Batch Plant Staging Area. The pedestrian inspection was accomplished through systematic sweeps, generally oriented east-west across the survey area. The interval between the archaeologists was generally approximately 30 feet. The lack of vegetation made for excellent visibility. All potential historic properties encountered were recorded and documented with a written field description, scale drawings, photographs, and each feature was located using Garmin GPSMAP 60CSx GPS survey technology (3-5 m accuracy).

2.2 Document Review

Historic and archival research included information obtained from the UH Mānoa Hamilton Library, the State Historic Preservation Division Library, the Hawai‘i State Archives, the State Land Survey Division, and the Archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary historical sources. This study is particularly indebted to the thorough research of Maly 1997 and Maly and Maly 2005. Information on Land Commission Awards was accessed through Waihona ‘Āina Corporation’s Māhele Data Base (www.waihona.com).

2.3 Consultation

The community consultation effort for the proposed TMT Observatory Project is detailed in the companion Cultural Impact Assessment report (Cruz et al. 2009). In general, Native Hawaiian organizations, government agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and the vicinity. The agencies consulted included the SHPD, the Office of Hawaiian Affairs (OHA), and the Hawai‘i Island Burial Council (HIBC).

Section 3 Background Research

3.1 Traditional and Historic Background

The traditional and historical background for the Project area is presented at length in a companion Cultural Impact Assessment study (Ka‘uhane et al. 2009; in progress) to which the reader is referred. A synopsis is presented below.

3.1.1 Mythological and Traditional Accounts

Holly McEldowney’s (1982) ethnographic background study of the Maunakea Summit Region notes the common case (as exemplified in Haleole’s Laieikawai and Fornander’s Hawai‘i Loa legend) of characters and themes inserted into more recent versions of older myths and legends and relatively modern fabrication of lore about Maunakea that has a semblance of antiquity. McEldowney notes that “Otherwise Mauna Kea is mentioned only briefly and rarely as the backdrop to more compelling events, or to characterize the attributes of a figure or an event by analogy.”

A common reference to Maunakea is as a last landmark that can be seen and hence the Maunakea summit becomes symbolic for the Hawaiian Islands. In Fornander’s (1919; Volume IV: 160-161) “The Legend of Kila” and in Fornander’s (1919; Volume V: 124-125) “Legend of Kūapāka‘a” we see that, as the first sight of land for long-distance voyagers, the summit of Maunakea is symbolic of Hawai‘i (Island).

In Fornander’s (1919; Volume IV: 224-225) “Story of ‘Umi: One of the Most Noted of Hawaiian Kings” (and in Thrum’s 1923: 98-103 *More Hawaiian Folk Tales)* the ruling chief ‘Umi-a-Līloa leads a war party out of Waipi‘o, Hāmākua arcing far up the slope of Maunakea to attack Hilo. In this account, the name “Poli‘ahu” is associated specifically with a trail and with a water source near the summit.

In Fornander’s (1919; Volume V: 340-341) “Tradition of Kamapua‘a” the pig deity sees the fires of Pele the goddess of volcanoes and begins to chant. The brilliant whiteness of the snows of Maunakea provides poetic contrast with the darkening smoke of Pele.

In Kalākaua’s *Legends and Myths of Hawaii* (1888: 249-315) account of “‘Umi, the Peasant Prince of Hawai‘i” are a number of passing references to Maunakea (such as comparing the color of an old priest’s hair to the snows of Maunakea) but one account merits particular mention. In a story about the fabulous conch shell trumpet known as the Kiha-pū is an account that: “In obedience to the revelation of a *kaula* [seer] of great sanctity, he [Kiha] had secretly deposited it [the Kiha-pu] in a cave near the summit of Mauna Kea …” The trumpet is transformed by the deity Lono so that a battle blast “was heard the distance of a day’s journey.” Thus the summit region of Maunakea is associated with the actions of deity, transformation of the Kiha-pū, and the imparting of qualities of awe and wonder.

In Kalākaua’s *Legends and Myths of Hawaii* (1888: 319-331) account of Lono and Kaikilani is an account of the prowess of the ruling chief Lonoikamakahiki: “He outran the fleetest…as in bringing a ball of snow from the top of Mauna Kea” (Kalākaua 1888: 322). In Thomas G. Thrum’s *Hawaiian Folk Tales* (1923: 108-116) is a chapter on Lono and Kaikilani that

understands Lono as the deity Lono whom we encounter: “reclining on the bosom of a cloud that rested over Mauna Kea.”

In Kalākaua’s (1888: 455-480) account of: “Laie i ka Wai” a supernatural (*kupua*) chief of Wailua Kaua‘i named Aiwohikupua is sailing the seas of Hāmākua, Hawai‘i and:

> …saw a woman of extraordinary beauty reclining on a cliff by the shore. She was graceful in every movement and wore a snow-white mantle. They landed and made her acquaintance. Her name was Poli‘ahu of Mauna Kea” (Kalākaua 1888: 462). She relates that she is also supernatural (“*kupua*”).

The goddess could produce a snow mantle or a sun mantle at will sending waves of cold or heat over her rivals.

In Kalākaua’s (1888: 501-507) account of: “Kahavari, Chief of Puna” is a brief discussion of the demi-god “Kana” who had the capacity to elongate himself so as to walk between the islands of the Hawaiian chain. It is asserted that when Kana waded back from the southern lands of Kahiki: “he hung his mantle to dry on Mauna Kea, which was then an active volcano” (Kalākaua 1888: 503). The tale seems to play on the height of the mountain and appears to provide an alternate explanation for whose cape explains the summit mantle of snow.

A number of accounts of a great flood as in the days of Noah have Maunakea as the only land remaining above the deluge.

3.1.2 Historic Accounts

The first recorded ascent of Maunakea was in 1823 by the missionary Joseph Goodrich (1794-1852). Like many missionaries, the Yale educated Goodrich was also a naturalist and he published his observations on Hawai‘i Island volcanoes in the *American Journal of Science* in 1826 and 1829. He approached via Kawaihae and Waimea. Goodrich attained the highest of several summits around 3:00 AM noting the presence of a pile of stones which he assumed had been constructed by Hawaiians. He then more or less retraced his steps back to the vicinity of Waimea. Few details are recorded. Goodrich made a second trip up Maunakea in 1825 noting (at a surprisingly early date) dead sheep on one of the cones at an estimated 13,612 ft elevation and speculating they had been driven there by wild dogs.

William D. Alexander (1892) described a trip up Maunakea with a surveying party, recording:

> [on] the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills [the “summit”] and a little over 13,000 feet in elevation. Here, as at other places on the plateau ancient graves are to be found. In olden times it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial.

Jerome Kilmartin (1974) published a brief reminiscence reflecting on his involvement in a 1925 United States Geological Survey Project to map the Lake Wai‘au topographic quadrangle. That 1925 work put him in the summit region for more than five months and then seemingly he did not return again until 1971. Kilmartin’s 1925 U.S. Geological Survey work approached the summit via the Umikoa Ranch based at approximately 3,500 foot elevation above Kūka‘iau in Hāmākua. Kilmartin reports little archaeological detail but does note a grave at Pu‘u Mākanaka (elevation 12,414 feet). He also notes:

> Ancient stone piles, quarries, walls, platforms, and burial caves are sufficient evidence that early Hawaiians were familiar with Mauna Kea's highlands. Stone chips from adze manufacture are found near a cave at 12,360 feet…[Kilmartin 1974:13]

It may also be noted in passing that the U.S. Geological Survey 1926 survey party created archaeological sites of their own (and perhaps many):

> …the wind was so strong I thought surely we would be blown away. However the *ahu* (stone pile) that we built did give a little protection after I had made a setup with the plane table only two feet above the ground. [Kilmartin 1974:15]

Kenneth Pike Emory is understood (following McCoy 1999:15) as the first person to have described the distinctive shrine features of Maunakea in a brief, popular piece published in *Paradise of the Pacific* magazine (April 1938). Emory was struck by the "immense quantity of chipped stone" and posited that the piles of debitage were "the largest so far recorded anywhere in the world." Emory concluded that the evidence of "chips and rejects" was the result of skilled adze makers and that "they were able to create a stone-tool industry on a scale unequaled in the stone-age because of the superior social organization of the Hawaiian people." Emory posited that in the shrines "each upright stone stood for a separate god" and referred to them as *"'eho*" ("a collection of stone gods") – a term evidently used in the Tuamotus as well as Hawai‘i to designate an alignment of upright stones.

Wentworth and Powers (1943) carried out geological studies on Maunakea in 1939 that noted archaeological sites in the Hopukani and Liloe Springs area. They noted stone walls that they interpreted as a trap to impound wild cattle that frequented the springs and certain older sites:

> In the area to the east and up the slope from the springs are numerous small heaps of pre-European stone adze workings. Certain lava caves contain evidence of habitation, suggesting that the springs were frequented by adze workers. The latter not only secured adze material from lava flows in places but carried on a surprising amount of casual prospecting on dense basalt boulders included in the moraines and outwash strewn several thousand feet down the mountain. [Wentworth and Powers 1943:544]

Holly McEldowney in her summary of the ethno-graphic background of the Maunakea summit region (1982:A-11) notes:

> Although most accounts speak in general terms, those that specifically locate the presence of human bones, "graves", "burial caves" or mortuary features indicate that burials are "not uncommon" between 7,800 ft and 13,000 ft elevation along the northern and eastern slopes of Mauna Kea. [Alexander 1892; Preston 1895:601; Gregory 1921; Aitken 1935:48; Gregory and Wentworth 1937:1720; Kilmartin 1974:15; Bryan 1927:106; Hāmākua Site Records, Dept. Anthropology, B.P. Bishop Museum]

3.1.3 Modern Land Use

It is understood that in 1936 the Civilian Conservation Corps carried out improvements to the old Maunakea-Humu‘ula Trail from near the main base of the sheep station at Kalai‘eha to the summit and that the first stone cabin at Hale Pōhaku was constructed at about that time.

In the early 1960s, researchers from the UH determined that the Maunakea Summit area was exceptional for making astronomical observations. Development of observatories began in 1964 with the construction of the Lunar and Planetary Station atop Pu‘u Poli‘ahu. The Mauna Kea Science Reserve was established in 1968. Currently there are eleven observatories in the Maunakea summit area and one observatory located on the southeastern flank at 12,000 feet. A 1978 aerial photograph of (Figure 5) shows the extent of development in the Maunakea summit area at that time. Note the 4-wheel drive road through the current survey area was constructed by this date.

3.2 Previous Archaeological Research

3.2.1 Previous Archaeological Studies

A summary of previous studies is presented in Table 1, with a more detailed summary of previous archaeological studies on Maunakea following. Previously identified historic properties in the Maunakea summit area are summarized in Table 2.

3.2.1.1 Cleghorn (1982)

Paul Cleghorn (1982) produced his UH Ph.D. dissertation in Anthropology on Maunakea adze quarry lithics focusing on technological analysis and experimental tests. Some 534 archaeological site components of 38 designated sites of the Maunakea adze quarry complex in the vicinity of Pu‘u Ko‘oko‘olau are briefly summarized (sites are referred to by Bishop Museum site nomenclature).

3.2.1.2 McCoy (1982)

Patrick McCoy (1982) documents reconnaissance level surveying of approximately 1,000 acres of the summit and north-slope (down to 13,000 ft). McCoy notes that:

> Few, if any, archaeological sites were predicted to occur within the boundaries of the project area, given the high altitude location and presumed absence of exploitable resources, including adze-quality stone, which on present evidence is restricted to the south slope of the mountain.

Thus it was far beyond expectations when 22 sites were recorded including an open air shelter and 21 shrine sites. McCoy was quite familiar with the “occupational shrines” near the adze quarries but concluded the function of these shrines was unknown. McCoy posits:

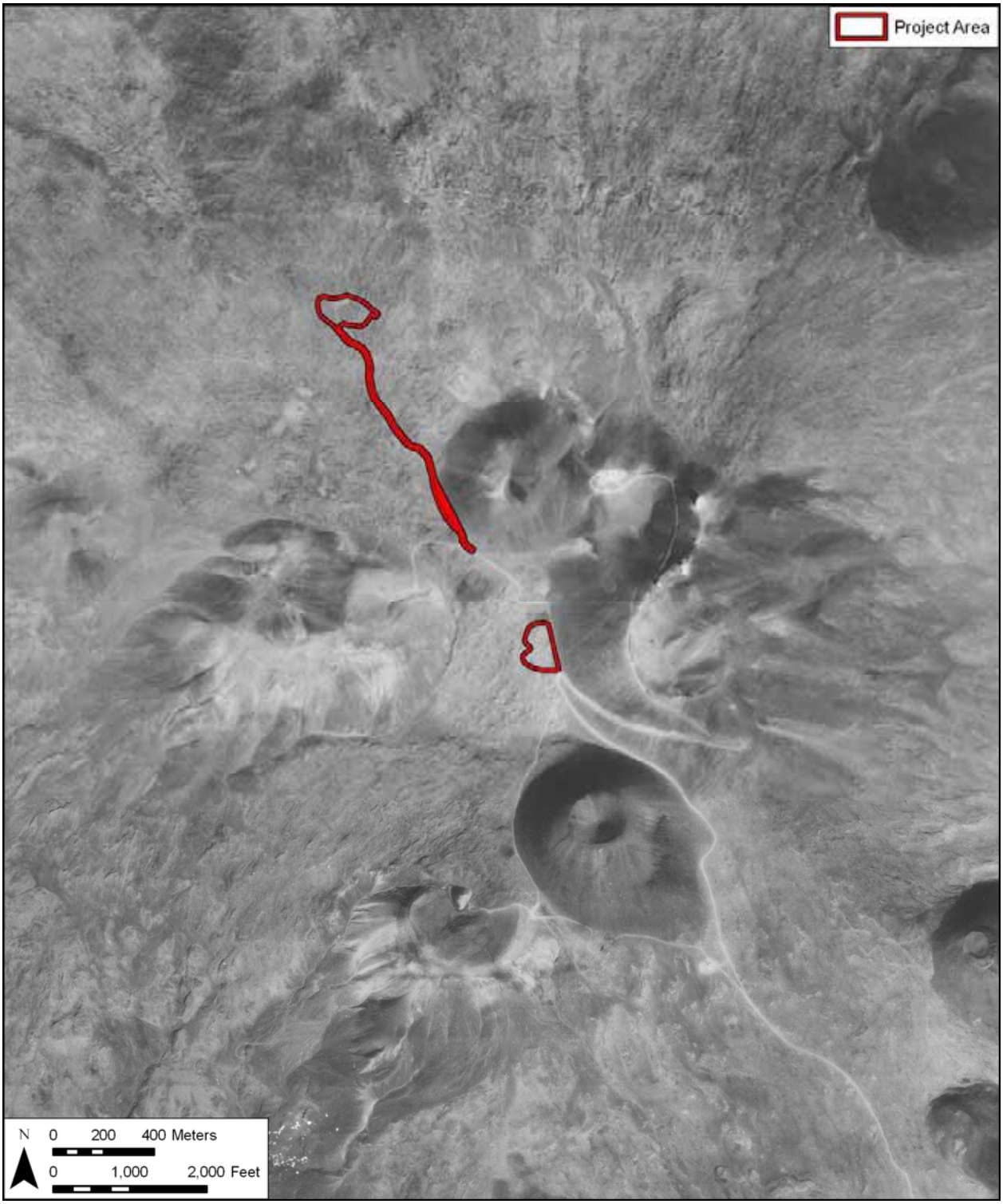

Figure 5. U.S. Geological Survey Orthophotograph, Mauna Kea Quadrangle (1978), showing the location of the Project area

Table 1. Summary of Previous Archaeological Studies on Maunakea

Reference	Nature of Study	Area of Study	Comments
McCoy 1976	"The Mauna Kea Quarry Project: A First Analysis."	Maunakea Adze Quarry Complex	--
McCoy 1977a	"Archaeological Investigations at the, Mauna Kea Adze Quarry Complex, Hawaii: Preliminary Results of the 1975-76 Fieldwork."	Maunakea Adze Quarry Complex	--
McCoy 1977b	A Summary of the 1975 Field Investigations."	Maunakea Adze Quarry Complex	--
McCoy 1978	Account of the "The B.P. Bishop Museum Mauna Kea Adze Quarry Project."	Maunakea Adze Quarry Complex	--
Allen 1981	Master’s thesis, UH at Mānoa	An analysis of the Maunakea Adze Quarry archaeobotanical assemblage.	--
McCoy 1981	"Stones For the Gods: Ritualism in the Mauna Kea Adze Quarry Industry, Hawaii."	Maunakea Adze Quarry Complex	--
Cleghorn 1982	UH Ph.D. dissertation in Anthropology on Maunakea adze quarry lithics	Maunakea adze quarry complex in the vicinity of Pu‘u Ko‘oko‘olau	Focuses on technological analysis and experimental tests. Some 534 archaeological site components of 38 designated sites are briefly summarized

Table 1. Summary of Previous Archaeological Studies on Maunakea (continued)

Reference	Nature of Study	Area of Study	Comments
McCoy 1982a	Reconnaissance survey	Approximately 1,000 acres of the summit and north slope (down to 13,000’ el.)	Documents 22 sites including an open air shelter and 21 shrine sites
McCoy 1982b	Archaeological Survey	Proposed Site of the Caltech 10-Meter Telescope	--
McEldowney 1982	Ethnographic Background report	Maunakea Summit Region	Documents legends, visitor’s accounts, land use and place names
Kam and Ota 1983	Archaeological Reconnaissance Survey	Mauna Kea Observatory Power line: Upper Portions	--
McCoy 1984a	A Summary of the 1984 Fieldwork	Maunakea Summit Region	--
McCoy 1984b	Archaeological reconnaissance	Hopukani, Waihu, and Liloe Springs area on the west side of Pōhakuloa Gulch between 8,640’ and 10,400’ elevation	Documents six archaeological sites and a number of find spots (More thorough coverage is presented in McCoy 1986)
McCoy 1985	Reconnaissance survey	Approximately 40 acres extending on both sides of the Maunakea Access Road between 9,080’ and 9,400’	Preliminary report for the Pu‘u Kalepeamoa Site documenting five lithic scatters and 2 shrines used for the manufacture of hammer stones and octopus lure sinkers. Ritual was an integral part of the manufacturing process.
McCoy 1986	Report on archaeological investigations	Hopukani and Liloe Springs area located on the west side of Pōhakuloa Gulch well southwest of the Maunakea summit region	Documents 3 mid-level sites (that were initially discussed in McCoy 1984). Eight radio-carbon dates indicated use spanning A.D. 1000 to A.D. 1800. It was concluded that these camps were used for acclimatization and for procuring water, food (primarily fowl) and fuel.

Table 1. Summary of Previous Archaeological Studies on Maunakea (continued)

Reference	Nature of Study	Area of Study	Comments
Williams 1987	Post-field letter report on an Archaeological Reconnaissance Survey	Summit Road between Hale Pōhaku and a stockpile area	--
Hammatt and Borthwick 1988	Reconnaissance survey	Two locations: an approximately 15-acre location between 11,560’ and 11,840’ on the west side of the present summit road and another approximately 100-acre location on the east side of the summit road in a saddle between 2 cinder cones at 12,100’ to 12,225’ elevation	4 sites were documented (none of which appear to have been previously recorded). Sites 11,076, 11,077 are probable pre-contact shrines; Site 11,078 is a probable pre-contact overhang shelter, and Site 11,079 included a probable pre-contact shrine and a probable pre-contact *ahu* or cairn with basalt flakes and an adze perform present.
Borthwick and Hammatt 1990	Reconnaissance survey	Two locations (total 2 acres) on the summit of Maunakea.	No finds – the areas had been “fully graded” for existing telescope facilities.
McCoy 1990	Study of: Factors of Production	Maunakea Adze Quarry Complex	--
Robins and Hammatt 1990	Reconnaissance survey	Two locations: 5.1 acre area on Pu‘u Hau Oki cinder cone at summit and a 21-acre lot near Hale Pōhaku	There were no finds at the JNLT summit Project area which had been largely graded. In the Hale Pōhaku area 3 lithic scatters that were described in McCoy, 1985 are discussed.
McCoy 1991	Survey and Test Excavations report	Pu‘u Kalepeamoa Site	--
Borthwick and Hammatt 1993	Reconnaissance survey	Proposed Gemini Telescope location at approximately 13,700’ on a ridge line north of the summit cone	Study notes that the entire summit ridge on which the Project area was located had been graded for existing telescope facilities. There were no finds.
McCoy 1993	Letter Report on an Archaeological Inspection	Two Sites Located in the Vicinity of the Smithsonian Sub millimeter Array	--

Table 1. Summary of Previous Archaeological Studies on Maunakea (continued)

Reference	Nature of Study	Area of Study	Comments
McCoy 1999	Analysis of a site complex (site 50-10-23-16204), that he had described 24 years earlier	Located on the east side of the Maunakea Access Road between 12,240’ and 12,300’ elevation just south of Pu‘u Līlīnoe	McCoy posits a ritual significance to the site specifically as a location for a rite of passage.
Hammatt and Shideler 2002	Data Recovery report for two lithic scatters	Sites 50-10-23-10,310 and 50-10-23-10,311 located in the Hale Pōhaku area between 9,080’ and 9,160’ elevation	Documentation of data recovery of sites identified in McCoy, 1985 and Robins and Hammatt, 1990. Two carbon dates (AD 1260-1410 and AD 1510-1950 at 95% probability) were both thought to be problematic. Possible ritual associations with healing and the deity Kanaloa are explored.
PCSI 2005	Archaeological Inventory Survey Interim Report No. 1	Mauna Kea Science Reserve	--
PCSI 2006	Archaeological Inventory Survey Interim Report No. 2	Mauna Kea Science Reserve	--

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (source: Draft Mauna Kea Cultural Resource Management Plan - McCoy et al. 2009)

SIHP #	Description	Function
11077	Single upright	Shrine
11079	Lithic scatter of adze manufacturing byproducts and 2 associated cairns	“Workshop” and possible shrine
16163	Platform/pavement with 14 uprights	Shrine
16164	3 to 5 uprights on platform and 1 isolated upright	Shrine
16165	Single row of 2 uprights	Shrine
16166	2 rows of uprights, 8 to possibly 9 total	Shrine
16167	Single row of 2 uprights	Shrine
16168	Semi-enclosure with 21 to possibly 25 uprights	Shrine
16169	Single row of 2 uprights	Shrine
16170	2 cairns with 3 to possibly 4 uprights	Shrine
16171	Single upright	Shrine
16172	Single upright	Shrine
16173	7 dispersed uprights	Shrine
16174	Boulder with 1 to possibly 8 uprights on the side	Shrine
16175	5 cairns with 1 upright each	Shrine
16176	Single row of 3 uprights	Shrine
16177	Single row of 3 uprights	Shrine
16178	Single upright	Shrine
16179	Single row of 3 uprights	Shrine
16180	Boulder with 3 uprights	Shrine
16181	Single upright	Shrine
16182	3 to 5 uprights	Shrine
16184	Semi-enclosure with 24 uprights	Shrine
16185	Single row of 3 uprights	Shrine
16186	Single row of 2 and possibly 3 uprights	Shrine
16187	Single row of 9 uprights	Shrine
16188	Single upright	Shrine
16189	Single row of 3 and possibly 4 uprights	Shrine
16190	Single row of 10 and off-set uprights	Shrine
16191	Single row of 4 uprights	Shrine
16192	2 sets of uprights, 6 total	Shrine

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
16193	Single upright	Shrine
16194	Single row of 12 - 14 uprights	Shrine
16195	2 cairns	Possible burial
16196	Single row of 2 uprights	Shrine
16197	Single upright	Shrine
16198	2-tiered platform with 7 uprights	Shrine
16199	1 to possibly 4 uprights	Shrine
16200	Single row of 5 to possibly 6 uprights	Shrine
16201	Single row of 3 uprights	Shrine
16202	Single upright	Shrine
16203	Single row of 2 to possibly 3 uprights and a lithic scatter of adze manufacturing byproducts	Adze “workshop” and shrine
16204	5 shrines, 26 stone-walled enclosures and a lithic scatter of adze manufacturing byproducts	Adze “workshop” and shrine complex
16248	Series of cairns	Burial
18682	Single row of 3 uprights	Shrine
18683	Single row of 2 uprights	Shrine
21197	2 platforms with a total of 5 uprights	Shrine
21198	Single upright	Shrine
21199	Single upright	Shrine
21200	Single upright	Shrine
21201	Single row of 2 uprights	Shrine
21202	Single row of 6 to possibly 7 uprights	Shrine
21203	Single row of 2 uprights	Shrine
21204	3 areas of stacked rock	Unknown
21205	Single upright	Shrine
21206	Single upright	Shrine
21207	Single upright	Shrine
21208	1 to 2 uprights on a boulder	Shrine
21209	Cairn on summit	Unknown
21210	Single upright	Shrine

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
21211	Single row of 2 uprights on a platform and a lithic scatter of adze manufacturing byproducts	Adze “workshop” and shrine
21212	Single row of 2 uprights	Shrine
21213	3 piles of rocks with 1 upright	Shrine
21214	Single row of 5 to possibly 7 uprights	Shrine
21406	Single upright	Shrine
21407	Single row of 2 uprights	Shrine
21408	Single upright	Shrine
21409	Single upright	Shrine
21410	Single row of 5 uprights	Shrine
21411	Cairn	Marker?
21412	Cairn	Marker?
21413	Cairn	Possible burial
21414	Cairn	Possible burial
21415	Cairn on boulder	Unknown
21416	Cairn	Possible burial
21417	Cairn	Unknown
21418	3 to possibly 4 uprights on top and to the side of a boulder	Shrine
21419	Single upright	Shrine
21420	Enclosure with 11 to possibly 12 uprights and a nearby stone platform	Shrine
21421	2 cairns, one with a possible upright and an isolated upright	Shrine
21422	Single upright	Shrine
21423	Stones on boulder	Marker?
21424	4 to 5 uprights on a platform and boulder	Shrine
21425	Single upright	Shrine
21426	Single row of 4 uprights	Shrine
21427	Terrace with possible upright	Unknown
21428	Single upright	Shrine
21429	Single upright	Shrine
21430	Single row of 3 uprights	Shrine

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
21431	Semi-enclosure with 7 to 10 uprights	Shrine
21432	Single row of 2 uprights	Shrine
21433	Single upright	Shrine
21434	8 stones on a boulder	Unknown
21435	Cairn and boulder with 1 upright	Shrine
21436	Cairn	Shrine
21437	Lithic scatter of adze manufacturing byproducts	Adze workshop
21438	Kukahauula (summit)	State Historic Property
21439	Pu`u Lilinoe	State Historic Property
21441	3 features with 12 uprights	Shrine
21442	Single upright	Shrine
21443	Single upright	Shrine
21444	Single upright	Shrine
21445	3 dispersed uprights	Shrine
21446	Single row of 9 uprights, plus two additional uprights	Shrine
21447	Single upright	Shrine
21448	Two uprights	Shrine
21449	Terrace	Unknown
21550	3 cairns	Historic survey markers
21551	Single upright	Shrine
21552	Platform	Probable human burial
25760	Lithic scatter of adze manufacturing byproducts	Adze workshop
25761	Lithic scatter of adze manufacturing byproducts	Adze workshop
25762	Lithic scatter of adze manufacturing byproducts and enclosures	Adze workshop and shelters
25763	Single upright on boulder	Shrine
25764	5-8 uprights on mound	Shrine
25765	Platform	Possible burial
25766	4 mounds	Unknown
25767	2 adze preforms	Isolate artifacts
25768	Basalt flake	Isolate artifacts

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
25769	Lithic scatter	Adze manufacturing
25770	Lithic scatter and rock pile	Adze manufacturing; possible burial
25771	Single upright in soil	Shrine or burial
25772	3 uprights, single upright on boulder, a mound, and lithic scatter of adze manufacturing byproducts	Shrines, adze workshop, and markers
25773	Single upright on boulder	Shrine
25774	4 pavements/low mounds	Unknown
25775	1-2 uprights on boulder	Shrine
25776	Cairn, enclosures, lithic scatter of adze manufacturing byproducts, and 2 possible fallen uprights	Shrine, adze workshop, and shelter
25777	Mound	Marker
25778	1-2 uprights on boulder	Shrine
25779	Lithic scatter of adze manufacturing byproducts, 3 preforms, and hammerstone	Adze workshop
25780	Single upright on mound	Shrine
25781	3-4 uprights, walled overhang, and lithics	Shrine, shelter, and adze manufacturing
25782	Single upright, lithic scatter of adze manufacturing byproducts, and 2 enclosures	Shrine, adze workshop, and shelter
25783	1 and possible 2 pairs of uprights	Shrine
25784	Single upright in bedrock crack	Shrine
25785	Rock pile	Marker
25786	1-3 uprights on bedrock surface	Shrine
25787	3-4 uprights in bedrock crack	Shrine
25788	Possible upright	Possible shrine
25789	17-20 uprights on bedrock surface and lithic scatter	Shrine and offering
25790	2-6 uprights on mound	Shrine
25791	Single upright on boulder	Shrine
25792	Rock pile with slabs	Shrine
25793	4 uprights on bedrock surface	Shrine
25794	Single upright in bedrock crack	Shrine

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
25795	Single upright on boulder	Shrine
25796	Lithic scatter of adze manufacturing byproducts and performs	Adze workshop
25797	Single upright on boulder	Shrine
25798	Single upright on boulder	Shrine
25799	Single upright, terrace, pavement, possible boulder shrine	Shrine complex
25800	Horseshoe	Historic artifact
25801	Lithic scatter of adze manufacturing byproducts	Adze workshop
25802	Terrace and mound	Burials
25803	Mound	Possible burial
25804	Mound	Possible burial
25805	Mound	Possible burial
25806	3 rock piles/mounds	Possible burials
25807	3 mounds	Burial
25808	Human remains and terraces	Burials
25809	Exposed human remains	Burials
25810	4 rock mounds	Shrine and markers
25811	Possible upright	Possible shrine
25812	Overhang and crude wall	Possible burial
25813	Mound with possible uprights (2)	Possible shrine
25814	3 mounds on cinder cone	Possible burials
25815	Mound	Possible burial
25816	Mound	Possible burial
25817	2 enclosed areas	Shelter
25818	Terrace with 5-7 uprights	Shrine
25819	Two groups of uprights (15-16 uprights)	Shrine
25820	3 uprights on mound	Shrine
25821	Single upright on boulder	Shrine
25822	Terrace with 6-9 uprights	Shrine
25823	Mound	Possible burial
25824	Mound	Possible burial

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
25825	2-3 uprights on mound	Shrine
25826	2 uprights on bedrock	Shrine
25827	2-4 uprights on bedrock	Shrine
25828	Lithic scatter of adze manufacturing byproducts	Adze workshop
25829	Mound	Possible burial
25830	Platform	Possible burial
25831	Mound	Possible burial
25832	Mound	Possible burial
26217	3 uprights on mound	Shrine
26218	Piled cobbles, alignments, historic trash	USGS camp site
26219	1-2 uprights on mound	Shrine
26220	C-shapes	Temporary shelters?
26221	Single upright on bedrock	Shrine
26222	1-2 uprights on mound	Shrine
26223	Single upright	Shrine
26224	3 uprights on bedrock	Shrine
26225	Single upright on boulder	Shrine
26226	Mound	Possible shrine
26227	Single upright on mound and lava tube	Shrine and possible shelter
26228	6-12 uprights on mound	Shrine
26229	1-2 uprights on boulder	Shrine
26230	Mound	Unknown
26231	2 uprights on mound	Shrine
26232	Rock wall and find spot	Temporary shelter and marker
26233	6-12 uprights on horseshoe-shaped enclosure	Shrine
26234	Single upright	Shrine
26235	Single upright	Shrine
26236	Single upright	Shrine
26237	Mound	Possible burial

Table 2. Previously Identified Historic Properties in the Summit Region of Maunakea (continued)

SIHP #	Description	Function
26238	Single upright on boulder	Shrine
26239	Single upright on boulder	Shrine
26240	4-5 uprights on mound and single upright in overhang	Shrines
26241	Mound	Unfinished shrine
26242	Cairns	Marker and shrine
26243	Single upright	Shrine
26244	Single upright	Shrine
26245	Cairn	Marker
26246	Cairn	Marker
26247	Cairn	Marker
26248	3-4 uprights on bedrock	Shrine
26249	Lithic scatter of adze manufacturing byproducts	Adze workshop
26250	1-3 uprights on mound, single upright on bedrock, and historic trash	Shrines and dump
26251	Single upright	Shrine
26252	2 uprights on bedrock	Shrine
26253	Complex consisting of multiple uprights, multiple lithic scatters of adze manufacturing byproducts, and quarried area for adze manufacturing	Shrines, adze workshops, and quarrying areas
26254	3 uprights on mound and cairns	Shrines and markers?
26255	Single boulder	Shrine
26256	Cairn	Marker

> …that these structures were erected by travelers, most probably in propitiation of mountain spirits. Such practices are universal in the high mountain regions of the world. [McCoy 1982:A-37]

McCoy does note however that the majority of the shrines were located in a narrow 200-foot contour interval band between 12,900 foot and 13,100-foot elevation. He posits reasonably that this clearly defined vertical zonation site pattern is the result of utilization of a break in slope at the edge of a summit plateau where: “when viewed from either the base of the steep inclined slope directly below, or from the base of the summit cones above, is a relatively flat horizon on which the shrine uprights are silhouetted and therefore visible from some distance.” McCoy associates these shrines with “the request for permission to pass over the summit” and notes that this indicates a preponderance of access from the northern, windward side of the islands consistent with the inclusion of the land within Hāmākua District. He further posits that the distribution of the shrines may relate to “the lower margins of snow fields” and possibly by extension to the goddess Poli‘ahu. McCoy notes that at one of the more complex “*Marae*” sites “the placement of offerings and whatever other ritual took place here appear to have been intentionally directed away from Maunakea. The possibility of astronomical concepts being operative is explored.” McCoy also posits that smaller sites were built and utilized by one or a few individuals while more complex shrines were built and utilized by a larger kin group and that perhaps “each structure would represent a separate social unit that had exclusive use rights.” McCoy recommends intensive archaeological survey and avoidance of construction and related activities on or in proximity to known archaeological sites.

3.2.1.3 McEldowney (1982)

Holly McEldowney (1982), then of the B.P. Bishop Museum Department of Anthropology, produced an Ethnographic Background report for the Maunakea Summit Region for the Research Corporation of the UH as part of an Environmental Impact Statement for a Mauna Kea Science Reserve Master Plan. The data is presented in three sections addressing 1) myths and legends and “oral traditions”, 2) land use practices and cultural activities, and 3) a study of place names.

McEldowney starts by relating a tradition of the goddess Poli‘ahu from Haleole’s (1863) story of Laieikawai. While McEldowney relates this as a “Hawaiian tradition recorded by S.N. Haleole”, Laieikawai has increasingly been recognized as a “romance”, a Cinderella-like story that undoubtedly utilized pre-contact traditions and motifs but was self-consciously more in the nature of a fairy-tale or work of imagination than a recordation of traditional legends. At any rate Haleole’s traditions of Poli‘ahu have almost nothing to do with Maunakea (although “Lilinoe” is given as the name of one of Poli‘ahu’s companions). McEldowney then goes on to discuss Westervelt’s (originally published in 1916) accounts of Poli‘ahu and opines that Westervelt “took the unwarranted license to assign each of the ‘goddesses of the snow covered mountains’ to specific localities.” This appears to be the case – that popular assignations of the names of deities to specific land-forms are basically modern appellations. McEldowney goes on to briefly discuss mentions of Maunakea, Poli‘ahu, and Līlīnoe in works by Fornander, Kamakau, Kalākaua and Thrum. She notes the common case (as exemplified in Haleole’s Laieikawai and Fornander’s Hawai‘i Loa legend) of characters and themes inserted into more recent versions of older myths and legends. McEldowney notes that “otherwise Maunakea is mentioned only

briefly and rarely as the backdrop to more compelling events, or to characterize the attributes of a figure or an event by analogy."

McEldowney notes that: "several early accounts report that Hawaiians were reluctant to travel or serve as guides on inland journeys, or that they professed no knowledge of these areas, leading to the false impression that these regions constituted a wilderness unknown to the Hawaiian people." This generality is even more pronounced for the summit plateau of Maunakea, where almost all early historic visitors made the final ascent to the summit without native guides. The only substantiated report of Hawaiians on Maunakea prior to the 1870s Boundary Commission accounts is Kamakau's (1961:285) reference to Ka‘ahumanu's 1828 visit "to Hawaii to fulfill a vow that she had made to attempt the recovery of the bones of Lilinoe on Mauna Kea…" It is unclear whether Ka‘ahumanu or her retainers actually ascended the mountain but: "It is said Ka‘ahumanu did not find the bones of Lilinoe…." (Kamakau 1961:285).

McEldowney relates various western visitors' accounts of Hawaiians acquiring fowl, hardwoods, fine-grained basalt, sandalwood and wild cattle in "this region." The first specific Hawaiian account of activities on the mountain brought to light in the McEldowney (1982) study appear to be in the Boundary Commission Testimony of a certain Haiki who asserts that: "my parents told me Humu‘ula went to Kaluakaakoi and Poli‘ahu. We used to go there after adzes for Humu‘ula people." As McEldowney notes: "Haiki's overall testimony and placement of the boundary was rejected by the commission."

Somewhat in keeping with her study of legends and myths and early accounts of land use, McEldowney's accounts of place names also emphasizes the dearth of information, the lack of specificity of the information, and the suspicious nature of what little early data we do have. McEldowney points out that guides and informants were often familiar with land features but traveled from landmark to landmark rather than on trails per se. She notes that access to the mountain in the second half of the 1800s appeared to utilize ranching establishments (Humu‘ula Sheep Station, Umikoa Ranch) and may not have related to pre-contact approaches. Many Hawaiian place names were noted to be basically modern.

3.2.1.4 McCoy (1984b)

Pat McCoy's (1984b) archaeological reconnaissance report for the Hopukani, Waihu, and Liloe Springs area documents six archaeological sites and a number of find spots located on the west side of Pōhakuloa Gulch between 8,640' and 10,400' elevation. The work was associated with a Pōhakuloa Training Area (PTA) Pipe Line Project. This preliminary report was elaborated upon in McCoy's (1986 study).

3.2.1.5 McCoy (1985)

Pat McCoy's (1985) preliminary report for the Pu‘u Kalepeamoa Site documents three archaeological surveys for a proposed new construction laborer camp at Hale Pōhaku located just above and below the Hawaii Institute for Astronomy's Mid-Level Facility encompassing a total of approximately 40 acres located on both sides of the Maunakea Access Road between 9,080 and 9,400-foot elevation. Five lithic scatters and 2 shrines were recorded. These archaeological features were understood as functionally integrated components of a single activity system and one Bishop Museum site number was assigned (lithic scatters no. 1 & 2 would subsequently be

given SIHP #s 50-10-23-10310 and 50-10-23-10311 respectively). McCoy concluded that the primary activity at the site was the manufacture of hammer stones and octopus lure sinkers from the crystalline dunite and gabro deposits on the slopes of Pu‘u Kalepeamoa but he noted that ritual was an integral part of the manufacturing process. Further research was recommended. The lithic scatters would be subject to further documentation (Robins and Hammatt 1990) and data recovery work (Hammatt and Shideler 2002).

3.2.1.6 McCoy (1986)

Pat McCoy's (1986) report on archaeological investigations for the Hopukani and Liloe Springs area documents three mid-level sites located on the west side of Pōhakuloa Gulch well southwest of the Maunakea summit region (that were initially discussed in McCoy 1984). These sites included a rock shelter at Hopukani Spring (10,400 foot elevation), the Hopukani Rock Shelter (10,160 foot elevation) and an open camp site at Liloe Spring (8,921 foot elevation) Eight radio-carbon dates indicated use spanning A.D. 1000 to A.D. 1800. It was concluded that these camps were used for acclimatization and for procuring water, food (primarily fowl) and fuel.

3.2.1.7 Hammatt and Borthwick (1988)

Cultural Surveys Hawai‘i (Hammatt and Borthwick 1988) carried out an archaeological reconnaissance survey of two locations for proposed antennas for the National Radio Astronomy Observatory. An approximately 15-acre relatively level location between the 11,560 foot and 11,840 foot elevations on the southeastern slope of the summit region on the west side of the present summit road was examined but no archaeological sites were observed. Another approximately 100-acre location on the east side of the summit road in a saddle between 2 cinder cones at 12,100 to 12,225 foot elevation was also examined and four archaeological sites were documented (none of which appear to have been previously recorded). Sites -11076, -11077 are probable pre-contact shrines; Site -11078 is a probable pre-contact overhang shelter with a stacked stone alignment, and Site -11079 had two components: a probable pre-contact shrine and a probable pre-contact *ahu* or cairn with basalt flakes and an adze perform present. Preservation of the four sites was recommended but it was thought that the Antenna Project potentially would be compatible with such preservation of the four relatively small and discrete sites in the large acreage.

3.2.1.8 Borthwick and Hammatt (1990)

Cultural Surveys Hawai‘i (Borthwick and Hammatt 1990) carried out an archaeological reconnaissance survey for two locations for the proposed Galileo Telescope on the summit of Maunakea. The study was of an approximately 2 acre portion of the summit ridge that (at that time) included the UKRT, U.H. 2.2 m, U.H. 24-inch, and Medical Support facilities. The study notes that previous work (McCoy 1982) had identified no sites in the summit region (above approximately 13,330 foot elevation). The study notes that the entire summit ridge on which the Project Areas were located had been "fully graded" for existing telescope facilities and no archaeological features were observed and no further work was recommended.

3.2.1.9 Robins and Hammatt (1990)

Cultural Surveys Hawai‘i (Robins and Hammatt 1990) carried out an Archaeological Reconnaissance Survey Project for the Subaru Observatory at both the summit and the Hale Pōhaku area. The actual summit construction area was an approximately 5.1 acre area on Pu‘u Hau Oki cinder cone in the northern portion of the Mauna Kea Science Reserve approximately 200 feet west of the existing W. M. Keck Observatory and 800 feet north of a paved “spur road” passing by the Caltech Sub-millimeter Observatory (CSO) facility. The summit project area had been largely graded although certain undisturbed outcrop formations were present. No archaeological features were identified within the Subaru Observatory summit project area.

The Robins and Hammatt (1990) study also included several areas near the Mid-Level Facility Complex (“Onizuka Center for International Astronomy (OCIA)”) including a small dormitory construction area located approximately 440 feet east of the Maunakea Access Road at 9,245 foot elevation (where no sites were observed) and an approximately 21-acre lot surrounding the dormitory delineated on the west and north side by the Maunakea Access Road and to the south by an existing jeep road. Two archaeological features were newly described and three previously identified sites were recorded in the approximately 21-acre lot. The two newly described features included a small oval enclosure and a roughly square enclosure that were both thought to be relatively recent constructions (no formal SIHP site numbers were assigned). The three previously recorded (McCoy 1985) sites included three lithic scatters (lithic scatters # 1, # 2, and #5) that McCoy had understood as being functionally integrated components of a single site. Further work at the lithic scatters was recommended. Cultural Surveys Hawai‘i (Hammatt and Shideler 2002) completed a Data Recovery report for lithic scatters # 1, # 2).

3.2.1.10 Borthwick and Hammatt (1993)

Cultural Surveys Hawai‘i (Borthwick and Hammatt 1993) carried out an archaeological reconnaissance survey for the proposed Gemini Telescope location at approximately 13,700 foot elevation on a ridge line north of the summit cone. The study notes that previous work (McCoy 1982) had identified no sites in the summit region above approximately the 13,330 foot elevation. The study notes that the entire summit ridge on which the project area was located had been graded for existing telescope facilities and no archaeological features were observed and no further work was recommended.

3.2.1.11 McCoy (1999)

Patrick McCoy (1999) wrote up an analysis of a site complex (SIHP # 50-10-23-16204), that he had described 24 years earlier, located on the east side of the Maunakea Access Road between 12,240 ft and 12,300 foot elevation just south of Pu‘u Līlīnoe that included five shrines and three enclosure complexes. The complex was notably located about a quarter mile from the nearest known source of worked raw lithic material and was perceived as “isolated”. McCoy (1999:14) noted that when viewed in terms of the natural environment and human productivity “the location of this site appears to be irrational” Of particular interest were some 26 very small open-air enclosures (typical interior area c. 17 square feet). This led McCoy to posit a ritual significance to the site specifically as a location for a rite of passage.

McCoy goes on to consider the form of the upright slabs of (typically un-worked) basalt that were arranged into the many shrines of Maunakea and Site -16204 in particular. McCoy posits that pointed uprights symbolize male gods and that flat-topped ones symbolize female gods (McCoy assumes that the Hawaiian goddesses Līlīnoe and Poli‘ahu were worshipped). Determining the affinities of the slabs is complicated by the presence of other forms (“angled”, “gabled”, “rounded” and “notched”) and the general difficulty of determining whether a particular stone was an upright at all.

McCoy posits that evidence supporting an unusual ritual function (rites of passage) includes:

- Unusual orientations of 4 of the 5 shrines,
- Lack of evidence of actual habitation,
- Unusual “lack of a cohesive structure” among the lithic byproducts present in the artifact assemblages – suggesting “symbolic manufacture and use”
- The numerous (26) very small open-air enclosures that were “too small to accommodate a person and a fire hearth” of no obvious purpose and believed to relate to temporary day-time use.

McCoy concludes that the small enclosures “may symbolically represent both a womb and a grave” and that the site “was the locus of initiation rites” related to “formal initiation rites for groups of apprentices”.

3.2.1.12 Hammatt and Shideler (2002)

Cultural Surveys Hawai‘i (Hammatt and Shideler 2002) completed a data recovery report for two lithic scatters (SIHP #s 50-10-23-10310 and 50-10-23-10311) located in the Hale Pōhaku area between 9,080 foot and 9,160 foot elevation. These sites were first recorded by McCoy (1985:11-12) as Lithic Scatter # 1 (SIHP # 50-10-23-10310) and Lithic Scatter # 2 (SIHP # 50-10-23-10311) of the Pu‘u Kalepeamoa Complex. Initially the UH Institute for Astronomy planned to preserve the two lithic scatters, however, dormitory construction increased erosion in the vicinity and in consultation with the State Historic Preservation Division a data recovery program was agreed to. Data recovery field work included mapping, surface collection and four $1m^2$ test units (2 at each of the two sites). Two carbon dates (AD 1260-1410 and AD 1510-1950 at 95% probability) were obtained but both were thought to be problematic. It was concluded that the sites were modest, out-lying, open, lithic workshop sites with octopus lure sinker manufacture of both “coffee-bean” and “bread-loaf” morphological types. It was concluded that the location of the sites was associated with a micro-climate of slightly greater moisture, slightly greater soil and slightly greater protection from the wind at the top of a natural drainage that favored *māmane* forest growth – which in turn provided greater protection from the elements, fuel and construction materials. It is suggested that the endeavor to produce octopus lures may have had other than quotidian purposes of food procurement and the affinities with healing prayers (*Pule he‘e*) dedicated to the deity Kanaloa are explored.

3.2.1.13 McCoy et al. (2009 in progress)

As this archaeological inventory survey report was being prepared, the authors interacted with Dr. Patrick McCoy at the offices of Pacific Consulting Services, Inc. and also within the Project

Area. We are thankful for his guidance. We were aware that a major study of the historic properties of the summit region was on-going by Pacific Consulting Services. This study, that should greatly advance our knowledge of traditional Hawaiian use of the Maunakea summit region, was not available as early drafts of this study were being prepared. If publicly available prior to the submission of this study to the SHPD for review it is the intent of the authors to include appropriate reference and germane summary of findings.

3.2.2 Culturally Significant Historic Properties

The State Historic Preservation Division has designated several prominent localities on Maunakea as Culturally Significant Historic Properties due to their cultural significance to the Hawaiian people. The Culturally Significant Historic Properties generally consist of prominent cinder cones and trails. The approximate boundaries of the Culturally Significant Historic Properties are indicated on Figure 6. Maly (1997:29) has suggested the entire Maunakea summit region down to the 6,000 foot elevation contour (Figure 7) be designated a Traditional Cultural Property. Three cinder cones in the summit region of Maunakea have also been designated historic properties. Pu‘u Kūkahau‘ula (SIHP # 50-10-23-21438) includes the three cinder cones that comprise the summit of Maunakea. Pu‘u Lilinoe (SIHP # 50-10-23-24139) consists of a cinder cone southeast of the summit. Waiau (SIHP # 50-10-23-21440) includes the small lake and cinder cone southwest of the summit.

Portions of the current Project area, including the Access Way and Batch Plant Staging Area, are partially located within or immediately adjacent to Pu‘u Kūkahau‘ula (SIHP # 50-10-23-21438). Pu‘u Kūkahau‘ula was documented through oral history interviews as the “generational repository of: *piko* (umbilical cords of children); ashes of individuals with strong attachment to Mauna Kea; and locations of an *ahu* (possibly more than one over time) associated with navigational practices and historical surveys” (Maly 1999).

3.2.3 Mauna Kea Summit Region Historic District

As a component of the Mauna Kea Science Reserve Master Plan, the State Historic Preservation Division (SHPD) prepared a Historic Preservation Plan (HPP) that addresses management of historic properties in four management areas: the Mauna Kea Science Reserve, the summit road corridor, the Hale Pōhaku area, and the Mauna Kea Ice Age Natural Area Reserve (SHPD 2000). The HPP specifies procedures to protect the historic properties within the management areas and to insure appropriate treatment over time.

Through the HPP, the SHPD designated the Maunakea summit region as the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869). The Historic District consists of the summit region to roughly 11,000-12,000 ft. elevation, including nearly the entire Mauna Kea Science Reserve and Mauna Kea Ice Age Natural Area Reserve (Figure 8). The historic district boundary corresponds with moraine fields and natural breaks in slope that define perimeter of the Maunakea summit region. The designation of the summit region as a historic district:

> allows the significance of the many individual [historic] properties located within the district to be addressed collectively and within the context of the summit’s natural landscape. It also allows the integrity of the district as a whole to be considered when the potential effects of particular activities or projects are evaluated. [SHPD 2000:1]

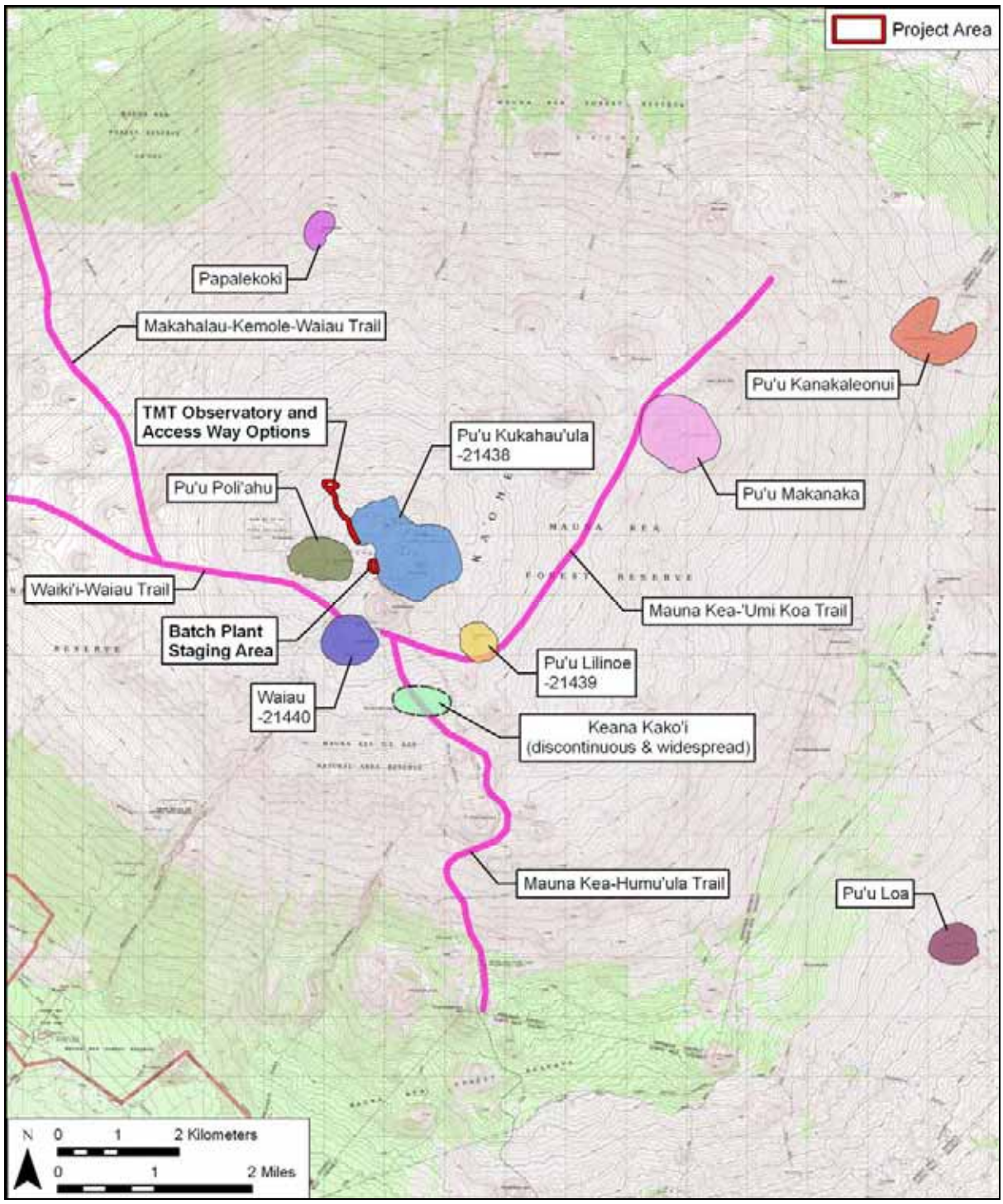

Figure 6. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing proposed Traditional Cultural Properties in the summit region of Maunakea (adapted from Maly 1997:Table 2 & Figure 2; Note: All of Maunakea down to the 6,000 foot elevation has been suggested to be a Traditional Cultural Property) (Boundaries shown should be understood as approximate)

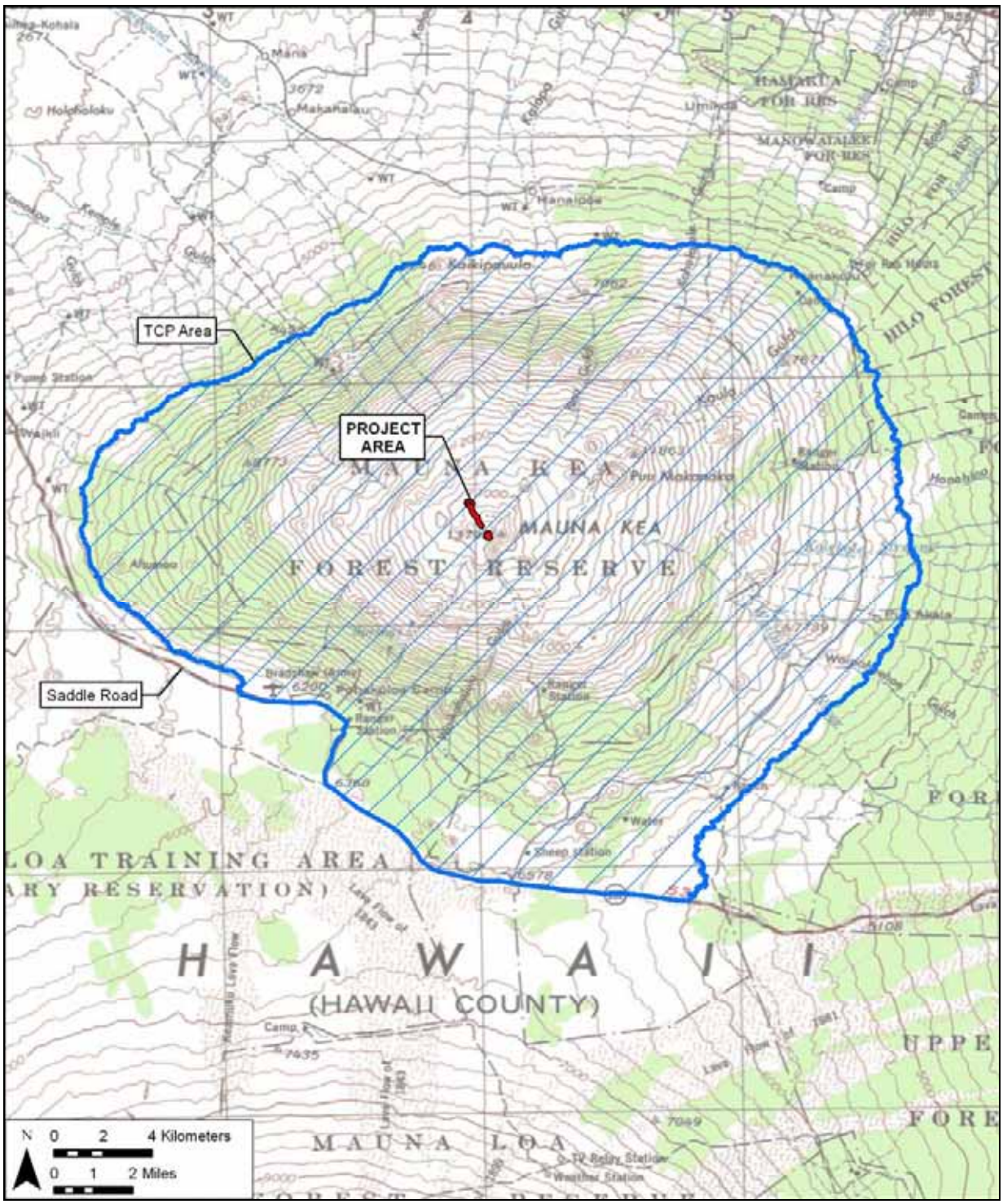

Figure 7. 1:100,000 Scale U.S. Geological Survey Map showing the proposed “Ka Mauna a Wākea or Mauna Kea” Traditional Cultural Property (TCP) down to the recommended 6,000 foot contour (following Maly 1997:29); estimated area approximately 150,000 acres

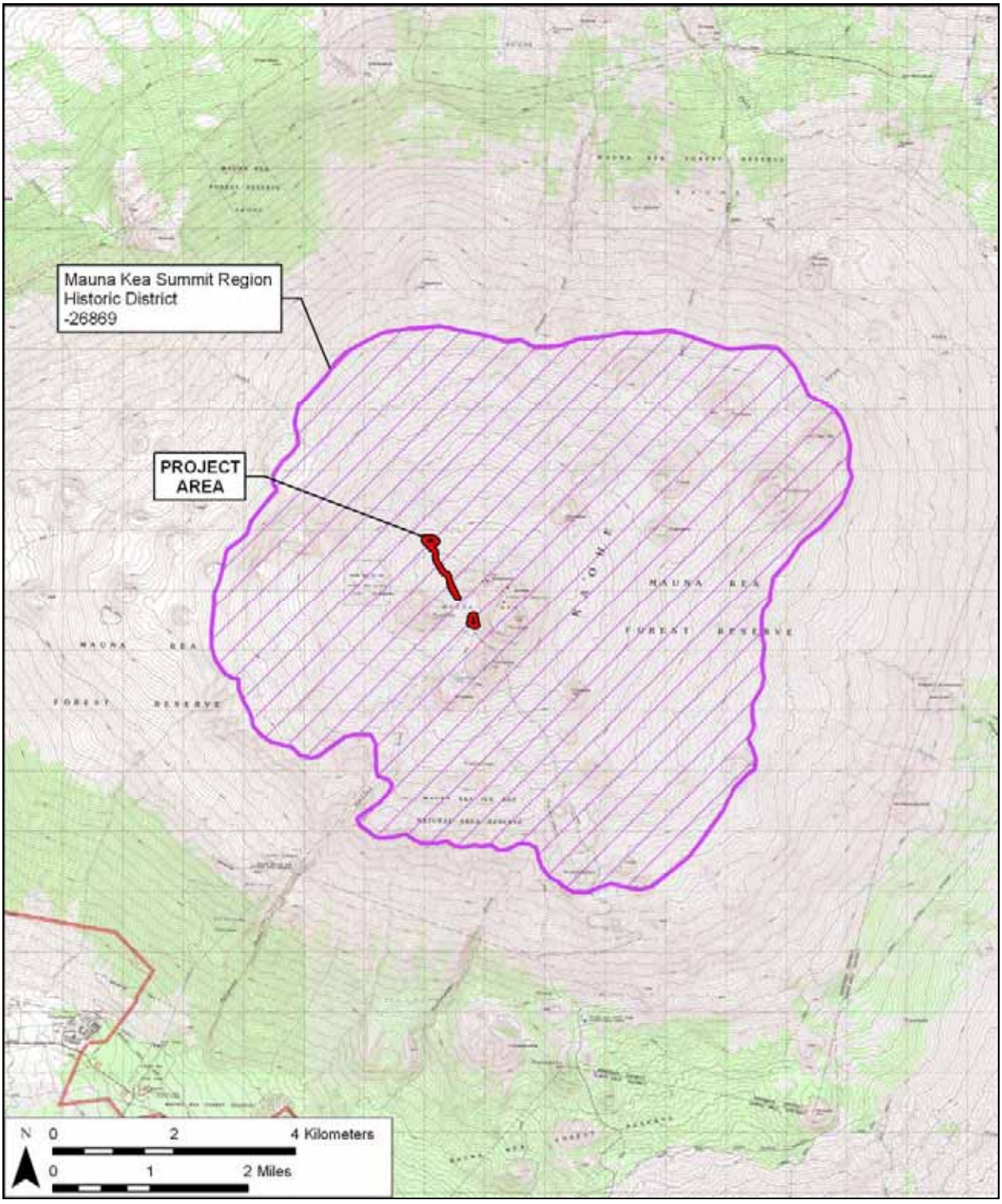

Figure 8. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing the extent of the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869)

3.3 Background Summary and Predictive Model

3.3.1 Burials and Possible Burials

3.3.1.1 Archaeological Data on Burials

McCoy 1999 presents a summary discussion of burials and possible burials on Maunakea noting that there are numerous traditions of burials at high elevations on Maunakea. He starts by presenting the account of Jerome Kilmartin (1974) that in 1925 Kilmartin personally observed human remains on Pu‘u Mākanaka. McCoy (1999:26) relates that in 1991 he and others observed human bones within several cairns on the southern rim of Pu‘u Mākanaka. McCoy notes that “several other spatially discrete groups of cairns, each comprised of two to three individual cairns, were found on the southern or eastern rim” [of Pu‘u Mākanaka] – suggesting that these may also contain human skeletal remains.

As far as we know, Pu‘u Mākanaka is the only place in the uplands of Maunakea in which human remains have been confirmed by archaeologists – although McCoy makes reference to “the well-known burial center at Kanakaleonui” and also to “a small group of cairns on the eastern rim of Pu‘u Waiau that are also believed to be burials.”

McCoy (1999:26) then goes on to discuss four “possible burial sites” (SIHP #s -16195, -21413, -21414 and -21416). Although no human remains were observed, these sites were thought to be burials because of: 1) the morphological similarity of these cairns to those on Pu‘u Mākanaka and Kanakaleonui and dissimilarity to other cairns (which are more cylindrical) and the presence on the eastern or southern rim of cinder cones.

McCoy (1999:27) clearly suggests that SIHP # -16195 consisting of 2 adjacent cairns on the eastern rim of Pu‘u Līlīnoe (recorded by McCoy in 1975) are “possible burials”. This conclusion appears to be based on William D. Alexander’s 1892 account of “ancient graves” on the summit of Pu‘u Līlīnoe. McCoy (1999:27) comments that: “If the cairns that were recorded in 1975 were in fact the same graves [as described by William D. Alexander in 1892] the remains had beenremoved sometime prior because no human bone was visible at that time.” Thus it appears that by 1975 these features were not graves but they may or may not have functioned as such previously (see Maly and Maly 2005 for a discussion of accounts of burials at Pu‘u Līlīnoe).

McCoy (1999:27) then discusses three possible burial cairn sites (SIHP #s -21413, -21414 and -21416) located on the southern and eastern rim of an unnamed (approximately 12,840-foot high cinder cone located approximately 0.7 miles northwest of the Mauna Kea Ice Age Natural Area Reserve) indicating that these may well be graves on the basis of form and location.

McCoy (1999:28) concludes:

> There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rock shelter or overhang. The basis of this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridge top amongst any of the shrines. There

in fact appears to be a clear separation between burial locations and shrine locations.

3.3.1.2 Informant Data on Burials

In striking contrast to the archaeological data (in which the closest confirmed burial appears to be 3 miles from the summit at Pu‘u Makanaka) is the belief of some contemporary Hawaiians that the summit region of Maunakea is something of a burial ground (“There’s lot of *kūpuna* been buried up there…”; and several similar stated concerns at www.mauna-a-wakea.info/maunakea/F4_burials.html). Allied with this line of thinking are rumors of burials being disturbed and destroyed by prior observatory developments (“Would bulldozing cemeteries be allowed anywhere else in the world?” and similar stated concerns at www.mauna-a-wakea.info/maunakea/F4_burials.html).

3.3.2 Shrines

In McCoy’s (1999:3) analysis of a total of 93 sites identified in the Maunakea summit area Science Reserve some 76 or 81.7% are classified as shrines (and an additional 8 shrines are components of adze manufacturing workshop sites). McCoy (1999:6) concludes that; “The vast majority of shrines are conspicuously sighted in the landscape, either on a ridge top, or at a break in the slope, which generally seems to correspond to either a lava flow margin or a change in the slope of a glacial moraine.” Of some interest, McCoy notes that “there are no shrines in the Science Reserve located on top of a cinder cone.”

As previously noted (McCoy 1982:A-37), an unusually high density of shrines are located in a narrow 200-foot contour interval band between 12,900 foot and 13,100-foot elevation on the north side of Maunakea in proximity to the present study area. He posits reasonably that this clearly defined vertical zonation site pattern is the result of utilization of a break in slope at the edge of a summit plateau where: “when viewed from either the base of the steep inclined slope directly below, or from the base of the summit cones above, is a relatively flat horizon on which the shrine uprights are silhouetted and therefore visible from some distance.”

3.3.2.1 Kahe Ule Subincision and the Maunakea Summit Region of Ka‘ohe Ahupua‘a, Hāmākua District

A central thesis of McCoy’s (1979:27) study of “A Rite of Passage Site” is that a certain site complex (SIHP # 50-10-23-16204) located at approximately the 12,280-foot level of Maunakea was the locus of initiation rites possibly related to formal initiation rites for groups of apprentices. This argument has support in the curious presence of some twenty-six open air shelters of quite small diameter that appear to have had temporary use. Few would dispute that some of the shrines of the summit region of Maunakea are “occupational shrines” specifically those near the adze quarries incorporating quarried lithic material. However it seems clear that the vast majority of the shrines of the summit region of Maunakea are not near the known adze quarries and do not incorporate quarried lithic material. This gives rise to the consideration that some quite different function may have been operative for many of the Maunakea shrines. One theory is that “these structures were erected by travelers most probably in propitiation of mountain spirits” (McCoy 1982:A-37) While this certainly seems probable as a partial

explanation it may be noted that the distribution of shrines does not suggest travel corridors so much as a broad band of elevation that was preferred for shrine construction.

An alternative theory offered here is that at least some of the shrines of Maunakea are related to the *Kahe Ule* or subincision practice of Ka‘ohe Ahupua‘a of Hāmākua District. What follows admittedly is less than a convincing argument and is offered only for future consideration.

We know little about the Hawaiian practice of *Kahe Ule* or subincision of the foreskin but it was almost certainly a ritualized practice involving a group of men, a religious expert (kahuna), a special bladed tool (understood as typically a bamboo knife) and a male youth to be subincised. Gutmanis (1983:55) relates a subincision prayer (bold added for emphasis)

*E Ki‘i **ka‘ohe** i Ho-mai-**ka-‘ohe***.	Bring the bamboo from Ho-mai-ka-‘ohe
*Eia **ka‘ohe** lauli‘i a Kāne*	Here is the small leafed bamboo of Kāne.
‘Okia i ka maka o ka ma‘i	Cut now the foreskin
Ua moku	It is divided

Notably the noun “*Ka‘ohe*” is mentioned three times. While on the one hand the phrase simply means “the bamboo” there seems little question the reference is to a ritual bamboo subincision knife. The general shape of Ka‘ohe bears a vague similarity to a knife as it cuts across the *piko* of Maunakea and Maunaloa dividing the island.

3.3.3 Adze Quarries and Manufacturing Workshops

It appears from McCoy’s (1999) summary analysis of site typology that the only quarries were in the extreme southern portion of the Mauna Kea Science Reserve (the Ko‘oko‘olau Complex Maunakea Adze Quarry; site 50-10-23-4136). McCoy does describe four adze manufacturing workshops (sites 11079, 16203, 16204 and 21211) defined in part by their being located where there is no naturally occurring stone-tool quality raw material. All four of these adze manufacturing workshops are on the south face of the mountain on the east side of the main Maunakea Access Road. Thus it would appear that few, if any, sites associated with quarrying or adze manufacture would be expected in the present study area.

3.3.4 Trails and Temporary Habitations

We have very little real documentation on pre-contact patterns of access to, and temporary habitation on, the summit region of Maunakea. There appears to be general agreement that: “Neither historic accounts nor archaeological surveys provide firm evidence for the prehistoric trails….historic accounts of trails used don’t necessarily reflect the prehistoric trails in the area.” (Maly 1997: D-12). Notably: “…no trails were mentioned by Hawaiians in the 1870s Boundary Commission records nor do any appear on the 1862 Wiltse map.” (Maly 1997:D-5). The four major trail systems documented in the summit region (from North clockwise: 1. the Maunakea-‘Umi Koa Trail, 2. the Maunakea-Humu‘ula Trail, 3. the Waiki‘i-Pu‘u Lā‘au-Wai‘au Trail, and 4. the Makahālau-Kemole-Wai‘au Trail) may all be largely or even entirely post-contact and primarily horse trails.

Land Boundary Commission testimony, particularly that of a certain Haiki (Boundary Commission Hawaii Volume B page 41), suggests that people of Humu‘ula, North Hilo District

accessed the resources of the Maunakea summit from the southeast. Variously there is an oral history account from Mr. William Akau:

> …as a child, William Akau heard his elders talking about visits made by people from other islands to Hawaii. In ancient times, canoes would land in the Kīholo vicinity, and people walked the trails along the gentle slopes of Mauna Loa-Mauna Kea to the summit to harvest and shape stone. [Maly 1997:22]

While this account suggests access from North Kona, from due west (Kīholo in north, North Kona), it seems unlikely that Hawaiians from other islands accounted for a significant percentage of the pre-contact traffic to the summit region.

Despite these differing accounts mentioned above, the general conception has followed the Land Boundary Commission that determined that the entire summit region of Maunakea lies within Ka‘ohe Ahupua‘a of Hāmākua District and that the socio-political connectedness of the summit lands lay to the north in Hāmākua. This certainly suggests that most of the access would be expected from the north. This would lead to the expectation that much of the evidence of access to the summit region in the form of trail markers or temporary habitation sites might be expected on the north slope.

The prevailing nighttime temperatures and wind would place a premium on any lava tubes or caves that might provide substantial shelter. In the general absence of such landforms on the north slope and summit plateau travelers would be expected to seek very temporary occupation at open habitation sites seeking what protection might be available on the lee side of rock outcroppings and ridges. While too great an emphasis should not be placed on any one account, the pattern of access in the first recorded ascent of Maunakea in 1823 by the missionary Joseph Goodrich may be notable. The preacher appears to have hiked from Waimea to the Maunakea summit and back to Waimea in one 24-hour marathon. In the vicinity of Waimea he spent the night (at approximately 2,700 foot elevation). Leaving early, and approaching the summit from the north, he followed a steep ravine reaching the tree line at about 9,000 feet elevation approximately 15 miles from Waimea where he rested for a few hours recording the temperature at 43° F at sunset. At 11:00 PM he pushed on in bright moonlight encountering snow at 1:00 AM and recording a temperature of 27° F. Goodrich attained the highest of several summits around 3:00 AM and quickly descended.

Section 4 Results of Fieldwork

4.1 Survey Findings

4.1.1 Survey Findings of the Area E Survey Area

The pedestrian inspection of the Area E survey area was completed at 100% coverage. The lack of vegetation within the survey area allowed for excellent visibility. An existing unpaved 4-wheel drive road (Figure 9) traverses the central portion of the survey area, in a roughly north-south orientation, generally dividing the survey area into east and west portions. The land surface within the western portion of the survey area is generally gently sloping, with little surface undulations (Figure 10). The land surface within the eastern portion of the survey area is relatively rough, with many lava channels bisecting the land surface, in a generally northwest to southeast orientation (Figure 11). During the pedestrian inspection, areas thought to have higher potential for encountering historic properties, including prominent ridges and Hawaiiite basalt exposures (Figure 12) were carefully examined.

Two potential historic properties were identified within the survey area (Figure 13 and Figure 14). CSH 1 was initially interpreted to be a possible pre-contact shrine, consisting of two upright stones, located in the northwestern portion of the survey area. CSH 2 was initially interpreted to be a possible pre-contact temporary habitation complex, consisting of a C-shaped enclosure and two small terraces, located within a lava channel in the northern portion of the survey area. Documentation of the find spots is presented in Appendix A.

In addition to the pedestrian inspection of the Project Area, previously identified historic properties in the vicinity of the Project Area were re-identified. SIHP #s 50-10-23-16166, -16167, and -16172 shrines were confirmed to be located outside of the survey area.

Following the completion of the pedestrian inspection of the survey area, a site visit was conducted with State Historic Preservation Division (SHPD) staff and Dr. Patrick McCoy to discuss the significance of the two potential historic properties that were identified within the survey area. Following discussions, CSH 1 and CSH 2 were determined to not warrant historic property designation and were therefore not assigned SIHP numbers. CSH 1 was determined to most likely be a modern structure, likely constructed within the last 10 years. This interpretation was based on prior surveys undertaken by McCoy within the current survey area that did not identify the feature. CSH 2 was determined to most likely represent natural geological features that only appeared to have been man-made.

The probability of any unmarked burials or human skeletal remains being present is regarded as very low inasmuch as: a) burials near the summit have only been reported at cinder cones (primarily on the south and east sides of the summit), b) most reports of burials are at lower elevations, c) no burials have been encountered during development thus far in the Astronomy Precinct, d) there are no burial markers or surface indicators of burials present, and e) the absence of caves in the area and the general desert pavement geology would not be conducive for burial location selection.

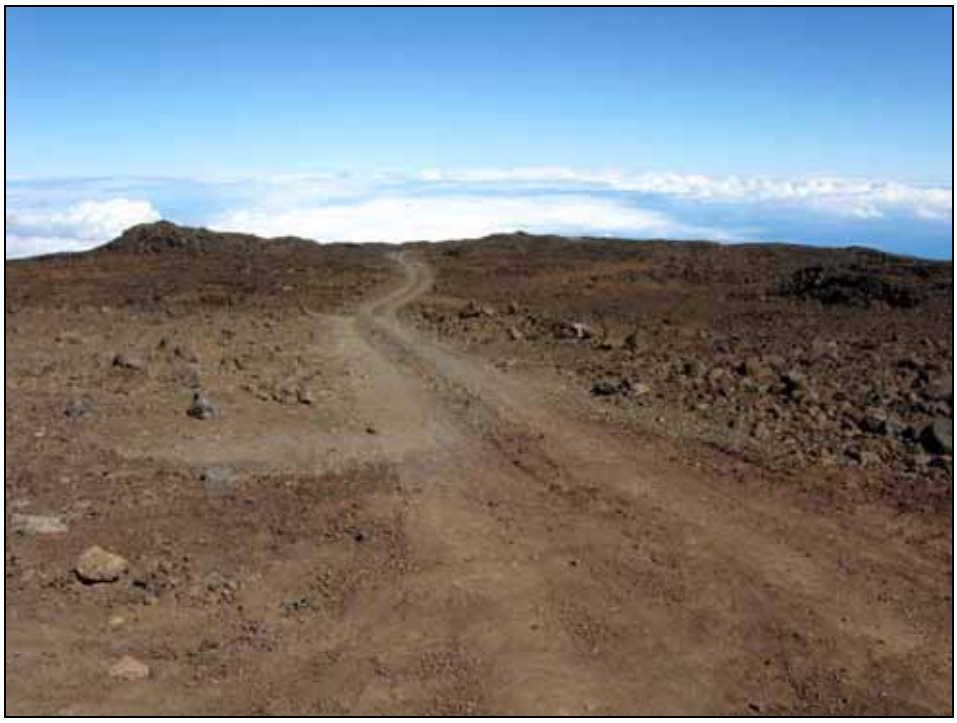

Figure 9. General view of the Area E survey area, view to northwest, showing existing 4-wheel drive access road and proposed Access Way through the central portion of the survey area

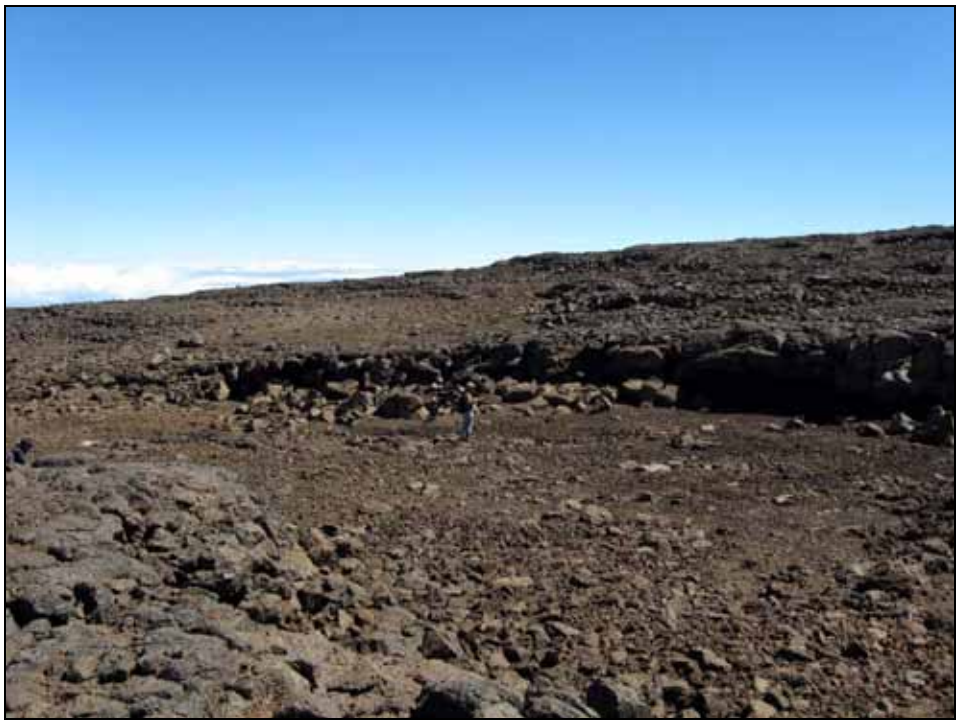

Figure 10. General view of the western portion of the Area E survey area, view to northeast

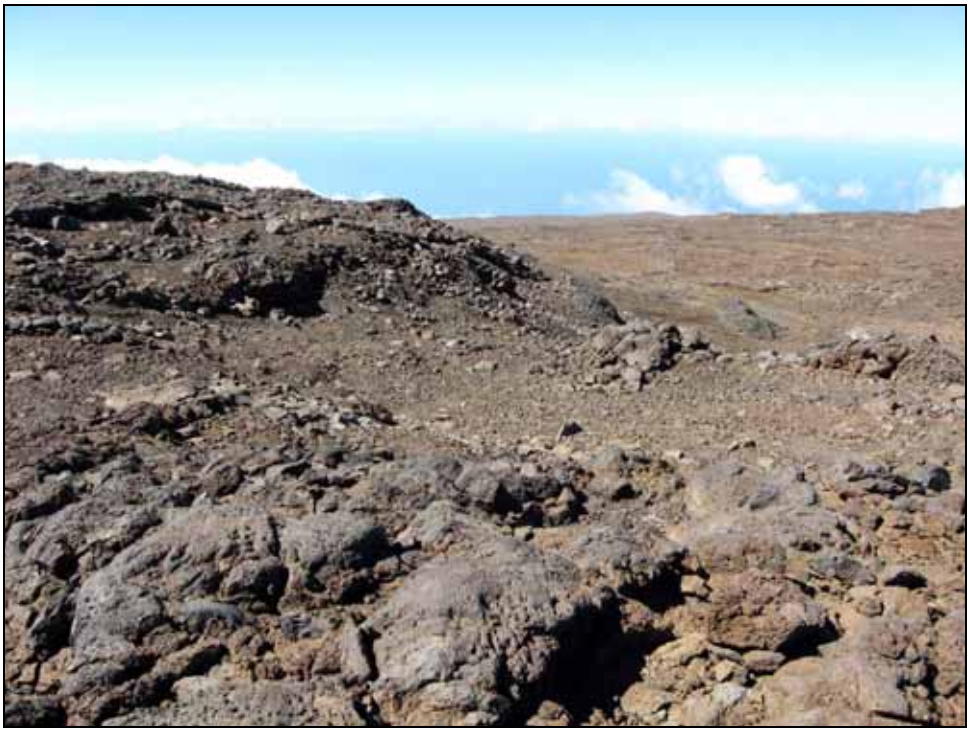

Figure 11. General view of the eastern portion of the Area E survey area, view to north



Figure 12. Example of Hawaiiite basalt exposure within the Area E survey area

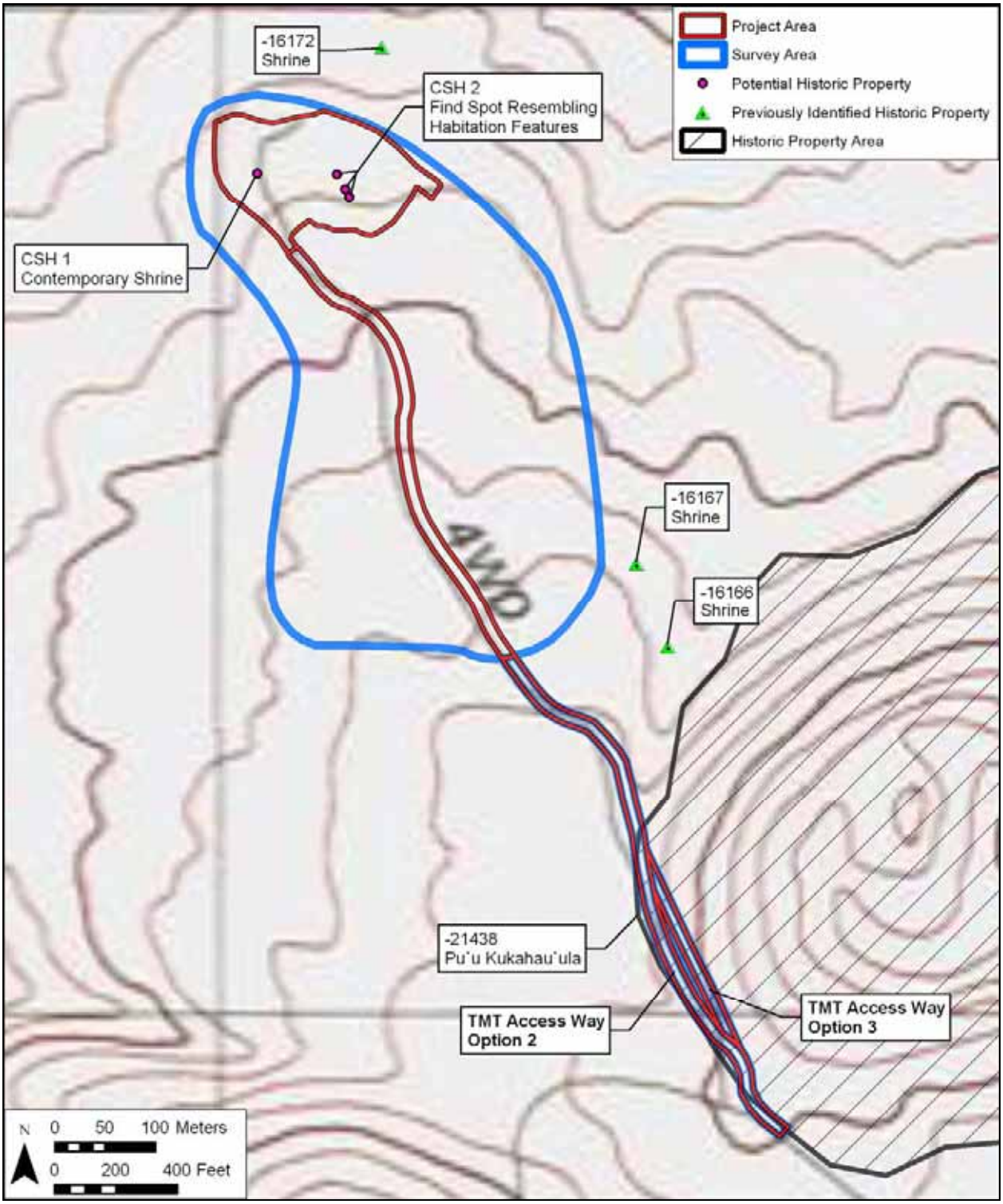

Figure 13. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing the locations of find spots and previously identified historic properties within and in the vicinity of the Observatory and Access Way Project areas

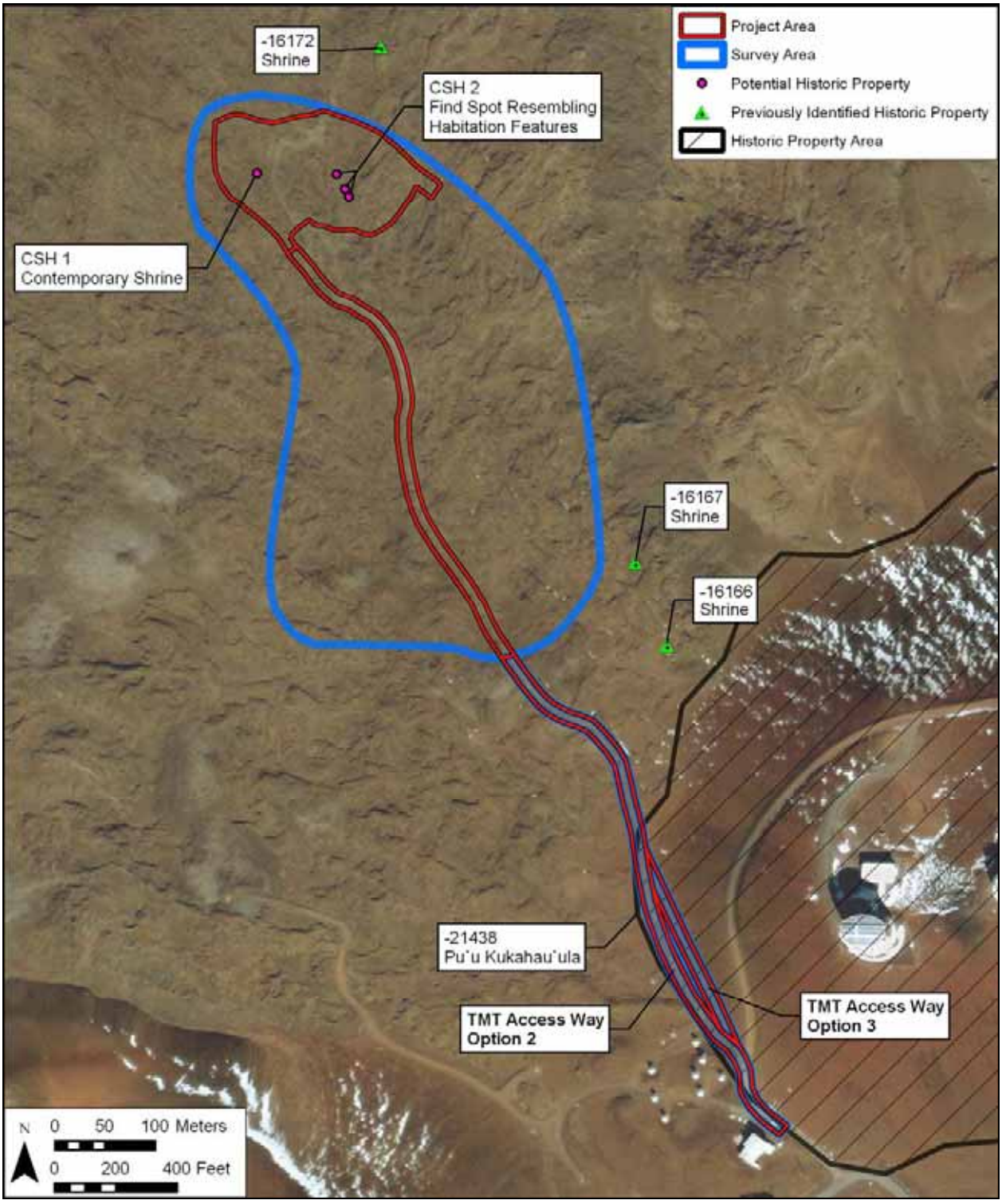

Figure 14. Aerial photograph (source: Google Earth 2009), showing the locations of find spots and previously identified historic properties within and in the vicinity of the Observatory and Access Way Project areas

4.1.2 Relationship of the Access Way Survey Area to the Pu‘u Kūkahau‘ula State Historic Property

Pu‘u Kūkahau‘ula or the summit cinder cone (variously known as Pu‘u Wēkiu, Pu‘u Kea, and Pu‘u Hau‘oki) is a State-designated historic property (SIHP # 50-10-23-21438) covering roughly 480 acres. Eight optical/infrared observatories and the summit loop portion of the Maunakea Access Road are presently within the Pu‘u Kūkahau‘ula State Historic Property.

Two Access Way options are presently being considered (designated TMT Access Way Option 2 and TMT Access Way Option 3; Option 1 has dropped out of consideration). Although various design alternatives are still under consideration, the TMT Access Way will be paved, with underground conduits for necessary electric and communication cables installed along the access way, and a drainage channel on the downslope side where appropriate.

A small portion of each of the two proposed TMT Observatory Access Way options will traverse the extreme southwestern edge of the Pu‘u Kūhahau‘ula State Historic Property (SIHP # 50-10-23-21438) (Figures 13 to 19).

It may be noted that a portion of a common segment of the proposed Access Way options presently is a portion of the Maunakea Access Road Loop servicing the Subaru Observatory (Figures 13 to 17). There are at two existing unimproved roads continuing on to the northwest of the Maunakea Access Road Loop portion of the Maunakea Access Road approximating TMT Access Way Option 2 and TMT Access Way Option 3 (Figures 15, 18 and 19).

4.1.3 Survey Findings of the Batch Plant Staging Area

On November 18, 2009, two archaeologists from Cultural Surveys Hawai‘i, Momi Wheeler B.A. and David W. Shideler M.A., working under the overall supervision of Hallett H. Hammatt Ph.D., carried out a pedestrian inspection of an approximately 4-acre proposed Batch Plant Staging Area (Figures 20 to 25) understood as to be potentially utilized by the TMT Project as a construction staging area during observatory construction. The proposed Batch Plant Staging Area is located approximately 150 m southeast of the California Institute of Technology 10.4 m Submillimeter Telescope and immediately northwest of where the summit access road bifurcates beginning the summit loop road.

Approximately 90% of the proposed batch plant area was observed to have been graded at some time in the past. A small area of undisturbed *pāhoehoe* outcrop was observed in the central east side. Particular attention was given to searching for any remnant lithic waste flakes or other evidence of traditional Hawaiian use.

No cultural resources were observed and none are believed to be present within the proposed Batch Plant Staging Area. The Batch Plant Staging Area does not lie within the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438) (Figures 20 and 21), but does lie within the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869) (see Figure 8).

Two previously identified historic properties (SIHP #s 50-10-23-16164 and -16165), understood to both be pre-contact shrines, are located in the general vicinity of the Batch Plant Staging Area portion of the Project area (see Figure 20 and Figure 21). These were both briefly re-visited and were determined to both be at their indicated position. Both of these historic properties lie at a distance of more than 200 feet from the designated Batch Plant Staging Area

and hence as long as Project activities remain within the designated Batch Plant Staging Area there should be no adverse impact to these historic properties.

4.1.4 Relationship of the Area E Survey Area and the Batch Plant Staging Area to the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869)

Both the Area E Survey Area and the Batch Plant Staging Area lie within the west central portion of the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869) (see Figure 8). All of the Maunakea summit astronomical infrastructure lies within this designated Historic District.

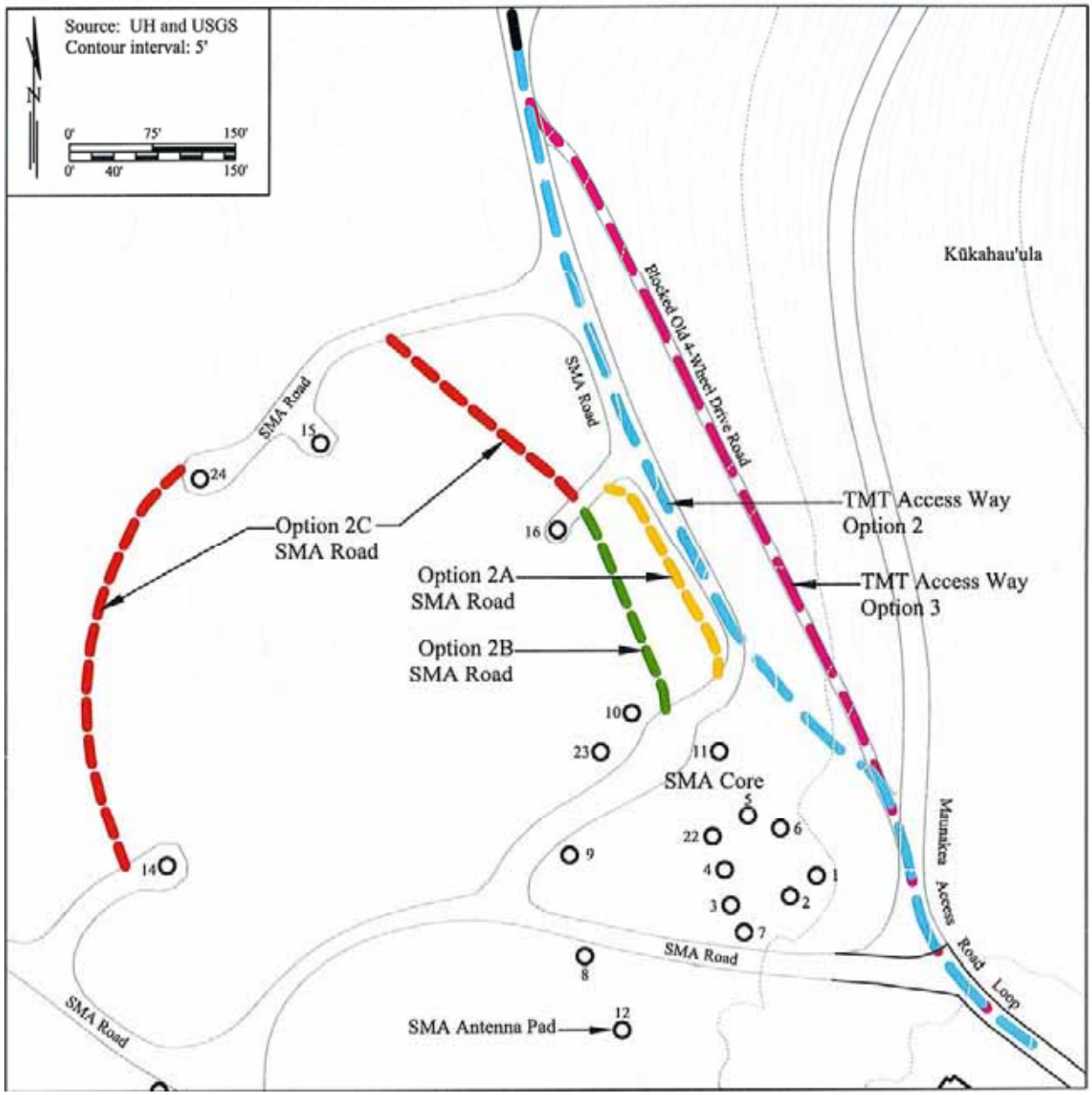

Figure 15. Map showing the routes of the two Access Way options (TMT Access Way Option 2 and TMT Access Way Option 3) under consideration extending north from the Maunakea Access Road Loop/SMA Road intersection



Figure 16. General view approaching the Submillimeter Array (at left) and access road leading to Subaru Telescope and Area E, view to northwest. Note: existing paved summit loop portion of the Maunakea Access Road, unimproved road, and infrastructure are on the southwest flank of the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438)



Figure 17. General view approaching divergence of the Area E access road (at left) and summit loop portion of the Maunakea Access Road leading to the Subaru Telescope, view to north. Note: unimproved road is on the southwest flank of the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438)

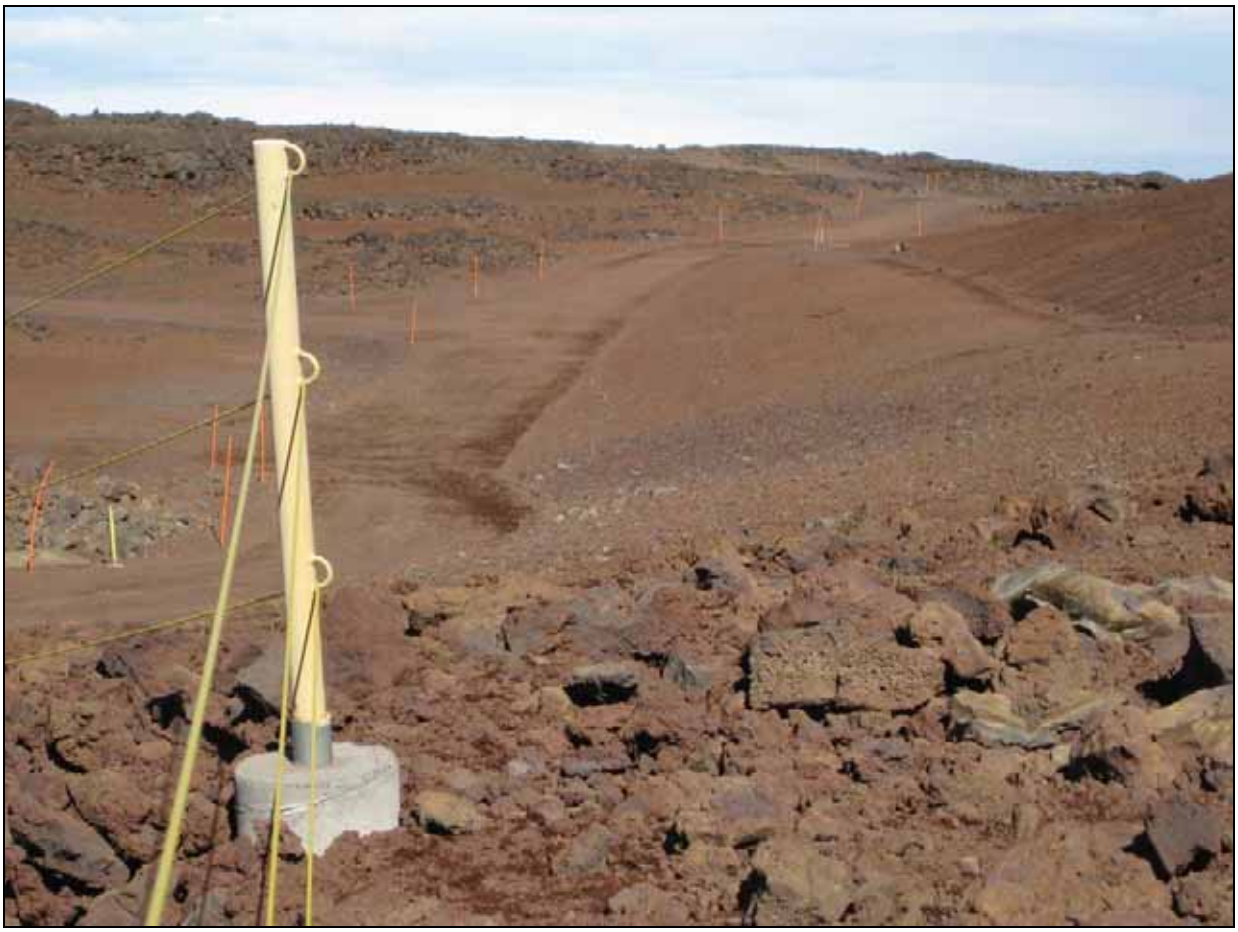

Figure 18. View from the northeast corner of the Submillimeter Array enclosure, showing the TMT Access Way Option 3 alignment corresponding to the unimproved road at upper right and the the TMT Access Way Option 2 alignment corresponding to the unimproved road at center, both are located on the extreme west flank of Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438), view to north



Figure 19. View showing the TMT Access Way Option 3 alignment corresponding to the unimproved road at upper left and the TMT Access Way Option 2 alignment corresponding to the unimproved road at right, both located on the extreme west flank of Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438), view to southeast

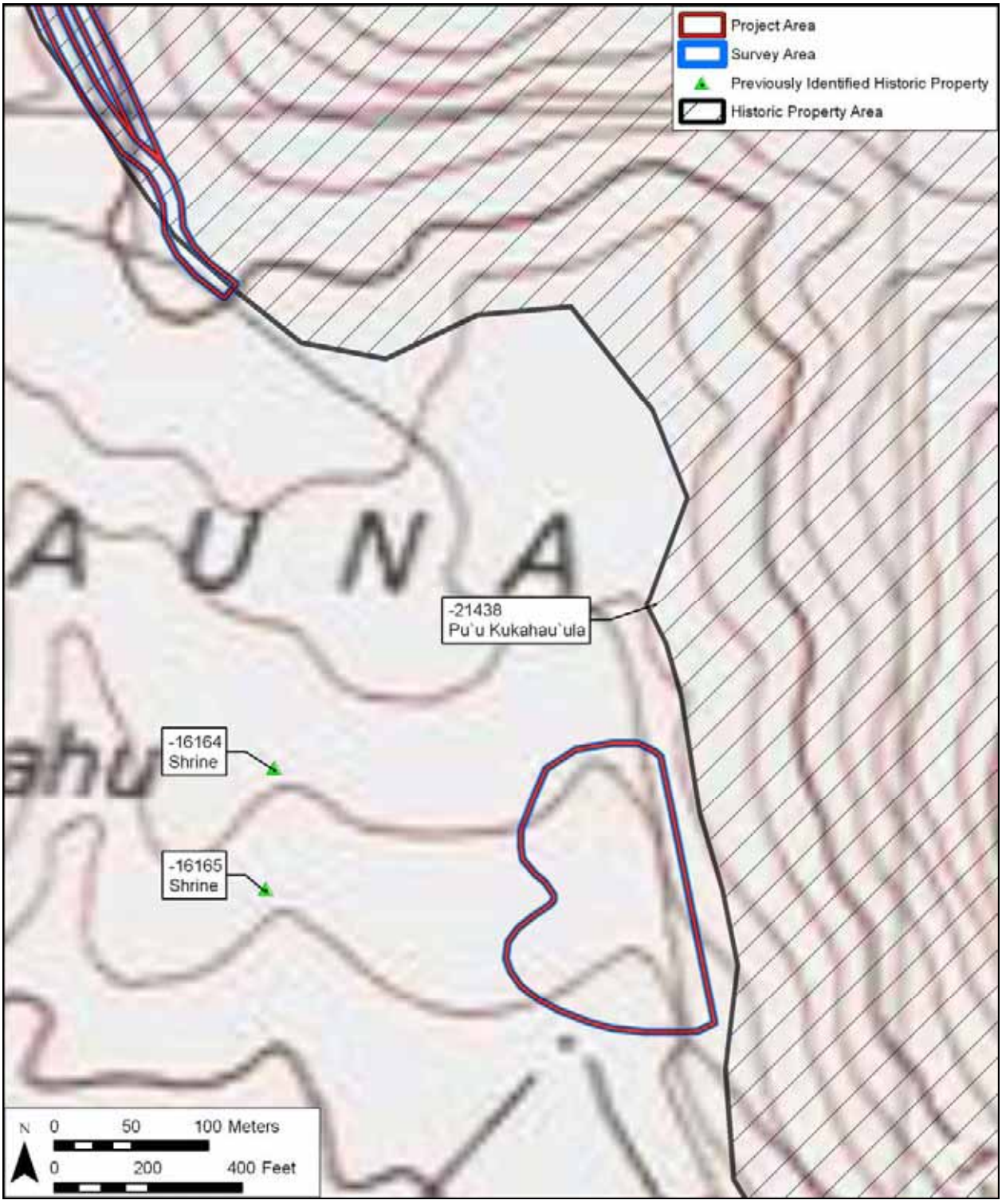

Figure 20. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing the locations of previously identified historic properties in the vicinity of the Batch Plant Staging Area

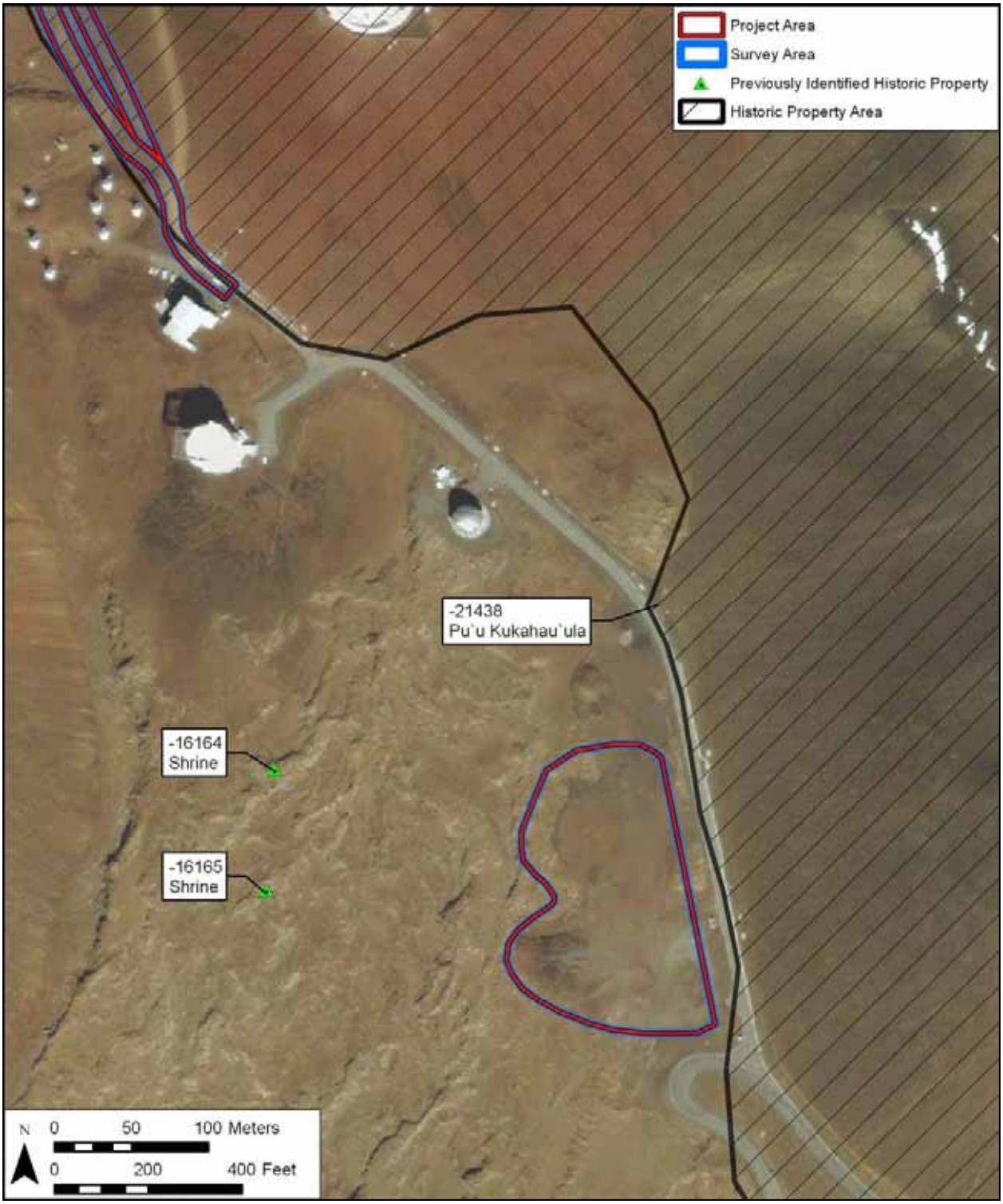

Figure 21. Aerial photograph (source: Google Earth 2009), showing the locations of previously identified historic properties in the vicinity of the Batch Plant Staging Area



Figure 22.General view of the eastern portion of the Batch Plant Staging Area, view to northwest

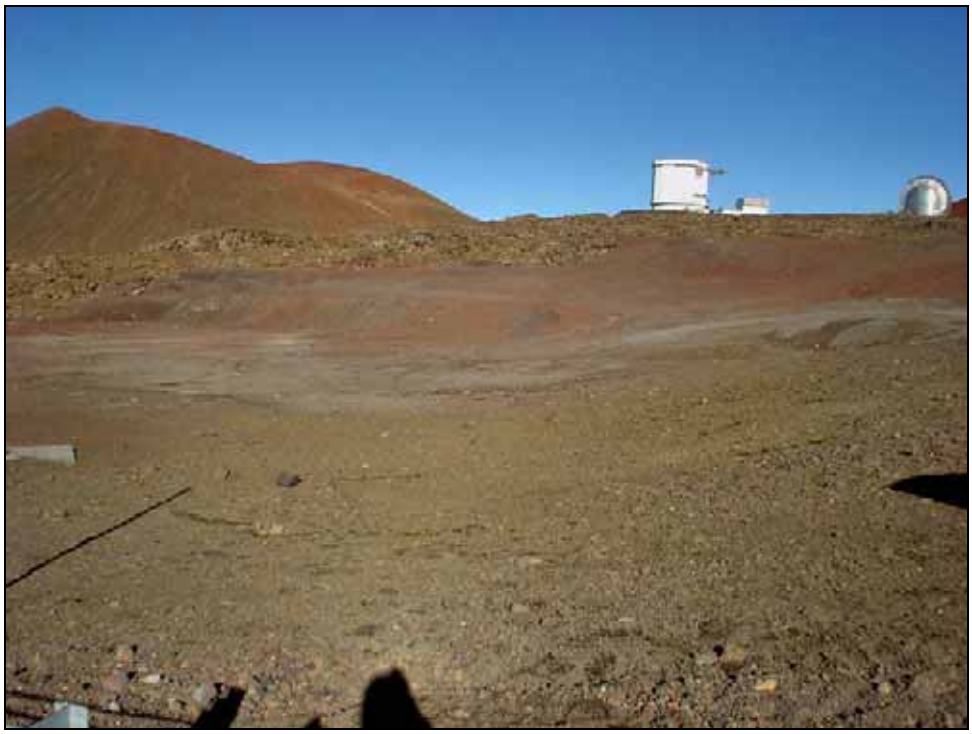

Figure 23. General view of western portion of the Batch Plant Staging Area, view to northwest



Figure 24. General view of the southeast portion of the Batch Plant Staging Area, view to southeast



Figure 25. General view of the southwest portion of the Batch Plant Staging Area, view to south

Section 5 Significance Assessments

The five criteria established for evaluating the significance of historic properties and assessing eligibility for placement on the National/Hawai‘i Registers of Historic Places are:

A Associated with events that have made an important contribution to the broad patterns of our history;

B Associated with the lives of persons important in our past;

C Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value;

D Have yielded, or is likely to yield information important for research on prehistory or history;

E Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property, or due to associations with traditional beliefs, events or oral history accounts – these associations being important to the group's history and cultural identity.

SIHP # 50-10-23-26869 Mauna Kea Summit Region Historic District was previously assessed as significant under Criteria A, B, C, D, and E of the National/Hawai‘i Registers of Historic Places evaluation criteria:

> The Mauna Kea Summit Region Historic District is significant under all four National Register criteria, and criterion "e" of the Hawaii Administrative Rules, Chapter §13-275-6. The district is significant under criterion "a" because of the presence of the Mauna Kea Adze Quarry Complex (a National Historic Landmark), which was used over a period of 500 years or more and the hundreds of shrines in and outside of the quarry. Both the quarry and the shrines are associated with broad patterns and events in Hawaiian prehistory. The district is significant under criterion "b" because of the association with several gods who may have been deified ancestors. These include Kūkahau`ula, Līlīnoe and Waiau. The sites in the adze quarry and many of the shrines embody distinctive characteristics of traditional Hawaiian stone tool manufacture by craft specialists and a distinctive type of shrine construction found in only a few other places in the Hawaiian Islands. These make the district significant under criterion "c." Studies of the Mauna Kea Adze Quarry Complex and the on-going archaeological survey of the Mauna Kea Science Reserve have already made a significant contribution to our understanding of Hawaiian prehistory and history, and hold the potential to make even more contributions. The district is thus significant under criterion "d." Finally, the district is significant under criterion "e" because of the presence of numerous burials and the hundreds of shrines which have been interpreted as evidence of a previously unknown land use practice in the form of pilgrimages to the summit of Mauna Kea to worship the gods and goddesses. [McCoy et al. 2009:2-49]

Per the Mauna Kea Historic Preservation Plan [SHPD 2000:20]:

> Within the [Mauna Kea Summit Region] historic district, the significance of properties is not evaluated individually because the summit region as a whole is considered eligible for inclusion in the National Register. Instead, the required assessments consider how each newly or previously recorded property potentially affected by a project contributes to the significance of the historic district as a whole.

SIHP # 50-10-23-21438 (Pu‘u Kūkahau‘ula) is a contributing component of the Mauna Kea Summit Region Historic District. Pu‘u Kūkahau‘ula is significant due to its cultural significance to the Hawaiian people, associations with former and on-going cultural practices, and associations with traditional beliefs, events, and oral history accounts.

Section 6 Project Effect and Mitigation Recommendations

The following project effect discussion and cultural resource management recommendations are intended to facilitate project planning and support the proposed project's required historic preservation consultation. This discussion is based on the results of this archaeological inventory survey investigation and CSH's communication with agents for the project proponents regarding the project's potential impacts to the historic properties described in the Results of Fieldwork section, above.

6.1 Project Effect

The proposed TMT Observatory Project involves the construction of a 30-meter diameter telescope and associated infrastructure on a 5-acre site within Area E of the Astronomy Precinct. The Project also includes construction of an Access Way, consisting of a 0.6-mile long road and utility corridor from existing facilities to the TMT Observatory. In addition, the Batch Plant Staging Area, consisting of a 4-acre area near the summit, would be temporarily used as a staging area during Project construction. Minimally, land disturbing activities would include grading of the TMT Observatory site, Access Way, and Batch Plant Staging Area, and excavations associated with building construction and installation of subsurface utilities.

The TMT Observatory, Access Way, and Batch Plant Staging Area are within the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869). The only individual historic property that will be affected by any of these Project components is the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438).

6.1.1 Absence of Direct Impact to Archaeological Sites

The proposed Project will not impact any specific archaeological sites. Three historic properties (SIHP #s 50-10-23-16166, -16167, and -16172), understood to all be pre-contact shrines, are located in the general vicinity of the Observatory and Access Way portions of the Project area (see Figures 13 and 14). As specified in a 2000 Master Plan, it is understood that Project activities should maintain a 200-foot buffer from these historic properties. All three of these historic properties lie at a distance of more than 200 feet from the designated Project areas, and hence as long as Project activities remain within the designated project areas, there should be no adverse impact to these historic properties.

Similarly, two historic properties (SIHP #s 50-10-23-16164 and -16165), understood to both be pre-contact shrines, are located in the general vicinity of the Batch Plant Staging Area portion of the Project area (see Figures 20 and 21). As specified in a 2000 Master Plan it is understood that Project activities should maintain a 200-foot buffer from these historic properties. Both of these historic properties lie at a distance of more than 200-feet from the designated Batch Plant Staging Area, and hence as long as Project activities remain within the designated Batch Plant Staging Area there should be no adverse impact to these historic properties.

6.1.2 SIHP # 50-10-23-21438 Pu‘u Kūkahau‘ula State Historic Property

The construction of either of the proposed TMT Access Way options, consisting of an approximately 0.6-mile long road and utility corridor from existing facilities to the TMT

Observatory will skirt a short stretch (approximately 540 feet) of the extreme western portion of the cinders of Pu‘u Kūkahau‘ula (understood as falling within SIHP # 50-10-23-21438) (see Figure 21 and the photograph series of Figure 16 to Figure 19) at approximately the 13,400-foot contour, approximately 400 feet below the 13,796 foot summit. It may be noted that two roughly parallel unimproved tracks lie adjacent to the proposed Access Way further upslope to the east (see Figures 18 and 19). Much of the proposed Access Way alignment follows existing roads that have been established in the summit area. Approximately 230 linear feet of the proposed alignment would involve road construction through Pu‘u Kūkahau‘ula cinder lands not previously used as roads. The proposed 26-ft. wide road would be graded, with subsurface utilities installed beneath the road surface. The road would be primarily unpaved, with the exception of the road in the vicinity of the core of the Submillimeter Array (SMA) facility that would be paved to minimize the effects of dust on the SMA antennas.

The to-be-chosen Access Way option will disturb an approximately 1.3-acre area of the 480-acre Pu‘u Kūkahau‘ula State Historic Property. This disturbance will occur on the western most extent of Pu‘u Kūkahau‘ula at the base of the cinder cone near the SMA. The Access Way affect will primarily be associated with a small 0.3-acre area of disturbance where there currently is no road, but this area is between two existing unimproved roads; the remaining 1.0 acre of disturbance within the Pu‘u Kūkahau‘ula State Historic Property would be along one of two existing tracks that will be improved. A retaining wall may or may not be required but some grading will be necessary within the limits of the Pu‘u Kūkahau‘ula State Historic Property. Pu‘u Kūkahau‘ula, on which eight optical/infrared observatories, a portion of the SMA area, and the loop portion of the Maunakea Access Road sit, will retain its current shape but a small area will be graded and a short section of new road and existing unpaved road at its base will be paved.

The SIHP # 50-10-23-21438 Pu‘u Kūkahau‘ula State Historic Property has been massively impacted by the construction and use of the existing loop access road, telescope pads and appurtenances. These impacts include not only effects to the cinder cone itself but also to the surrounding view plane. In an effort to minimize adverse impacts to SIHP # 50-10-23-21438 the TMT observatory was located significantly outside of the designated historic property, well to the northwest.

Whichever of the two Access Way options that is chosen will skirt the lowest edge of SIHP # 50-10-23-21438 at approximately the 13,400-foot contour approximately 400 feet below the 13,796 foot summit of the historic property. The Access Way will have an adverse physical impact to this lowest westernmost portion of the historic property. Additionally, the TMT observatory and appurtenances will be visible to the west and north of the historic property. It may be noted that we understand the observatory will not be visible from the actual summit (Figure 26). Due to the potential adverse effect on this significant historic property, CSH’s project-specific effect recommendation is “effect, with proposed mitigation commitments.”

6.1.3 SIHP # 50-10-23-26869 Mauna Kea Summit Region Historic District

The Project area, including the Observatory, the Access Way, and the Batch Plant Staging Area, is located within the SIHP # 50-10-23-26869 Mauna Kea Summit Region Historic District (see Figure 8). All of the Maunakea summit astronomical infrastructure lies within this designated Historic District. Due to the potential adverse effect on significant historic properties,

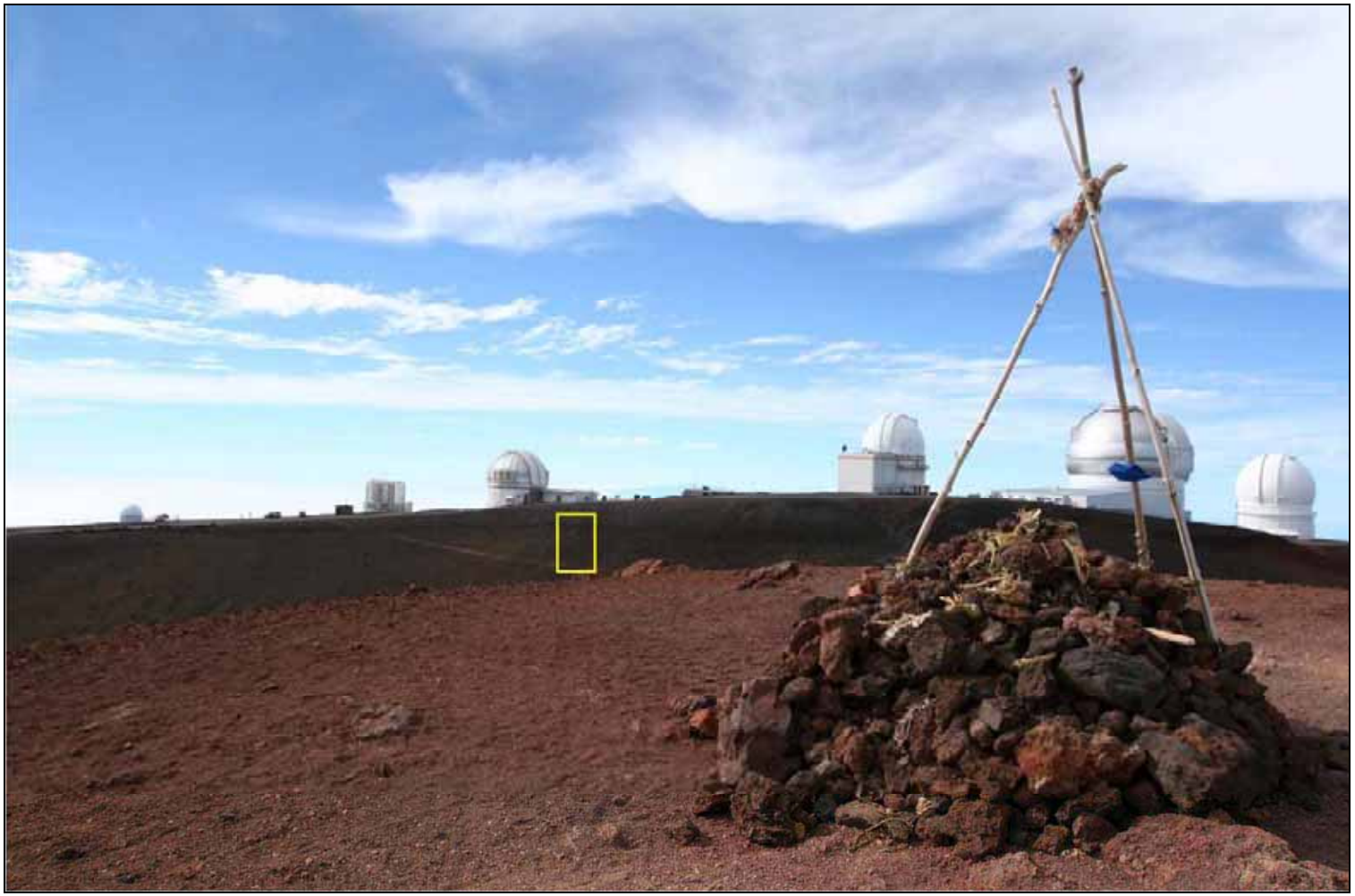

Figure 26. Illustration of how the TMT Observatory will not be visible from the summit of the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-26869. TMT would be in the yellow box is you could see through the mountain

CSH’s project-specific effect recommendation is “effect, with proposed mitigation commitments.”

6.2 Mitigation Recommendations

As discussed in Section 6.1.1 above, the Project is anticipated to have no direct affect on any archaeological sites per se. However, due to the potential adverse effect on two significant historic properties (Pu‘u Kūkahau‘ula State Historic Property, SIHP # 50-10-23-21438 and the Mauna Kea Summit Region Historic District, SIHP # 50-10-23-26869), CSH’s project-specific effect recommendation is: “effect, with proposed mitigation commitments.”

The Mauna Kea Historic Preservation Plan (SHPD 2000:20-21) prepared by SHPD, states:

> Within the historic district, the effect of a project on the historic district as a whole needs to be assessed as well as the project’s effect on individual historic properties located within or immediately adjacent to the project area. The effect of a project on the historic district must be addressed even if no individual historic properties are found within or immediately adjacent to the project area.
>
> Effects on a district would consider the visual impact of a facility on the surrounding landscape (i.e., the various land forms creating the setting and context of the multiple historic properties encompassed by the district) and on those individual historic properties which contribute to the significance of the district. Creating a network of roads would affect the historic district because, in addition to altering the landscape, it creates easier access to more areas in the historic district and thus increases the possibility of historic properties being damaged by visitors.

Project affects on the Pu‘u Kūkahau‘ula State Historic Property and the Mauna Kea Summit Region Historic District have little to do with specific archaeological sites per se, but rather are closely related to Project impacts on the perceived spiritual and sacred quality of Maunakea. This includes:

- Project affect on the integrity of cinder cones within the district.
- The visual affect of the Project’s man-made structures within the district.
- The affect of Project employees in the summit region.
- The affect of the potential accidental release of wastewater or hazardous substances due to Project activities within the district.
- The affect of noise and dust generated by Project activities within the district.

6.2.1 Historic Properties and Integrity of Cinder Cones

The Project affects on the Pu‘u Kūkahau‘ula State Historic Property, the only individual Historic Property within or adjacent to the Mauna Kea Summit Region Historic District affected by the Project, are discussed above. All Project components within the Historic District are more than 200 feet away from individual Historic Properties within the Historic District.

Because Pu‘u Kūkahau‘ula is also a cinder cone, the Project affects on it are also the Project affects on the integrity of cinder cones. The only other Project facility that is within 200 feet of a cinder cone in the district is the Batch Plant Staging Area. The Batch Plant Staging Area is located across Maunakea Access Road from the southeastern portion of Pu‘u Kūkahau‘ula. The Batch Plant Staging Area has been used during previous construction projects and the Project’s use will be similar to those uses. No additional areas nearby will be disturbed by the Project, including the Pu‘u Kūkahau‘ula cinder cone across the road.

The impact of the project will be mitigated by virtue of keeping the Access Way on the extreme lower margin of Pu‘u Kūkahau‘ula (SIHP # 50-10-23-21438) at approximately the 13,400-foot contour approximately 400 feet below the 13,796 foot summit of the historic property. By keeping the new Access Way construction within the immediate vicinity of two existing vehicular roads (see Figures 18 and 19) further adverse impact to the cinder cone integrity will be minimized.

6.2.2 Visual

The TMT Observatory will not be visible from the summit of the Pu‘u Kūkahau‘ula State Historic Property (see Figure 26). This is due to the presence of the northern ridge of Pu‘u Kūkahau‘ula blocking the view from the summit peak. The TMT Observatory will also not be visible from the Pu‘u Līlīnoe (SIHP # 50-10-23-21439) and Waiau (SIHP # 50-10-23-21440) State Historic Properties. However, the TMT Observatory will add a new visual element to the northern plateau area that will be visible to varying degrees from the northern ridge of Pu‘u Kūkahau‘ula and some of the historic shrines and other historic properties along the northern slopes of Maunakea. The TMT Observatory will appear in the view directly toward the summit from only a few of the shrines on the northern plateau.

Although the TMT Observatory will be built in a relatively undeveloped portion of the Mauna Kea Science Reserve (MKSR) Astronomy Precinct, it will be less visible from within the Historic District than the existing observatories. From all locations within the district that the TMT Observatory will be visible, multiple existing observatories will also be visible.

6.2.3 Roads and Access

The Access Way will not create a new road, it will improve an existing road. This improvement could not be characterized as creating a “network” of roads, but will create easier access to a limited area of the Historic District. The Access Way will only substantially improve access (improve a 4-wheel drive road to an improved dirt road) over a 0.3 mile length starting beyond (north of) the SMA access road. Nevertheless, TMT employees and visitors will be accessing a portion of the Historic District that is currently rarely visited.

The establishment of a specific Access Way will mitigate the present state of affairs in which somewhat braided, ad-hoc vehicular access prevails (see Figures 18 and 19). The establishment of one main access alignment should mitigate the present impacts over a larger area.

6.2.4 Employees in the Summit Region

Some Native Hawaiians have expressed that just knowing that Maunakea is there is sufficient; there is not a strong need to visit. In this framework, the regular presence of any people is not

considered a normal condition for Maunakea and could affect its spiritual and sacred quality, and hence the Historic District. It is estimated that approximately 100 employees currently work at the observatory facilities within MKSR. It is expected that an average of 24 employees will work at the TMT Observatory during daytime operations, with a minimum of 15 and a maximum of 43 possible; nighttime operations will require an average of 6 employees at the facility. Thus there will be a relatively small number of employees within a clearly demarcated facility. A program of employee education emphasizing the importance of minimizing adverse impact to cultural resources will mitigate any adverse impact associated with increased human use of Pu‘u Kūkahau‘ula and the Mauna Kea Summit Region Historic District

6.2.5 Accidental Release of Wastewater or Hazardous Substances

Some Native Hawaiians have indicated that the practice of releasing domestic wastewater into the subsurface through septic systems by current observatories desecrates the spiritual and sacred quality of the mountain, and hence the district. The same has been said regarding the potential accidental spillage of wastewater or hazardous substances. For these reasons the Cultural Resources Management Plan (CRMP) requires that all new users remove all domestic wastewater from the mountain for treatment. The Project will comply with this requirement and will not utilize a septic system to dispose of domestic wastewater. No wastewater will be released and all wastewater will be trucked off the mountain for disposal.

6.2.6 Noise and Dust

Noise and dust could have an effect on the spiritual and sacred quality of the mountain and hence the Historic District, respectively. Noise is closely associated with vehicular movements in the summit region and dust is closely associated with vehicular movements on unpaved roads in the summit region. The movements of employees and materials to and from the TMT Observatory will generate noise and dust. The noise and dust generated by Project activities will adversely affect the spiritual and sacred quality of Maunakea and the Historic District. Specific measures will be taken to minimize noise and dust during construction and subsequent routine use of the TMT Observatory.

6.2.7 Treatments

The following treatments, commonly known as mitigation measures, will be implemented by the Project:

- An Archaeological Monitoring Plan will be developed in accordance with HAR section 13-279 and cultural and archaeological monitors will be present at construction sites on Maunakea and have authority to stop work if cultural finds are made, including historic properties. They will also inform workers of the possibility of inadvertent cultural finds, including human remains.
- A Mitigation Plan will be developed and implemented meeting the requirements of HAR section 13-284-8(a)(2). This Mitigation Plan will be developed in consultation with native Hawaiian organizations, including the Office of Hawaiian Affairs, to seek their views on the proposed forms of mitigation.

- In compliance with the CMP and to mitigate potential effects on cultural practices and Historic Properties, among other things, a Cultural and Natural Resources Training Program will be developed and implemented. As discussed in the CMP, the Cultural and Natural Resources Training Program will include educational instruction and materials designed to:
  - Impart an understanding of Maunakea's cultural landscape, including cultural practices, historic properties and their sensitivity to damage, and the rules and regulations regarding the protection of historic properties.
  - Make it clear that any disturbance of a historic property is a violation of HRS Chapter 6E-11 and punishable by fine.
  - Provide guidance and information as to what constitutes respectful and sensitive behavior while in the summit area.

  The training program will be updated regularly to incorporate UH Management Area-wide updates by OMKM. All people involved in TMT Observatory operation and maintenance activities, including but not limited to scientists and support staff, will receive the training on an annual basis.
- To mitigate the TMT Observatory's visual effect within the Historic District:
  - In compliance with the 2000 Master Plan, the TMT Observatory has selected the 13N site within Area E, which, as the 2000 Master Plan details, was selected to minimize the Project's visual effect.
  - The Project has attempted to reduce the TMT Observatory's visual impact to mitigate its visual effect. Steps include design efforts to reduce its size, finish the support building and fixed structure exterior with a lava color, and finish the dome with a reflective aluminum-like finish similar to the Subaru Observatory.
- To mitigate the Access Way's effect on Kūkahau‘ula and the Historic District, the Access Way Options:
  - Have been designed to reduce disturbance by including the steep slopes of Option 2 and modifying Option 3 to a single lane configuration, even though these designs are not desirable from an observatory operation standpoint.

While the TMT Observatory will impact the view plane in certain portions of the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438) and the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869), the impact will be far less than that of any existing observatory (see Figure 26). The location and elevation of the observatory and infrastructure were specifically designed to minimize adverse impacts to view planes within the district (see Figure 26).

6.2.8 Off-Site Mitigation

TMT is considering a number of possible mitigation measures that relate to cultural and archaeology/historic potential impacts. These are presently being discussed with cultural consultants in the context of the on-going, companion *Cultural Impact Assessment for the Thirty*

Meter Telescope (TMT) Observatory Project and Hale Pōhaku Mid-Level Support Facilities Project, Maunakea, Ka‘ohe Ahupua‘a, Hāmākua District, Hawai‘i Island, TMK: [3] 4-4-015:001 por., 009 por., 012 por. (Cruz et al. 2009). Specific discussion is focusing on if consultants can (a) provide input to improve or focus proposed off-site mitigation measures; (b) suggest alternative ideas. Below is a list of general concepts but it should be made clear that the TMT Observatory team is not prepared to make any commitments at this time believing that it is appropriate to receive further feedback from the concerned community first (the on-going *Cultural Impact Assessment* is one avenue to get that feedback). Off-site mitigation measures being presently considered include the following:

1. Help fund the restoration the stone cabins at Hale Pōhaku and turn them into a cultural interpretive center associated with the Visitor Information Station (VIS)
2. Help fund the expansion of the VIS and generally improve it so that, together with the stone cabins, it provides a well rounded presentation and education regarding cultural (including archaeology), natural, and astronomy.
3. Provide funding to benefit either the University of Hawai‘i at Hilo Hawaiian Studies and Hawaiian Language program or funding to benefit the Hawaiian immersions charter schools (looking for input on what people think would be more beneficial - college level or grade school level funding for cultural programs).
4. Coordinate with Imiloa on the development of programs and informational materials that explore the connection between Hawaiian culture and astronomy.
5. Possibly shutting down operations for 4 or 5 days a year, the most cultural significant days, such as solstice and equinox days.
6. Host annual, or otherwise, cultural events/workshops at Hale Pōhaku or elsewhere that provide cultural extension to the community - ideas: adze making workshop, how to identify an archaeology site, etc.
7. Fund some translation of chants and then take lessons from them to (a) cultural events/workshops, and/or (b) schools and such.

6.2.9 Summary of Mitigation

The main form of mitigation is in the locating of the TMT Observatory off of the summit and well away from all known archaeological sites. Keeping the TMT Observatory and appurtenances more than 200 feet away from all known sites is a major form of mitigation. Similarly the fact that the TMT Observatory will not be visible from the actual summit (Figure 26) is suggested to be a major form of mitigation of impact to both the Pu‘u Kūkahau‘ula State Historic Property (SIHP # 50-10-23-21438) and the Mauna Kea Summit Region Historic District (SIHP # 50-10-23-26869).

The probability of burials or human skeletal remains within the Project area is regarded as very low for reasons given in Section 4.1 above. However, in the unlikely event that cultural resources including but not limited to human remains or other significant cultural deposits are encountered during the course of Project-related construction activities, all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

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Appendix A Documentation of Potential Historic Properties

CSH 1

INITIALLY INTERPRETED SITE TYPE: Shrine
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 6.6 feet NW/SE x 3.3 ft. NE/SW
CONDITION: Excellent
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:009

DESCRIPTION:

CSH 1 consists of two upright stones, located in the northwestern portion of the survey area (see Figure 13 and Figure 14). The upright stones, consisting of flat slabs of hawaiiite basalt, are situated on the edge of a natural basalt boulder terrace, measuring approximately 50 ft. long and 2 ft. in height (Figure 27). The upright stones are wedged into cracks within or between the top surface of large boulders, with cobbles used to fill the remaining gaps (i.e. chinking) and support the stones in an upright position (Figure 28 and Figure 29). The upright stones are spaced 4 ft. apart, at a bearing of 132° true north. The southeastern upright stone measures 22 inches high and 10 inches wide, with a thickness of 2 inches. The northwestern stone measures 18.5 inches high and 12 inches wide, with a thickness of 1.5 inches. CSH 1 was initially interpreted to be a pre-contact shrine, similar to shrines previously identified in the vicinity of the project area. However, following consultation with SHPD staff and Dr. Pat McCoy within the project area, the shrine was determined to be a modern structure, likely constructed within the last 10 years.

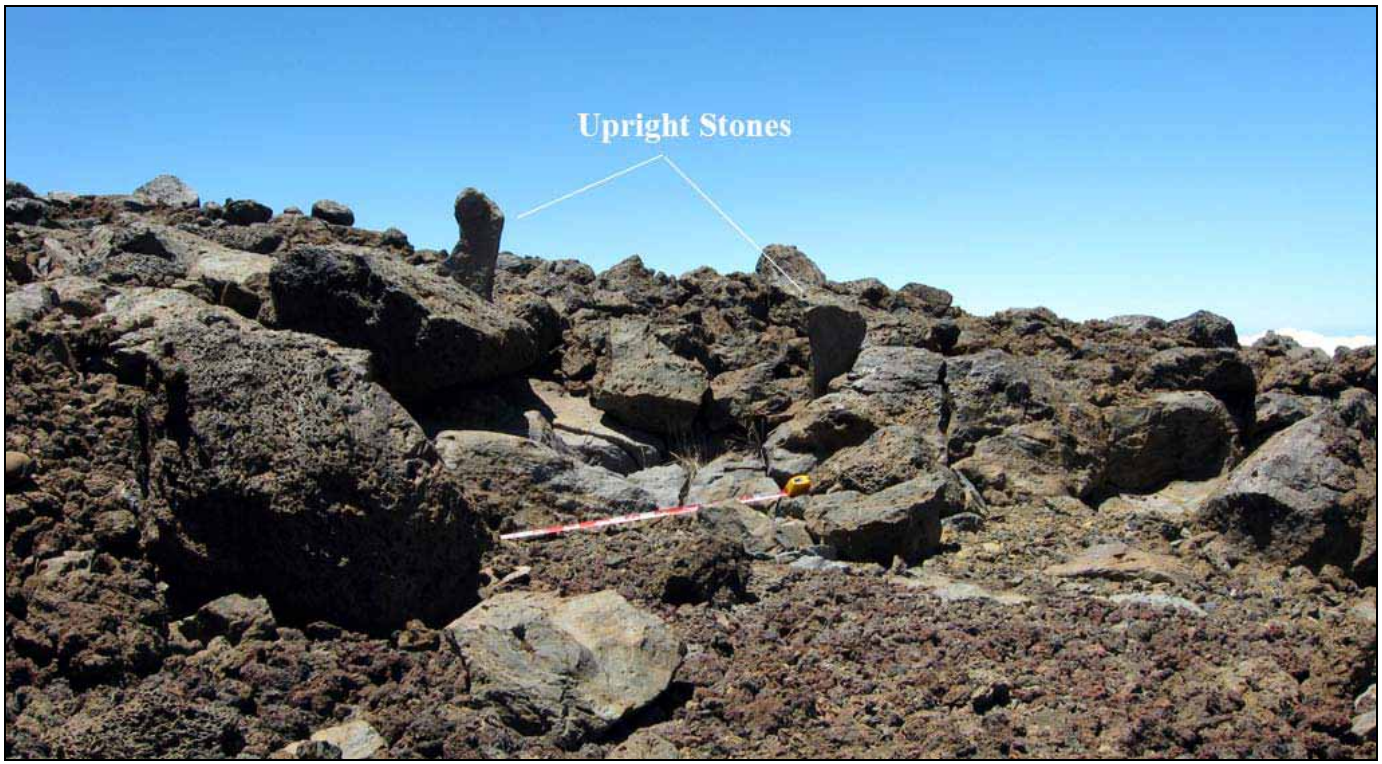

Figure 27. Photograph of CSH 1 understood as a contemporary shrine, view to southwest, showing two upright stones



Figure 28. Photograph of CSH 1 understood as a contemporary shrine, showing southeastern upright stone



Figure 29. Photograph of CSH 1 understood as a contemporary shrine, showing northwestern upright stone

CSH 2

[The following account relates to how this find spot was initially recorded]

INITIALLY INTERPRETED SITE TYPE:	Temporary Habitation Complex
INITIALLY INTERPRETED FUNCTION:	Temporary Habitation
FEATURES:	3
DIMENSIONS:	100 feet NW/SE x 22 feet NE/SW
CONDITION:	n/a
PROBABLE AGE:	n/a
TAX MAP KEY:	[3] 4-4-015:009

DESCRIPTION:

CSH 2 was originally believed to consist of three possible temporary habitation structures, located in the northwestern portion of the project area (see Figure 13 and Figure 14). The possible temporary habitation structures are located within a northwest to southeast trending lava channel, sheltered from the prevailing northeasterly winds. Feature A, the northernmost of the possible structures, is a C-shaped enclosure located at the base of the lava channel (Figure 30). Feature A measures 6.2 feet by 4.9 ft. wide, and utilizes an 2.6 ft. high bedrock outcrop along the eastern edge of the structure, with a 2 ft. high, 1-3 course, stacked boulder and cobble wall along the southeastern edge, forming a C-shaped windbreak. The interior of Feature A is a level, pebble-paved surface, cleared of larger stones. Feature B, located approximately 17 m southeast of Feature A, is a terrace constructed against the northeastern ridge of the lava channel (Figure 31). Feature B measures 6.2 ft. by 4.3 ft. wide and is constructed with a 3.9 ft. high, 3-5 course, roughly stacked boulder and cobble retaining wall along the north and west edges of the structure. The wall retains a level, pebble-paved terrace surface. Feature C, the southernmost of the structures, is a terrace located approximately 30 ft. southeast of Feature B (Figure 32). Feature C, measuring 8.5 ft. by 5 ft., is constructed against the northeastern ridge of the lava channel. A 2.6 ft. high, 2-4 course, roughly stacked boulder and cobble retaining wall is constructed along the southwest portion of the structure, retaining a level, pebble paved terrace surface.

CSH 2 was initially interpreted to be a pre-contact temporary habitation complex. However, following a subsequent on-location consultation with SHPD staff and Dr. Pat McCoy, CSH 2 was determined to most likely consist of natural features.



Figure 30. Photograph of CSH 2 Feature A, initially perceived as a C-shaped temporary habitation structure, view to east



Figure 31. Photograph of CSH 2 Feature B, initially perceived as a temporary habitation terrace, view to east



Figure 32. Photograph of CSH 2 Feature C, initially perceived as a temporary habitation terrace, view to northeast

Appendix H. Archaeological Assessment Report, Hale Pōhaku

Preface

The Archaeological Study and Assessment for the Thirty-Meter-Telescope (TMT) Observatory Project Ancillary Facilities, Hale Pōhaku Area, Kaʻohe, Ahupuaʻa, Hāmākua District, Hawaiʻi Island, TMK: [3] 4-4-015:001 por., 012 por. has been updated since the Draft EIS was completed. This report addresses only the Project facilities in and near Hale Pōhaku; Project facilities in the Mauna Kea Science Reserve (MKSR) are discussed in a separate report in Appendix G. The Archaeological Study and Assessment report has been updated to address comments on the report received from State of Hawaiʻi Department of Land and Natural Resources, State Historic Preservation Division, in a letter dated July 31, 2009. That letter, and responses to comments in the letter, is included in Chapter 8, Volume 2, of the Final EIS. Changes made to this technical report since the Draft EIS was completed are not illustrated as they are within this preface and the body of the Final EIS. Substantial changes to the Archaeological Study and Assessment report include the following:

- Clarifications to the Project, surveyed areas, and APE were made.
- State Inventory of Historic Properties (SIHP) numbers have been indicated for an identified lithic scatter.

Within the body of this Final EIS, historic and archaeological resources are discussed in Section 3.3, Archaeologic/Historic Resources.

Archaeology Study and Assessment for the Thirty-Meter-Telescope (TMT) Observatory Project Ancillary Facilities, Hale Pōhaku Area, Maunakea, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island TMK: [3] 4-4-015:001 por., 012 por.

Prepared for

PB Americas, Inc.

Prepared by

Hallett H. Hammatt, Ph.D.

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Management Summary

Reference	Archaeology Study and Assessment for the Thirty-Meter-Telescope (TMT) Observatory Project Ancillary Facilities, Hale Pōhaku Area**,** Maunakea, Ka‘ohe Ahupua‘a, Hāmākua District, Hawai‘i Island TMK: [3] 4-4-015:001 por., 012 por. (Hammatt 2009)
Date	November 2009
Project Number (s)	Cultural Surveys Hawai‘i Inc. (CSH) Job Code: MAUNAKEA 4
Investigation Permit Number	The fieldwork component of the archaeological assessment study was carried out under archaeological permit number 09-20, issued by the Hawai‘i State Historic Preservation Division / Department of Land and Natural Resources (SHPD/DLNR), per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282.
Project Location	The approximately 6-acre Project area consists of two discreet parcels located in the Hale Pōhaku area, at approximately 2,800 m (9,200 ft.) elevation on the southern slope of Maunakea. The Project area is depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993) (Figure 1).
Land Jurisdiction	State of Hawai‘i
Agencies	Hawai‘i State Historic Preservation Division / Department of Land and Natural Resources
Project Description	The proposed TMT Observatory Project involves the construction of a thirty (30) meter diameter telescope and associated infrastructure at the Maunakea Summit Area. The current Project area is proposed for use as construction staging areas and development of housing for TMT Project staff and contractors. The proposed Project also involves upgrades to the existing Hawai‘i Electric Light Company (HELCO) power substation at Hale Pōhaku. Minimally, land disturbing activities would include grading of the construction staging areas, and excavations associated with construction of residential and associated structures, installation of subsurface utilities, and power substation upgrades.
Project Acreage	Approximately 6-acres, including the Hale Pōhaku (5.2 ac.) and HELCO Substation (0.4 ac.) portions

Area of Potential Effect (APE) and Survey Acreage	The survey area for the current study included four areas of potential development: (i.e. Survey Area A – 5.2 ac., Survey Area B – 1.6 ac., Survey Area C – 1.8 ac., and Survey Area D – 4.8 ac.), as well as an area 200 ft. (60 m) in radius surrounding the existing HELCO substation (i.e. Survey Area E – 7.0 ac.). Subsequent to the survey, Survey Area A was selected as the proposed development area for the Project (i.e. the Hale Pōhaku Project Area – 5.2 ac.). Project engineers also determined that upgrades to the HELCO substation will occur within the existing fenced enclosure (i.e. the HELCO Substation Project Area – 0.4 ac.), with access to the substation enclosure restricted to the existing substation access road. The area of potential effect (APE) for the Project is defined as the entire approximately 6-acre Project area, consisting of the Hale Pōhaku and HELCO Substation portions of the Project area.
Historic Preservation Regulatory Context	At the request of PB, CSH conducted the present archaeological inventory survey-level investigation and a companion Cultural Impact Assessment study (Cruz et al. 2009) for the proposed TMT Observatory Project. Per the requirements of Hawai‘i Administrative Rules (HAR) Chapter 13-13-276, the study was conducted to identify, document, and make Hawai‘i Register of Historic Places (Hawai‘i Register) eligibility recommendations for the survey area’s historic properties. Because no historic properties were identified in the survey area, this investigation is termed an archaeological assessment per HAR Chapter 13-13-275-5. This archaeological assessment report was prepared to support the proposed Project’s historic preservation review under Hawai‘i Revised Statutes (HRS) Chapter 6E-8 and HAR Chapter 13-13-275. It is also intended to support any Project-related historic preservation consultation with stake-holding State or County agencies and interested Native Hawaiian and community groups.
Fieldwork Effort	The CSH field crew included: David W. Shideler, M.A.; Todd Tulchin, B.S.; Auli‘i Mitchell, B.A.; Brian Cruz, B.A.; Momi Wheeler, B.A; and Lisa Gollin, Ph.D., under the overall supervision of Hallett H. Hammatt, Ph.D. Fieldwork was conducted on February 26, 2009 and required 6 person-days to complete.
Number of Historic Properties Identified within the Project’s APE	None

Effect Recommendation	No historic properties were identified within the approximately 6-acre Project area. Three previously identified historic properties in the vicinity of the survey area were re-identified and confirmed to be outside of the Project area. CSH's effect recommendation for the proposed Thirty-Meter-Telescope (TMT) Observatory Project is "no historic properties affected."
Mitigation Recommendation	No historic preservation mitigation measures are recommended for the proposed TMT Observatory Project, Hale Pōhaku Area. We do however recommend that should there be any proposed development more than 20 m north and west from the northwest corner of the HELCO Substation enclosure that there be prior consultation with Dr. Patrick McCoy regarding the previously identified SIHP # 50-10-23-10320 - Locality 8 lithic scatter to determine proper mitigation measures, potentially including data recovery. The probability of any unmarked burials or human skeletal remains being present is regarded as very low inasmuch as: a) burials in the Maunakea uplands have only been reported at cinder cones; b) no burials have been encountered during development thus far in the Hale Pōhaku Area; c) there are no burial markers or surface indicators of burials present; and d) the absence of caves in the area and the general desert pavement geology would not be conducive for burial location selection. However, in the unlikely event that cultural resources, including human skeletal remains or other significant cultural deposits, are encountered during the course of Project-related construction activities, all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

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Section 1 Introduction

1.1 Project Background

At the request of PB Americas, Inc. (PB), Cultural Surveys Hawai‘i Inc. (CSH) completed an archaeological assessment for the proposed Thirty-Meter-Telescope (TMT) Observatory Project, Hale Pōhaku Mid-Level Facilities Area, Ka‘ohe Ahupua‘a, Hāmākua District, Hawai‘i Island (TM:K [3] 4-4-015:001 por., 012 por.). The approximately 6-acre Project area consists of two discreet parcels located in the Hale Pōhaku area, at approximately 2,800 m (9,200 ft.) elevation on the southern slope of Maunakea (Figures 1-3). The Project area is depicted on the U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993).

Lands within the Project area are owned by the State of Hawai‘i. The eastern portion of the Project area is leased to, and is managed by, the University of Hawai‘i (UH) as the Hale Pōhaku Mid-Level Astronomy Facilities. The western portion of the Project area, which consists of the existing Hawai‘i Electric Light Company (HELCO) power substation, is located within the Mauna Kea Forest Reserve. The proposed TMT Project involves the construction of a thirty (30) meter diameter telescope and associated infrastructure at Area E of the Astronomy Precinct, below the summit of Maunakea. The current Project area is proposed for use as construction staging areas and development of housing for TMT Project staff and contractors. The proposed Project also involves upgrades to the existing HELCO power substation at Hale Pōhaku. Minimally, land disturbing activities would include grading of the construction staging areas, and excavations associated with construction of residential and associated structures, installation of subsurface utilities, and power substation upgrades.

The survey area for the current study included four areas of potential development: (i.e. Survey Area A – 5.2 ac., Survey Area B – 1.6 ac., Survey Area C – 1.8 ac., and Survey Area D – 4.8 ac.), as well as an area 200 ft. (60 m) in radius surrounding the existing HELCO substation (i.e. Survey Area E – 7.0 ac.). Subsequent to the survey, Survey Area A was selected as the proposed development area for the Project (i.e. the Hale Pōhaku Project Area – 5.2 ac.). Project engineers also determined that upgrades to the HELCO substation will occur within the existing fenced enclosure (i.e. the HELCO Substation Project Area – 0.4 ac.), with access to the substation enclosure restricted to the existing substation access road. The area of potential effect (APE) for the Project is defined as the entire approximately 6-acre Project area, consisting of the Hale Pōhaku and HELCO Substation portions of the Project area.

At the request of PB, CSH conducted the present archaeological inventory survey-level investigation and a companion Cultural Impact Assessment study (Cruz et al. 2009) for the proposed TMT Observatory Project. Per the requirements of Hawai‘i Administrative Rules (HAR) Chapter 13-13-276, the study was conducted to identify, document, and make Hawai‘i Register of Historic Places (Hawai‘i Register) eligibility recommendations for the Project area’s historic properties. Because no historic properties were identified in the Project area, this investigation is termed an archaeological assessment per HAR Chapter 13-13-284-5. This archaeological assessment report was prepared to support the proposed Project’s historic preservation review under Hawai‘i Revised Statutes (HRS) Chapter 6E-8 and HAR Chapter 13-13-275. It is also intended to support any Project-related historic preservation consultation with

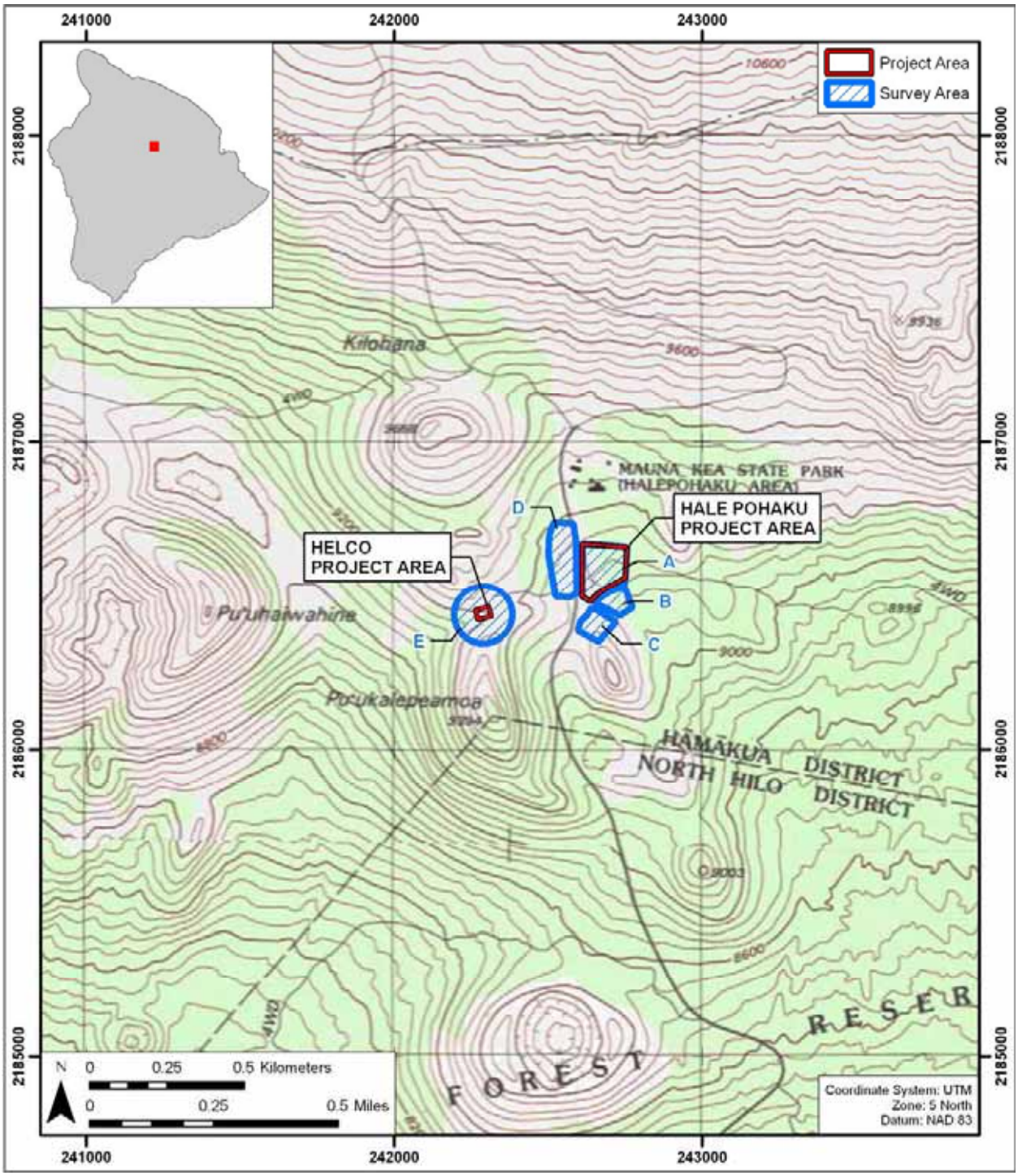

Figure 1. U.S. Geological Survey 7.5-Minute Series Topographic Map, Mauna Kea Quadrangle (1993), showing the locations of the Project area and survey areas

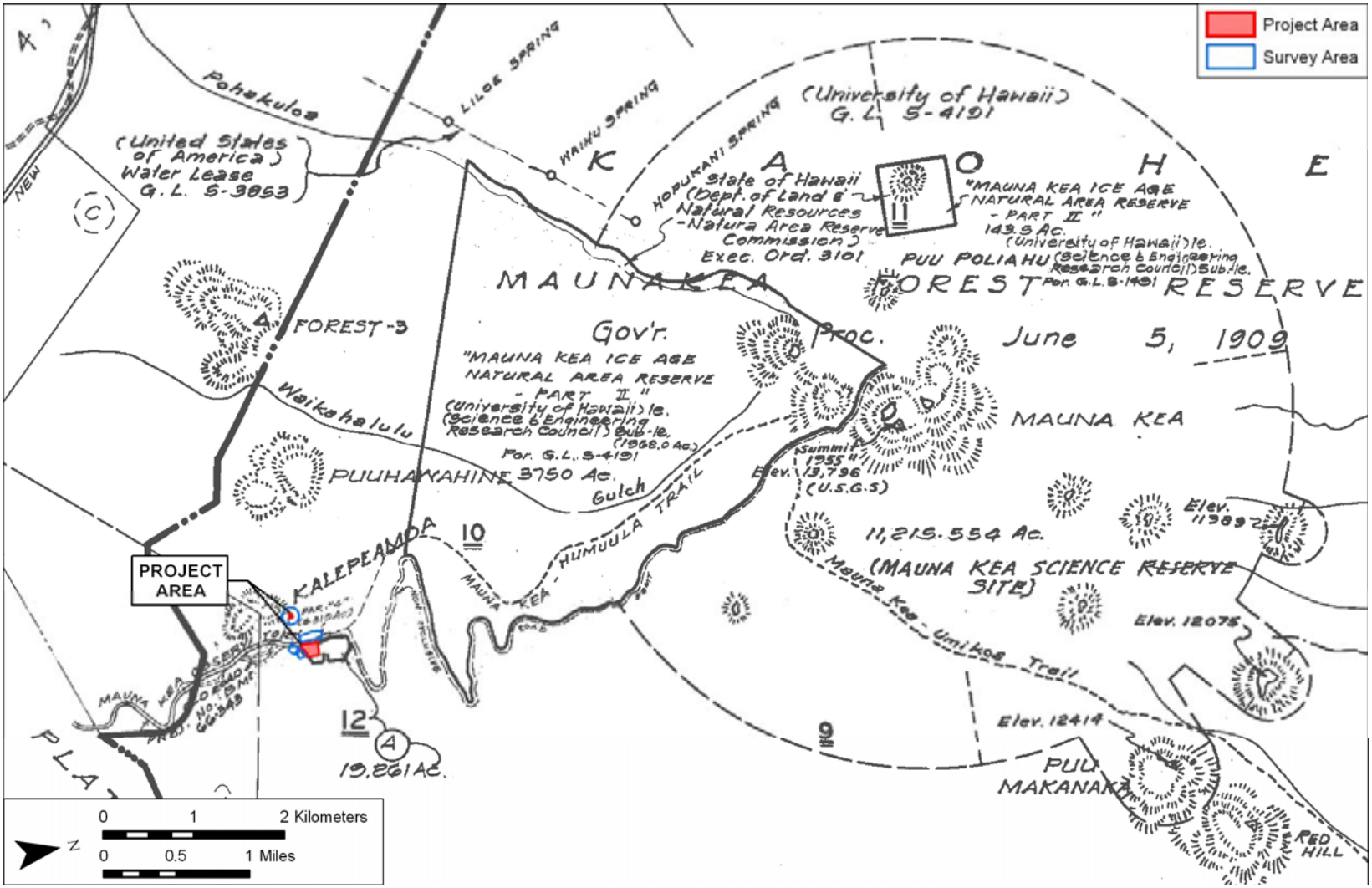

Figure 2. Portion of Tax Map Key (TMK) 4-4-015, showing the location of the Project areas

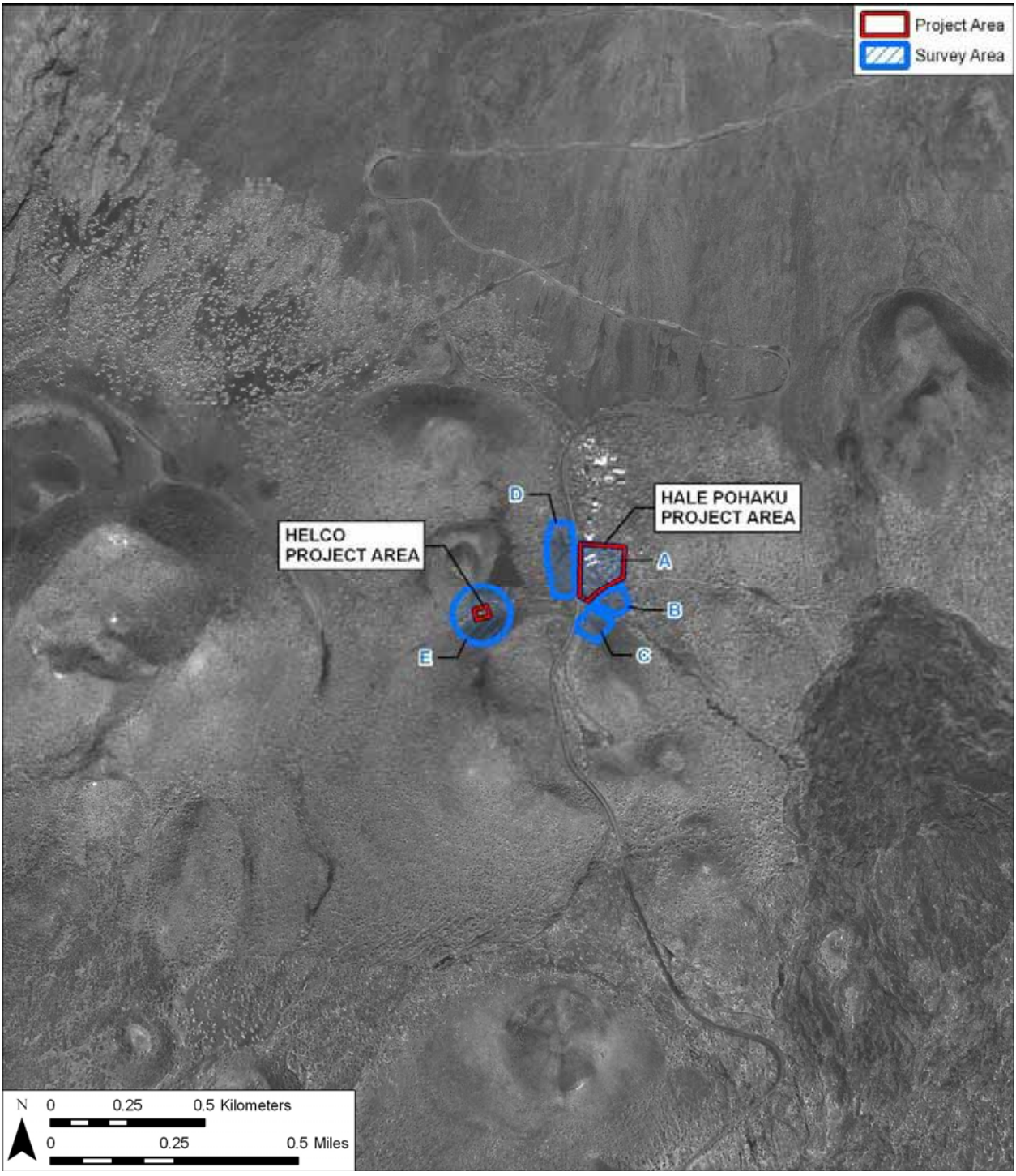

Figure 3. Aerial photograph (source: U.S.D.A. 2000), showing the location of the Project areas

stake-holding State or County agencies and interested Native Hawaiian and community groups. For more detailed accounts of the project area's cultural history, the reader is referred to the companion Cultural Impact Assessment study (Cruz et al. 2009) and the thorough work of Maly (1997) and Maly and Maly (2005).

1.2 Scope of Work

The following scope of work satisfies the State requirements for an archaeological inventory survey, per HAR Chapter 13-13-276:

1. Historic and archaeological background research, including a search of historic maps, written records, Land Commission Award documents, and the reports from prior archaeological investigations. This research focused on the specific Project area's past land use, with general background on the pre-contact and historic settlement patterns of the *ahupua‘a* and district. This background information was used to compile a predictive model for the types and locations of historic properties that could be expected within the Project area.
2. A complete (100% coverage) systematic pedestrian inspection of the Project area to identify any potential surface historic properties. Surface historic properties were recorded with an evaluation of age, function, interrelationships, and significance. Documentation included photographs, scale drawings, and, if warranted, limited controlled excavation of select sites and/or features, and location of historic properties with GPS survey equipment.
3. As appropriate, consultation with knowledgeable individuals regarding the Project area's history, past land use, and the function and age of the historic properties documented within the Project area.
4. As appropriate, laboratory work to process and gather relevant environmental and/or archaeological information from collected samples.
5. Preparation of this archaeological assessment report, including the following:
    a) A Project description;
    b) A section of a USGS topographic map showing the survey area boundaries and the location of all recorded historic properties;
    c) Historical and archaeological background sections summarizing prehistoric and historic land use of the Project area and its vicinity;
    d) Descriptions of all historic properties, including selected photographs, scale drawings, and discussions of age, function, laboratory results, and significance, per the requirements of HAR 13-13-276. Each historic property was assigned a Hawai‘i State Inventory of Historic Properties (SIHP) number;
    e) If appropriate, a section concerning cultural consultations [per the requirements of HAR 13-276-5(g) and HAR 13-275].
    f) A summary of historic property categories, integrity, and significance based upon the Hawai‘i Register of Historic Places evaluation criteria;

g) A Project effect recommendation;

h) Treatment recommendations to mitigate the Project's potential adverse effect on historic properties identified in the Project area that are recommended eligible to the Hawai‘i Register of Historic Places.

This scope of work includes full coordination with the State Historic Preservation Division (SHPD), and County relating to archaeological matters. This coordination takes place after consent of the landowner or representatives.

1.3 Environmental Setting

1.3.1 Natural Environment

The environmental setting of the Hale Pōhaku area has been well described by McCoy (1990:237-92; 1991:4-9) and the reader is referred to his work for a thorough study and references. A brief overview is presented in this study, based on Dr. McCoy's work. The current Project area is located on a gently sloping saddle area surrounded by prominent cinder cones, including Pu‘u Kalepeamoa, Pu‘u Haiwahine, and Kilohana. Pu‘u Kalepeamoa is understood as an older hawaii-ite cone which contains a large number of cored bombs many of which are formed of angular mafic blocks with dunite and gabbro inclusions (McCoy 1991:6). Pu‘u Kalepeamoa is understood as the likely source for much of the raw material worked at the Pu‘u Kalepeamoa site complex (see Section 3.2 Previous Archaeological Research). The surrounding geology includes cinder cones, lava flows and air fall deposits termed Laupahoehoe Volcanics understood as probably less than 40,000 years old.

Elevations within the Project area range from approximately 2,780-2,805 m (9,120-9,200 ft.) above mean sea level. The Project area receives an average of approximately 26 inches of annual rainfall (Giambelluca et al. 1986). Sediments within the Project area are listed as Huikau Extremely Stony Loamy Sand (rHLD) and Cinder Land (rCL) (Figure 4). Soils of the Huikau Series are described as "somewhat excessively drained loamy sands that formed in volcanic ash, pumice, and cinders" (Sato et al. 1973). Cinder Land is described as "bedded cinders, pumice, and ash…The particles have jagged edges and a glassy appearance and show little or no evidence of soil development" (Sato et al. 1973).

The Project area lies close to the timberline and the vegetation is generally a subalpine xerophytic scrub of *pūkiawe* (*Styphelia tameiameiae*), *noho-anu* (*Geranium cuneatum*), *‘ōhelo* (*Vaccinium reticulatum*), *na‘ena‘e* (*Raillardia ciliolata*), *kalamoho* fern (*Pellaea ternifolia*), *‘āheahea* (*Chenopodium oahuensis*), *pilo* (*Coprosma montana*), *māmane* (*Sophora chrysophylla*), and a variety of native and exotic grasses. It seems probable that prior to human utilization of this area, and the presence of feral goats and sheep, that the *māmane* vegetation was more extensive and diverse (McCoy 1990:91). The work of McCoy has also emphasized the "non-subsistence" nature of this alpine environment, and it is understood that virtually all food to support temporary habitation in the area would have been imported from lower elevations.

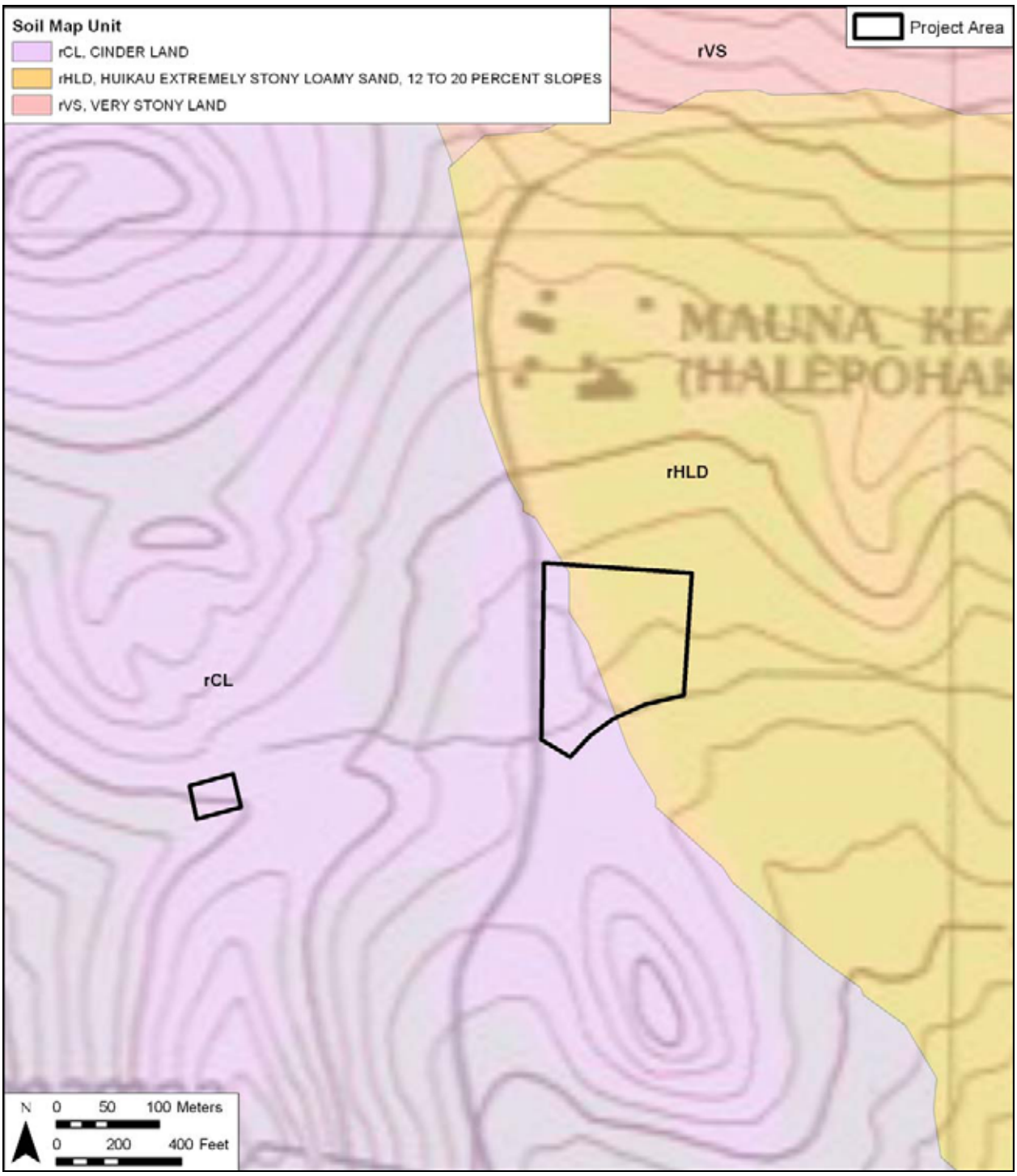

Figure 4. U.S. Geological Survey Topographic Map, Mauna Kea Quadrangle (1993) with overlay of the Soil Survey of the Island of Hawai‘i (Sato et al. 1972), showing sediment types within the Project area

1.3.2 Built Environment

The eastern portion of the Project area is adjacent to the Maunakea Access Road and includes components of the Hale Pōhaku Mid-Level Astronomy Facilities. Development in the Hale Pōhaku area includes the Onizuka Center for International Astronomy, the Visitor Information Station (a.k.a. Ranger Station), and construction laborer residences. The construction laborer residences are located within the current Project area and include two dormitory structures and four cabins (Figure 5). The western portion of the Project area consists of the existing HELCO power substation within a fenced enclosure (Figure 6). The vicinity of the Project area is generally undeveloped, with the exception of jeep roads.



Figure 5. General view of the Hale Pōhaku portion of the Project area, showing existing residential structures within the Project area located immediately east of the Maunakea Access Road, view to east



Figure 6. General view of the HELCO substation portion of the Project area, showing the existing power substation area located approximately 820 feet (250 m) west of the Maunakea Access Road, view to north

Section 2 Methods

2.1 Field Methods

The fieldwork component of the archaeological assessment study was carried out under archaeological permit number 09-20, issued by the Hawai‘i State Historic Preservation Division / Department of Land and Natural Resources (SHPD), per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282. The CSH field crew included: David W. Shideler, M.A.; Todd Tulchin, B.S.; Auli‘i Mitchell, B.A.; Brian Cruz, B.A.; Momi Wheeler, B.A; and Lisa Gollin, Ph.D.; under the overall supervision of Hallett H. Hammatt, Ph.D. Fieldwork was conducted on February 26, 2009 and required 6 person-days to complete.

The archaeological assessment fieldwork consisted of a complete (100% coverage) pedestrian inspection of the Project area. The pedestrian inspection was accomplished through systematic sweeps. The interval between the archaeologists was generally 33 feet (10 m). The general lack of vegetation made for excellent visibility. All potential historic properties encountered were recorded and documented with a written field description, scale drawings, photographs, and each feature was located using Garmin GPSMAP 60CSx GPS technology (10 to 16 ft accuracy).

In a number of areas, physical evidence of human activity (typically stone constructions representing a small investment in labor) was observed, but there were believed to be good grounds for concluding that the specific construction was less than fifty years old, and hence the physical evidence of human activity was regarded as inappropriate for designation as a historic property. In order to provide a more complete record, these cases are documented in the present “Appendix A Documentation of Find Spots”. These find spots are not regarded as significant under formally established criteria for designation as historic properties by virtue of their modernity.

2.2 Document Review

Historic and archival research included information obtained from the UH Mānoa Hamilton Library, the State Historic Preservation Division Library, the Hawai‘i State Archives, the State Land Survey Division, and the Archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary historical sources. This study is particularly indebted to the thorough research of Maly (1997) and Maly and Maly (2005). In some cases within this study we have standardized Hawaiian language spelling to conform to current orthography.

2.3 Consultation

The community consultation effort for the proposed TMT Observatory Project is detailed in a companion Cultural Impact Assessment report (Cruz et al. 2009). In general, Native Hawaiian organizations, government agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and vicinity. The agencies consulted included the SHPD, the Office of Hawaiian Affairs (OHA), and the Hawai‘i Island Burial Council (HIBC).

Section 3 Background Research

3.1 Traditional and Historic Background

The traditional and historical background for the Project area is presented at length in a companion Cultural Impact Assessment study (Cruz et al. 2009) to which the reader is referred. There is very little traditional information regarding the Hale Pōhaku area.

‘Umi-a-Liloa, the renowned mid 1500s king, constructed *heiau* in honor of Halulu, the god who provided his power. The following excerpt from Maly and Maly (2005:28-29) tells of ‘Umi’s *heiau* including one constructed in the vicinity of Hale Pōhaku:

> …He (‘Umi) also built a *heiau* (temple) below Pohaku Hanalei, it is called the ahua o Hanalei (altar of Hanalei); and on the side of Mauna Kea, by where one travels to Hilo, he built the third of his temples, at the place called Puukekee [also written Puu Keekee in historical texts]; and there at Mauna Halepohaku he built the fourth of his temples; there, it is said, Umi dwelt with his many people. It is said that Umi was a chief who dwelt upon the mountain, it was because of his love of his people, that he (‘Umi) returned and dwelt in the middle of the island [Ahu-a-Umi], that is where he dwelt with his beloved people. His commoners lived along the shores, and they brought food for them (in the uplands), from one side of the island to the other… [*Ke Au Okoa*; Mei 22, 1865; Maly, translator] (Maly and Maly 2005:28-29).

There has to our knowledge never been a positive identification of this *heiau* of ‘Umi “at Mauna Halepohaku.” The reference possibly could be to “Shrine 1” (described below in Section 4.1.2.1) but this is only conjecture.

3.1.1 Historic Accounts

The first recorded ascent of Maunakea was in 1823 by the missionary Joseph Goodrich (1794-1852) (Goodrich 1826). He approached via Kawaihae and Waimea and thus was never near the Hale Pōhaku area. The vast majority of ascents to the Mauna Loa summit prior to the 1930s appear to have been from the north or east and little discussion of the Hale Pōhaku area is available.

3.1.2 Modern Land Use

L. W. Bryan, of the Territorial Forestry Office for the island of Hawai‘i from 1922 to 1949, and from 1949 to 1961 the Territorial Forester, built the two stone houses at Hale Pōhaku with the Conservation Corps in 1936 and 1939 (Rosendahl 1999:C-6). He named Hale Pōhaku after a *heiau* (Maly, personal communication 2009).

It is understood that in 1936 the Civilian Conservation Corps carried out improvements to the old Maunakea-Humu‘ula Trail from near the main base of the sheep station at Kalaieha to the summit.

In the early 1960s, researchers from the University of Hawai‘i determined that the Maunakea Summit area was exceptional for making astronomical observations. Development of observatories began in 1964 with the construction of the Lunar and Planetary Station atop Pu‘u Poli‘ahu. The Mauna Kea Science Reserve was established in 1968. Currently there are eleven observatories in the Maunakea summit area and one observatory located on the southeastern flank at 12,000 feet.

3.2 Previous Archaeological Research

3.2.1 Previous Archaeological Studies

A summary of previous archaeological studies in the Hale Pōhaku area is presented in Table 1, with a more detailed discussion below. Previously identified historic properties in the Hale Pōhaku area are summarized in Table 2.

3.2.1.1 McCoy (1979)

Patrick McCoy (1982) documents an archaeological reconnaissance survey for the Mauna Kea Mid Level Facilities Master Plan but documented no sites at that time.

3.2.1.2 McCoy (1985)

Pat McCoy's (1985) preliminary report for the Pu‘u Kalepeamoa Site documents three archaeological surveys for a proposed new construction laborer camp at Hale Pōhaku located just above and below the UH Institute for Astronomy's Mid-Level Facility encompassing a total of approximately 40 acres located on both sides of the Maunakea Access Road between 9,080 and 9,400-foot elevation. Five lithic scatters and 2 shrines were recorded. These archaeological features were understood as functionally integrated components of a single activity system and one Bishop Museum site number was assigned (lithic scatters no. 1 & 2 would subsequently be given SIHP #s 50-10-23-10310 and 50-10-23-10311 respectively). McCoy concluded that the primary activity at the site was the manufacture of hammer stones and octopus lure sinkers from the crystalline dunite and gabro deposits on the slopes of Pu‘u Kalepeamoa but he noted that ritual was an integral part of the manufacturing process. Further research was recommended. The lithic scatters would be subject to further documentation (Robins and Hammatt 1990) and data recovery work (Hammatt and Shideler 2002).

3.2.1.3 Bonk (1986)

In 1986 William Bonk of UH Hilo conducted a reconnaissance level survey for a proposed HELCO transmission line and the substation area that is a focus of the present study. No historic properties were identified.

3.2.1.4 Sinoto (1987)

Aki Sinoto then of the B. P. Bishop Museum began data recovery documentation with survey and surface collections at eleven different lithic scatter areas. In this and the subsequent McCoy1991 work a total of 2,364 artifacts were recovered along with 129 samples of faunal

Table 1. Summary of Previous Archaeological Studies in the Hale Pōhaku Area

Reference	Nature of Study	Area of Study	Comments
McCoy 1979	Letter Report Dated August 22, 1979 to Mr. Francis Oda on Archaeological Reconnaissance Survey	Prepared for the Preparation of the Mauna Kea Mid-Elevation Facilities Master Plan.	No sites found
McCoy 1985	Reconnaissance survey	Approximately 40 acres extending on both sides of the Maunakea Access Road between 9,080’ and 9,400’	Preliminary report for the Pu‘u Kalepeamoa Site documenting five lithic scatters and two shrines used for the manufacture of hammer stones and octopus lure sinkers. Ritual was an integral part of the manufacturing process.
Bonk 1986	An Archaeological Survey - *Papers in Ethnic and Cultural Studies* 86-2	Middle Level, Southern Flank of Maunakea	No sites found
Sinoto 1987	Post-Field Report on the Archaeological Surface Survey	Halepōhaku Substation Site and Overland Transmission line-Mauka Approach Areas, Halepōhaku	Survey and surface collections at eleven different lithic scatters and limited test excavations at two of the scatters
Robins and Hammatt 1990	Reconnaissance survey	Two locations: 5.1 acre area on Pu‘u Hau Oki cinder cone at summit and a 21-acre lot near Hale Pōhaku	There were no finds at the JNLT summit project area which had been largely graded. In the Hale Pōhaku area 3 lithic scatters that were described in McCoy, 1985 are discussed.
McCoy 1991	Survey and Test Excavations report	Pu‘u Kalepeamoa Site	Survey and surface collections at eleven different lithic scatters and limited test excavations at two of the scatters

Reference	Nature of Study	Area of Study	Comments
Hammatt and Shideler 2002	Data Recovery report for two lithic scatters	Sites 50-10-23-10,310 and 50-10-23-10,311 located in the Hale Pōhaku area between 9,080’ and 9,160’ elevation	Documentation of data recovery of sites identified in McCoy, 1985 and Robins and Hammatt, 1990. Two carbon dates (AD 1260-1410 and AD 1510-1950 at 95% probability) were both thought to be problematic. Possible ritual associations with healing and the deity Kanaloa are explored.
McCoy 2005	Archaeological Monitoring Report	Four Septic Tank Excavations at the Mid-Level Facilities at Hale Pōhaku, (TMK: [3] 4-4-015:012).	Notes that while all known surface features in the lease area have undergone data recovery and no longer exist there is a possibility that buried cultural deposits might exist in undisturbed areas

Table 2. Previously Identified Historic Properties in the Hale Pōhaku Region of Maunakea

SIHP #	Elevation (ft.)	Description	Function
BPBM # 50-Ha-G28-87 (SIHP #s including 50-10-23-10,310 and -10,311 were subsequently assigned)	Between 9,080 and 9,200 ft elevation	Pu‘u Kalepeamoa site including two shrines and twelve lithic scatters	Shrine and lithic manufacturing

remains. The lithic assemblage included debitage related to adze manufacture, octopus sinker production and some 20 special purpose bird cooking stones or *pōhaku ‘eho*. Three radio-carbon dates on charcoal samples indicated late pre-contact occupation circa AD 1600 – 1700.

3.2.1.5 Robins and Hammatt (1990)

Cultural Surveys Hawai‘i (Robins and Hammatt 1990) carried out an archaeological reconnaissance survey project for the Subaru Observatory at both the summit and the Hale Pōhaku area. The Robins and Hammatt (1990) study included several areas near the Mid-Level Facility Complex (“Onizuka Center for International Astronomy (OCIA)”) including a small dormitory construction area located approximately 134 m (440 feet) east of the Maunakea Access Road at 9,245 foot elevation (where no sites were observed) and an approximately 21-acre lot surrounding the dormitory delineated on the west and north side by the Maunakea Access Road and to the south by an existing jeep road. Two archaeological features were newly described and three previously identified sites were recorded in the approximately 21-acre lot. The two newly described features included a small oval enclosure and a roughly square enclosure that were both thought to be relatively recent constructions (no formal SIHP site numbers were assigned). The three previously recorded (McCoy 1985) sites included three lithic scatters (lithic scatters # 1, # 2, and #5) that McCoy had understood as being functionally integrated components of a single site. Further work at the lithic scatters was recommended. Cultural Surveys Hawai‘i (Hammatt and Shideler 2002) completed a Data Recovery report for lithic scatters # 1, # 2.

3.2.1.6 McCoy (1991)

Patrick McCoy (1999) wrote up data recovery work and results expanding on the Sinoto (1987) documentation.

3.2.1.7 Hammatt and Shideler (2002)

Cultural Surveys Hawai‘i (Hammatt and Shideler 2002) completed a data recovery report for two lithic scatters (SIHP #s 50-10-23-10310 and 50-10-23-10311) located in the Hale Pōhaku area between 9,080 foot and 9,160 foot elevation. These sites were first recorded by McCoy (1985:11-12) as Lithic Scatter # 1 (SIHP # 50-10-23-10310) and Lithic Scatter # 2 (SIHP # 50-10-23-10311) of the Pu‘u Kalepeamoa Complex. Initially the UH Institute for Astronomy planned to preserve the two lithic scatters, however, dormitory construction increased erosion in the vicinity and in consultation with the State Historic Preservation Division a data recovery program was agreed to. Data recovery field work included mapping, surface collection and four $1m^2$ test units (2 at each of the two sites). Two carbon dates (AD 1260-1410 and AD 1510-1950 at 95% probability) were obtained but both were thought to be problematic. It was concluded that the sites were modest, out-lying, open, lithic workshop sites with octopus lure sinker manufacture of both “coffee-bean” and “bread-loaf” morphological types. It was concluded that the location of the sites was associated with a micro-climate of slightly greater moisture, slightly greater soil and slightly greater protection from the wind at the top of a natural drainage that favored *māmane* forest growth – which in turn provided greater protection from the elements, fuel and construction materials. It is suggested that the endeavor to produce octopus lures may

have had other than quotidian purposes of food procurement and the affinities with healing prayers (*Pule he‘e*) dedicated to the deity Kanaloa are explored.

3.2.1.8 McCoy (2005)

The McCoy (2005) archaeological monitoring report for four septic tank excavations at the Mid-Level Facilities at Hale Pōhaku identified no new sites. Notes that while all known surface features in the lease area have undergone data recovery and no longer exist there is a possibility that buried cultural deposits might exist in undisturbed areas.

3.2.1.9 McCoy et al. (2009 in progress)

As this Archaeological Assessment was being prepared, the authors interacted with Dr. Patrick McCoy at the offices of Pacific Consulting Services, Inc. and also within the Project area. We are thankful for his guidance. We were aware that a major study of the historic properties of Maunakea was on-going by Pacific Consulting Services. This study, that should greatly advance our knowledge of traditional Hawaiian use of the upper reaches of Maunakea, was not available as early drafts of this study were being prepared. If publicly available prior to the submission of this study to the SHPD for review it is the intent of the authors to include appropriate reference and germane summary of findings.

3.2.2 Traditional Cultural Properties

The State Historic Preservation Division has designated several prominent localities on Maunakea as Traditional Cultural Properties (TCP) due to their cultural significance to the Hawaiian people. The approximate boundaries of the TCPs are indicated on Figure 7. Maly (1997:29) has suggested the entire Maunakea summit region down to the 6,000 foot elevation contour (Figure 8) be designated a Traditional Cultural Property.

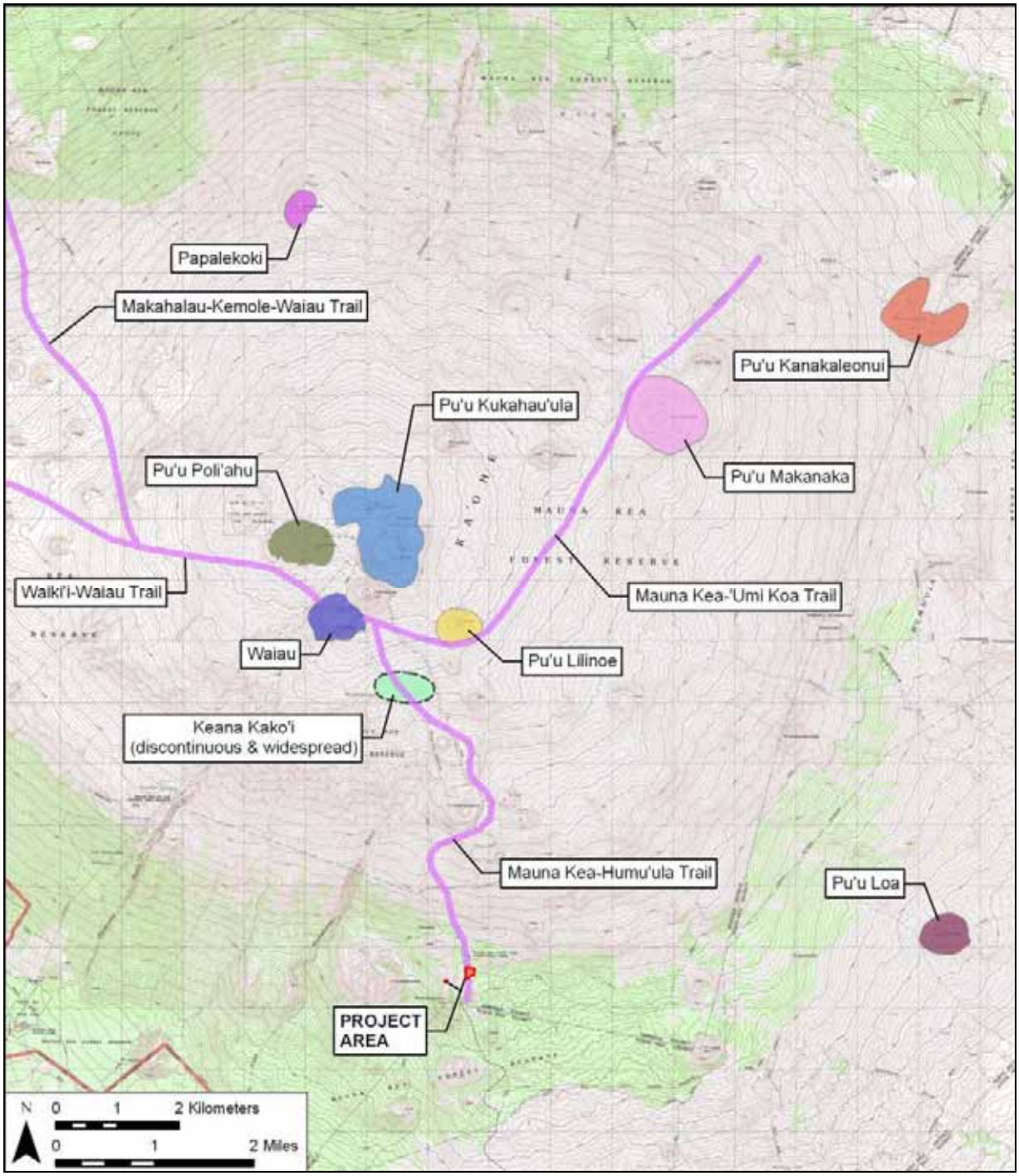

Figure 7. U.S. Geological Survey Map, Mauna Kea Quadrangle (1993), showing Traditional Cultural Properties in the summit region of Maunakea (adapted from Maly 1997:Table 2 & Figure 2; Note: All of Maunakea down to the 6,000 foot elevation has been suggested to be a Traditional Cultural Property) (Boundaries shown should be understood as approximate)

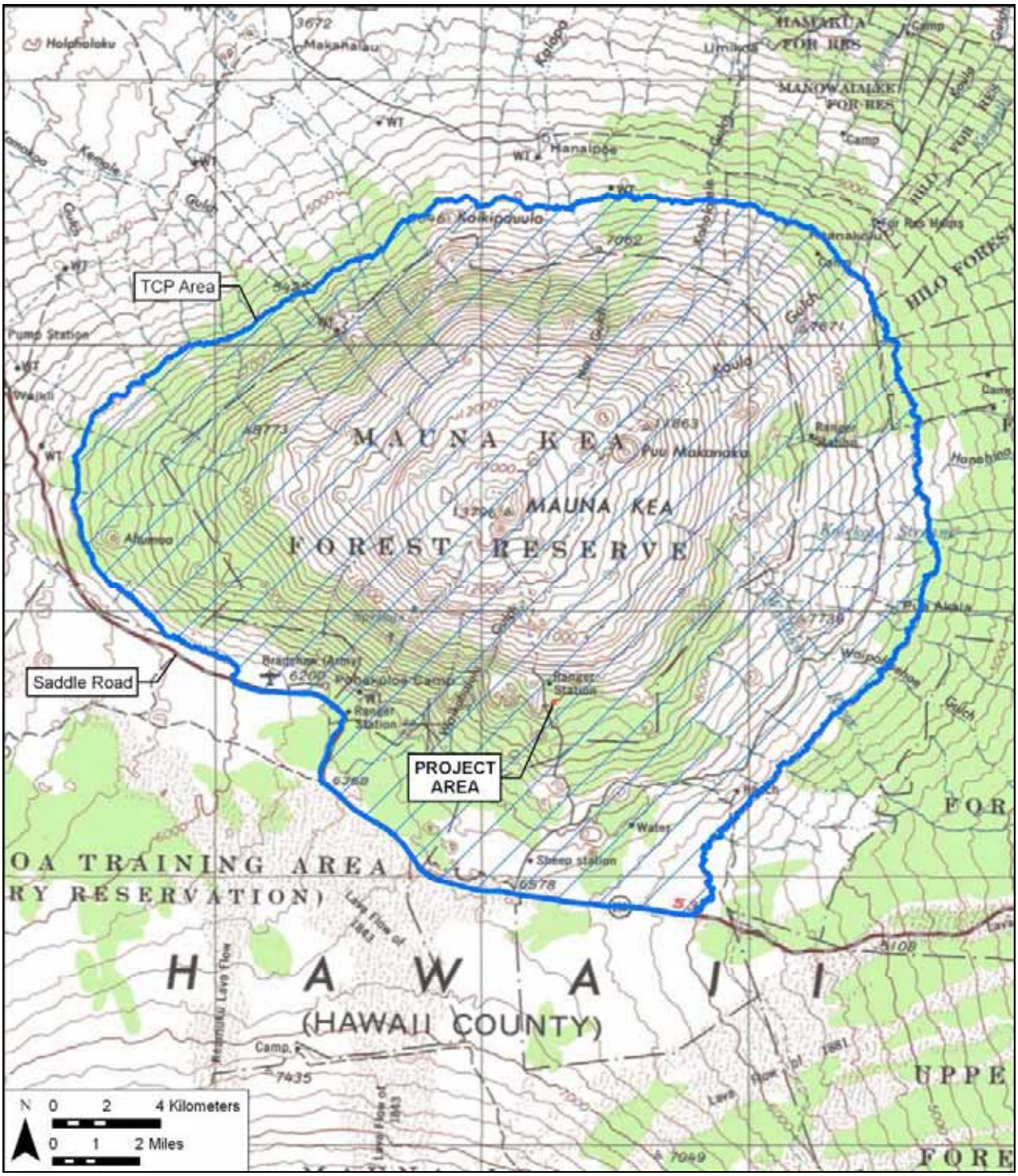

Figure 8. 1:250,000 Scale U.S. Geological Survey Map showing “Ka Mauna a Wākea or Mauna Kea” Traditional Cultural Property (TCP) down to the recommended 6,000 foot contour (following Maly 1997:29); estimated area approximately 150,000 acres

3.3 Background Summary and Predictive Model

3.3.1 Burials and Possible Burials

3.3.1.1 Archaeological Data on Burials

McCoy (1999) presents a summary discussion of burials and possible burials on Maunakea noting that there are numerous traditions of burials at high elevations on Maunakea. He starts by presenting the account of Jerome Kilmartin (1974) that in 1925 Kilmartin personally observed human remains on Pu‘u Mākanaka. McCoy (1999:26) relates that in 1991 he and others observed human bones within several cairns on the southern rim of Pu‘u Mākanaka. McCoy notes that "several other spatially discrete groups of cairns, each comprised of two to three individual cairns, were found on the southern or eastern rim" [of Pu‘u Mākanaka] – suggesting that these may also contain human skeletal remains.

As far as we know, Pu‘u Mākanaka is the only place in the uplands of Maunakea in which human remains have been confirmed by archaeologists – although McCoy makes reference to "the well-known burial center at Kanakaleonui" and also to "a small group of cairns on the eastern rim of Pu‘u Waiau that are also believed to be burials."

McCoy (1999:26) then goes on to discuss four "possible burial sites" (SIHP #s -16195, -21413, -21414 and -21416). Although no human remains were observed, these constructions were thought to be burials because of: 1) the morphological similarity of these cairns to those on Pu‘u Mākanaka and Kanakaleonui; 2) dissimilarity to other cairns (which are more cylindrical); and 3) the presence on the eastern or southern rim of cinder cones.

McCoy (1999:27) clearly suggests that SIHP # -16195 consisting of two adjacent cairns on the eastern rim of Pu‘u Līlīnoe (recorded by McCoy in 1975) are "possible burials". This conclusion appears to be based on William D. Alexander's 1892 account of "ancient graves" on the summit of Pu‘u Līlīnoe. McCoy (1999:27) comments that: "If the cairns that were recorded in 1975 were in fact the same graves [as described by William D. Alexander in 1892] the remains had been removed sometime prior because no human bone was visible at that time." Thus it appears that by 1975 these features were not graves, whether or no they had been graves previously (see Maly and Maly 2005 for a discussion of accounts of burials at Pu‘u Līlīnoe).

McCoy (1999:27) then discusses three possible burial cairn sites (SIHP #s -21413, -21414 and -21416) located on the southern and eastern rim of an unnamed (approximately 12,840-foot high cinder cone located approximately 0.6 miles northwest of the Mauna Kea Ice Age Natural Area Reserve) indicating that these may well be graves on the basis of form and location.

McCoy (1999:28) concludes:

> There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rock shelter or overhang. The basis of this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridge top amongst any of the shrines. There

in fact appears to be a clear separation between burial locations and shrine locations.

3.3.1.2 Informant Data on Burials

In striking contrast to the archaeological data (in which the closest confirmed burial appears to be 3.1 miles from the summit at Pu‘u Mākanaka) is the belief of some contemporary Hawaiians that the summit region of Maunakea is something of a burial ground ("There's lot of *kūpuna* been buried up there…"; and several similar stated concerns at www.mauna-a-wakea.info/maunakea/F4_burials.html). Allied with this line of thinking are rumors of burials being disturbed and destroyed by prior observatory developments ("Would bulldozing cemeteries be allowed anywhere else in the world?" and similar stated concerns at www.mauna-a-wakea.info/maunakea/F4_burials.html).

3.3.2 Shrines

In McCoy's (1999:3) analysis of a total of 93 sites identified in the Maunakea summit area Science Reserve some 76 or 81.7% are classified as shrines (and an additional 8 shrines are components of adze manufacturing workshop sites). McCoy (1999:6) concludes that; "The vast majority of shrines are conspicuously sighted in the landscape, either on a ridge top, or at a break in the slope, which generally seems to correspond to either a lava flow margin or a change in the slope of a glacial moraine." Of some interest, McCoy notes that "there are no shrines in the Science Reserve located on top of a cinder cone."

As previously noted (McCoy 1982:A-37), an unusually high density of shrines are located in a narrow 200-foot contour interval band between 12,900 foot and 13,100-foot elevation on the north side of Maunakea. He posits reasonably that this clearly defined vertical zonation site pattern is the result of utilization of a break in slope at the edge of a summit plateau where: "when viewed from either the base of the steep inclined slope directly below, or from the base of the summit cones above, is a relatively flat horizon on which the shrine uprights are silhouetted and therefore visible from some distance."

3.3.2.1 Kahe Ule Subincision and the Maunakea Summit Region of Ka‘ohe Ahupua‘a, Hāmākua District

A central thesis of McCoy's (1979:27) study of "A Rite of Passage Site" is that a certain site complex (SIHP # 50-10-23-16204) located at approximately the 12,280-foot level of Maunakea was the locus of initiation rites possibly related to formal initiation rites for groups of apprentices. This argument has support in the curious presence of some twenty-six open air shelters of quite small diameter that appear to have had temporary use. Few would dispute that some of the shrines of the summit region of Maunakea are "occupational shrines" specifically those near the adze quarries incorporating quarried lithic material. However it seems clear that the majority of the shrines of the summit region of Maunakea are not near the known adze quarries and do not incorporate quarried lithic material. This gives rise to the consideration that some quite different function may have been operative for many of the Maunakea shrines. One theory is that "these structures were erected by travelers most probably in propitiation of mountain spirits" (McCoy 1982:A-37) While this certainly seems probable as a partial

explanation it may be noted that the distribution of shrines does not suggest travel corridors so much as a broad band of elevation that was preferred for shrine construction.

An alternative theory is that at least some of the shrines of Maunakea are related to the *Kahe Ule* or Subincision practice of Ka‘ohe Ahupua‘a of Hāmākua District. What follows admittedly is less than a convincing argument, but is offered for future consideration.

We know little about the Hawaiian practice of *Kahe Ule* or Subincision of the foreskin but it was almost certainly a ritualized practice involving a group of men, a religious expert (*kahuna*), a special bladed tool (understood as typically a bamboo knife) and a male youth to be subincised. Gutmanis (1983:55) relates a subincision prayer (bold added for emphasis)

*E Ki‘i **ka‘ohe** i Ho-mai-**ka-‘ohe***.	Bring the bamboo from Ho-mai-ka-‘ohe
*Eia **ka‘ohe** lauli‘i a Kāne*	Here is the small leafed bamboo of Kane.
‘Okia i ka maka o ka ma‘i	Cut now the foreskin
Ua moku	It is divided

Notably the noun “*Ka‘ohe*” is mentioned three times. While on the one hand the phrase simply means “the bamboo” there seems little question the reference is to a ritual bamboo subincision knife.

The general shape of Ka‘ohe bears a vague similarity to a knife as it cuts across the *piko* of Maunakea and Maunaloa dividing the island.

3.3.3 Adze Quarries and Manufacturing Workshops

It appears from McCoy’s (1999) summary analysis of site typology that the only quarries were in the extreme southern portion of the Mauna Kea Science Reserve (the Ko‘oko‘olau Complex Maunakea Adze Quarry; SIHP # 50-10-23-4136). McCoy does describe four adze manufacturing workshops (SIHP #s -11079, -16203, -16204 and -21211) defined in part by their being located where there is no naturally occurring stone-tool quality raw material. All four of these adze manufacturing workshops are on the south face of the mountain on the east side of the main Maunakea Access Road.

3.3.4 Trails and Temporary Habitations

We have very little real documentation on pre-contact patterns of access to, and temporary habitation on, the summit region of Maunakea. There appears to be general agreement that: “Neither historic accounts nor archaeological surveys provide firm evidence for the prehistoric trails….historic accounts of trails used don’t necessarily reflect the prehistoric trails in the area.” (Maly 1997: D-12). Notably: “…no trails were mentioned by Hawaiians in the 1870s Boundary Commission records nor do any appear on the 1862 Wiltse map.” (Maly 1997:D-5). The four major trail systems documented in the summit region (from North clockwise: 1. the Maunakea-‘Umi Koa Trail, 2. the Maunakea-Humu‘ula Trail, 3. the Waiki‘i-Pu‘u Lā‘au-Wai‘au Trail, and 4. the Makahālau-Kemole-Wai‘au Trail) may all be largely or even entirely post-contact and primarily horse trails.

Land Boundary Commission testimony, particularly that of a certain Haiki (Boundary Commission Hawaii Volume B page 41), suggests that people of Humu‘ula, North Hilo District accessed the resources of the Maunakea summit from the southeast.

Variously there is an oral history account from Mr. William Akau:

> …as a child, William Akau heard his elders talking about visits made by people from other islands to Hawaii. In ancient times, canoes would land in the Kīholo vicinity, and people walked the trails along the gentle slopes of Mauna Loa-Mauna Kea to the summit to harvest and shape stone. [Maly 1997:22]

While this account suggests access from North Kona, from due west (Kīholo in north, North Kona), it seems unlikely that Hawaiians from other islands accounted for a significant percentage of the pre-contact traffic to the summit region.

Despite these differing accounts mentioned above, the general conception has followed the Land Boundary Commission that determined that the entire summit region of Maunakea lies within Ka‘ohe Ahupua‘a of Hāmākua District and that the socio-political connectedness of the summit lands lay to the north in Hāmākua. This certainly suggests that most of the access would be expected from the north. This would lead to the expectation that much of the evidence of access to the summit region in the form of trail markers or temporary habitation sites might be expected on the north slope.

The prevailing nighttime temperatures and wind would place a premium on any lava tubes or caves that might provide substantial shelter. In the general absence of such landforms on the north slope and summit plateau travelers would be expected to seek very temporary occupation at open habitation sites seeking what protection might be available on the lee side of rock outcroppings and ridges. While too great an emphasis should not be placed on any one account, the pattern of access in the first recorded ascent of Maunakea in 1823 by the missionary Joseph Goodrich may be notable. The preacher appears to have hiked from Waimea to the Maunakea summit and back to Waimea in one 24-hour marathon. In the vicinity of Waimea he spent the night (at approximately 2,700 foot elevation). Leaving early, and approaching the summit from the north, he followed a steep ravine reaching the tree line at about 9,000 feet elevation approximately 15 miles from Waimea where he rested for a few hours recording the temperature at 43° F at sunset. At 11:00 PM he pushed on in bright moonlight encountering snow at 1:00 AM and recording a temperature of 27° F. Goodrich attained the highest of several summits around 3:00 AM and quickly descended.

Section 4 Results of Fieldwork

4.1 Survey Findings

On February 26, a Cultural Surveys Hawai‘i field crew of six began traversing the Project area. The pedestrian inspection was accomplished through systematic sweeps. The interval between the archaeologists was generally 33 feet. The general lack of vegetation made for excellent visibility. All potential historic properties encountered were recorded. The Project area was understood as in two physically separate areas: the “Hale Pōhaku” portion of the Project area that lies on the east side of the Maunakea Access Road and just south of the Visitor Information Station (Figures 9, 11 & 12) and the “HELCO substation” (Figures 10, 11 & 13) portion of the Project area that lies on the west side of the Maunakea Access Road.

In a number of areas, physical evidence of human activity (typically stone constructions representing a small investment in labor) was observed but there were believed to be good grounds for concluding that the specific construction was less than fifty years old and hence the physical evidence of human activity was regarded as inappropriate for designation as a historic property. In order to provide a more complete record, and to avoid any possible misunderstanding, these cases are documented in the present “Appendix A: Documentation of Find Spots.” These find spots (designated CSH 1-5, CSH 7-13, and “Modern Refuse Disposal Areas”) are not regarded as significant under formally established criteria for designation as historic properties by virtue of their modernity.

4.1.1 “Hale Pōhaku” portion of the Project area

The fieldwork began in the “Hale Pōhaku” portion of the Project area that lies on the east side of the Maunakea Access Road and just south of the Visitor Information Station (a.k.a. Ranger Station) (Figures 9, 11 & 12). No historic properties were identified within this portion of the Project area. Only one find spot (CSH 1,– described in Appendix A of this study) a modern *ahu* or small cairn was observed (see Figures 11, 12 & 21) within the Hale Pōhaku portion of the Project area. Confidence is high that this is contemporary in date, took only a couple of minutes to construct, does not meet established criteria of significance, and is of no formal historic-preservation concern.

An oval, outlined on the relatively clear ground with a single course of the locally-available, scoria, *ʻaʻā* cobbles, was observed just north (outside) of the Hale Pōhaku portion of the Project area and was designated as CSH 2 (see Figures 11, 12 & 22 and description in Appendix A of this study). This was understood as a contemporary shrine. Confidence is high that this is contemporary in date, took only a few minutes to construct, does not meet established criteria of significance, and is of no formal historic-preservation concern.

Two small areas of late Twentieth century trash disposal (“Modern Refuse Disposal Areas”) were observed east (outside) of the Hale Pōhaku portion of the Project area and were briefly documented (see Figures 11, 12, 34 & 35 and description in Appendix A of this study). Confidence is high that these refuse disposal areas are less than fifty years old, took only a few minutes to create, do not meet established criteria of significance, and are of no formal historic-preservation concern.

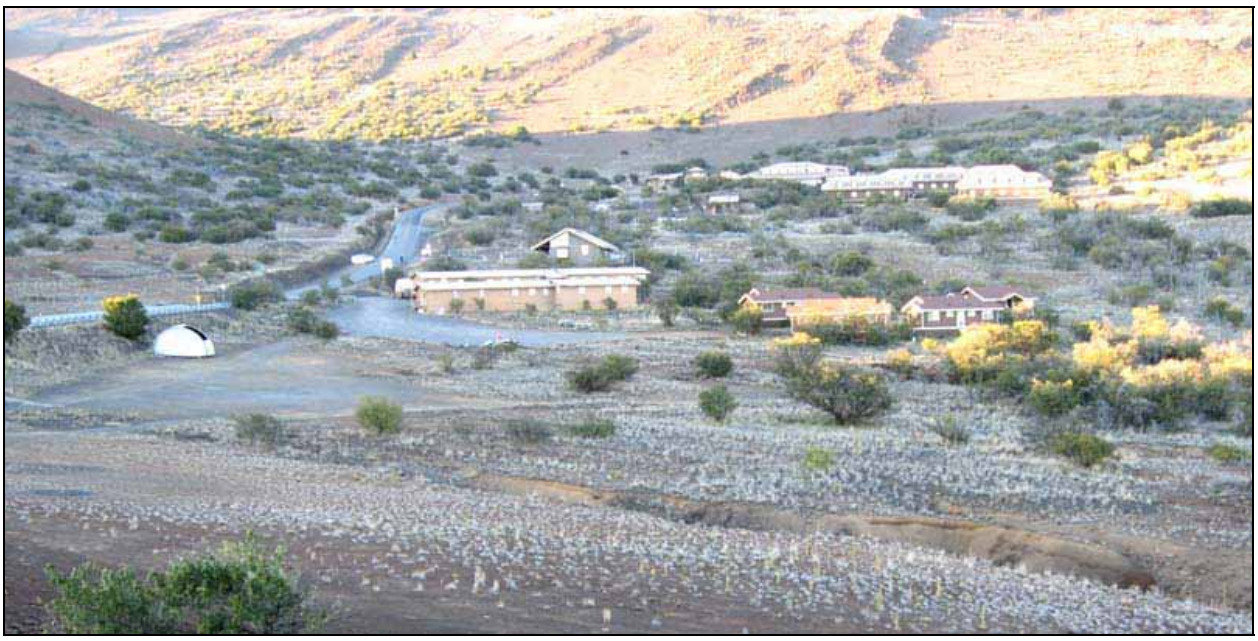

Figure 9. General view of the Hale Pōhaku portion of the Project area, view to north



Figure 10. General view of the HELCO substation portion of the Project area and vicinity, view to north

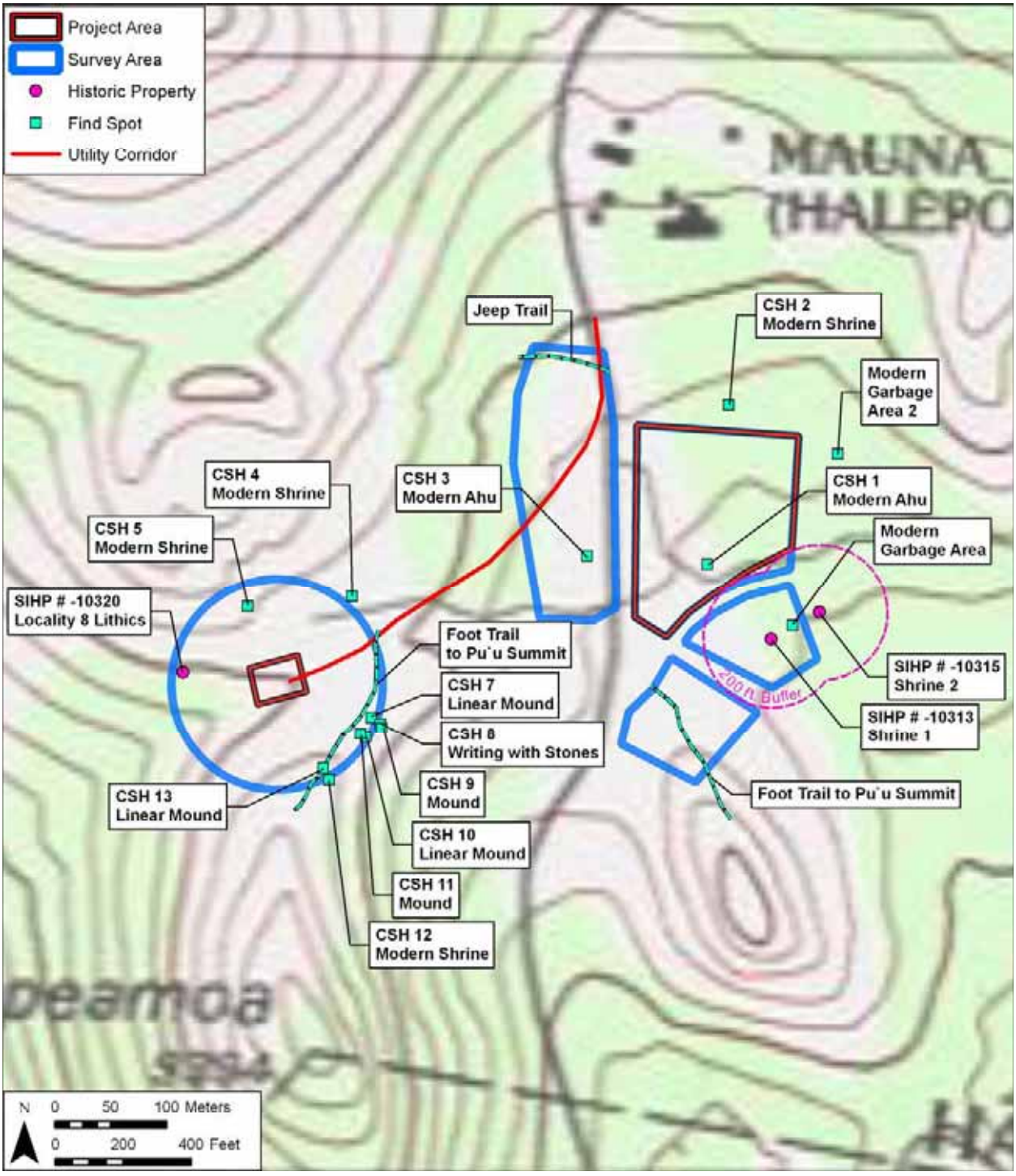

Figure 11. U.S. Geological Survey Topographic Map, Mauna Kea Quadrangle (1993), showing the locations of historic properties and find spots in the vicinity of the Project area

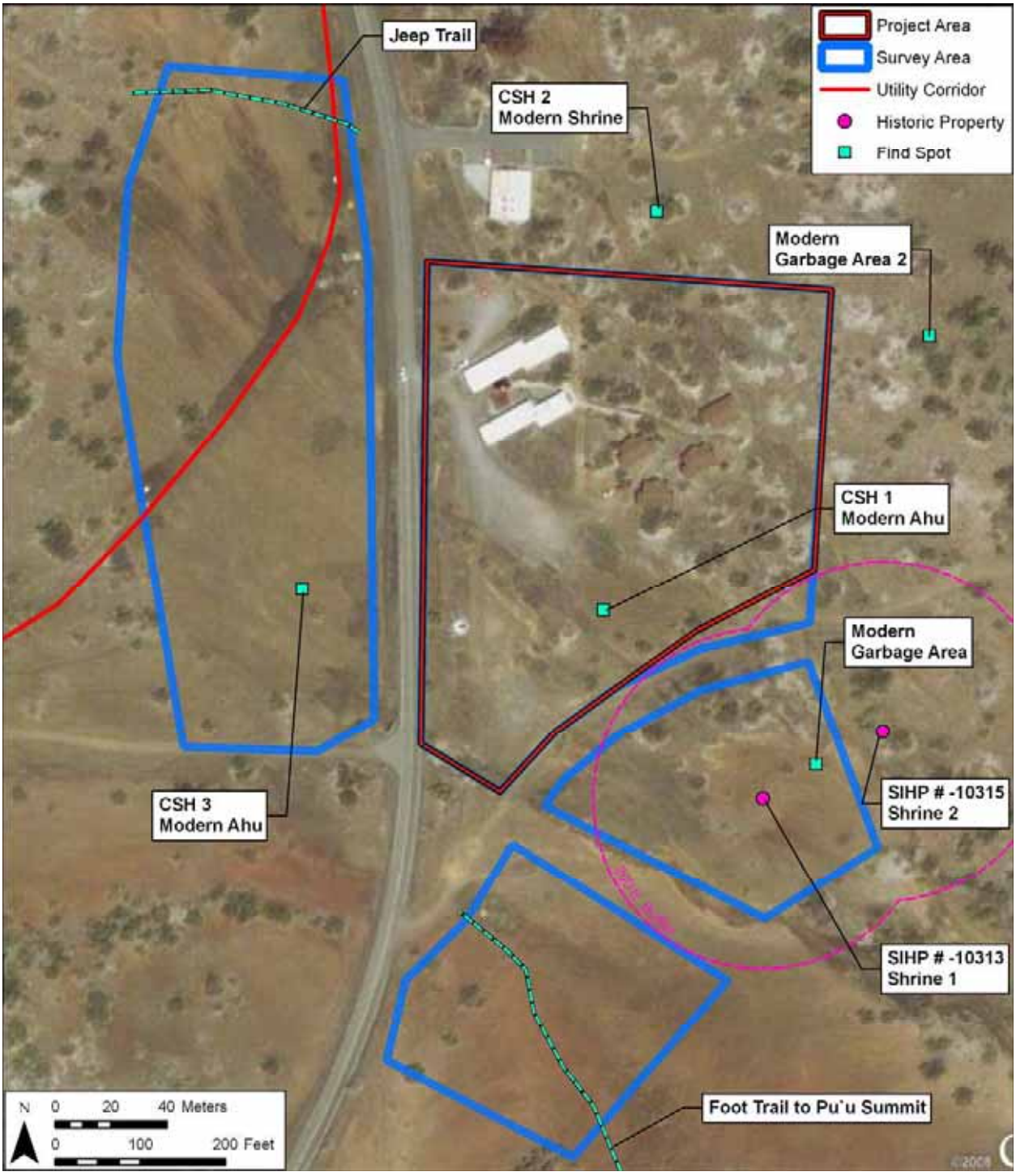

Figure 12. Aerial photograph (source: Google Earth 2009) showing the locations of historic properties and find spots in the vicinity of the Hale Pōhaku portion of the Project area

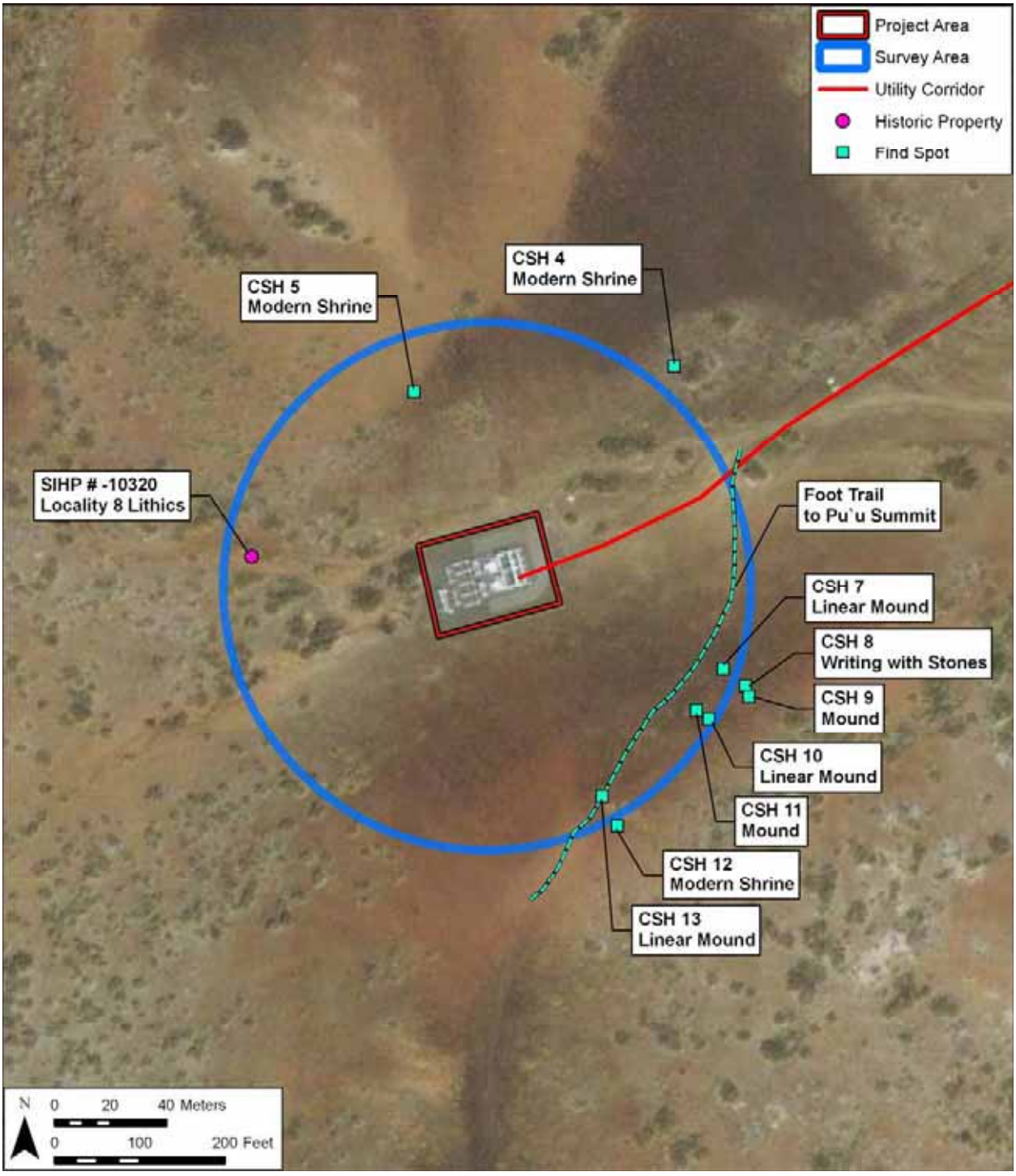

Figure 13. Aerial photograph (source: Google Earth 2009) showing the locations of historic properties and find spots in the vicinity of the HELCO substation portion of the Project area

4.1.2 Historic Property Descriptions (located approximately 200 feet southeast of the Hale Pōhaku portion of the Project area

Only two historic properties were identified in the course of the archaeological assessment fieldwork and we need to be very clear they both lie at a distance of 200 feet or more southeast (outside) of the Project area. The preservation boundaries of these sites are understood as 200-feet in radius and it is our understanding these 200 foot buffers will be maintained (see Figures 11 and 12).

4.1.2.1 SIHP # 50-10-23-10313 - Shrine 1

SITE TYPE: Shrine
FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 18 feet NE/SW x 5 feet NW/SE
CONDITION: Good
PROBABLE AGE: Pre-contact
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

SIHP # 50-10-23-10313 was designated as "Shrine 1" (and as B.P. Bishop Museum Site 50-Ha-G28-87-S1) by McCoy (1985) and was described as follows:

> The southernmost structure, designated Shrine 1, is a low, rectangular stone-filled terrace with three and possibly five uprights located on the eastern edge of a rubbly *ʻaʻā* outcrop. The terrace measures 5.5 m long, 1.5 m wide, and 35 to 50 cm in maximum height along the east, down slope wall. All three walls are crudely stacked chunks of *ʻaʻā*, one to several courses high. The east wall is partially collapsed, thus explaining the irregular profile in the plan view map [present Figure 15, following]. The row of uprights, which define the back side of the shrine, are located on essentially level ground, which is the basis for describing the main structure as a terrace rather than a platform since not all four side are free-standing walls. There are three standing uprights of similar dimensions projecting 50 cm above ground surface and oriented 21° E of magnetic north, and two other elongated stones that are tentatively regarded as possible uprights. They are all unmodified chunks of *ʻaʻā*, like the rest of the structure.
>
> On the surface of the terrace, centered in front of the two central uprights, is a "cache" of some 40 angular to subangular stones in the 5 to 10 cm size range (avg. c. 7 cm), with a distinctively red cortex, except for a few smaller broken pieces revealing the internal crystalline matrix of light and dark minerals. These rocks, subsequently identified as dunite and gabbro were clearly deposited on the shrine after it was built., thus leading to the conclusion that they are offerings.

> Two smaller caches of these same rocks (also interpreted as ritual offerings) were found in close proximity to the shrine on the south, in a similar topographic position on the eastern edge of the same outcrop. The first cache, located 4.7 m to the southwest of upright No. 1, consists of two chunks and a number of smaller fragments at the downslope base of a stacked pile of *‘a‘ā* rubble, one to two courses high. This feature, which can be described as a cairn, has a basal diameter of 90 cm. The height above the outcrop varies between 35 cm on the upslope side to 80 cm on the lower side. Further to the south, near the southern edge of the *‘a‘ā* outcrop and downslope of a solitary *māmane* tree (Fig. 3), is the second cache, comprised of three stones adjacent to some larger chunks of naturally occurring *‘a‘ā* rubble.

The site as observed on February 26, 2009 (Figures 15 & 16) was very much as described by McCoy in 1985.

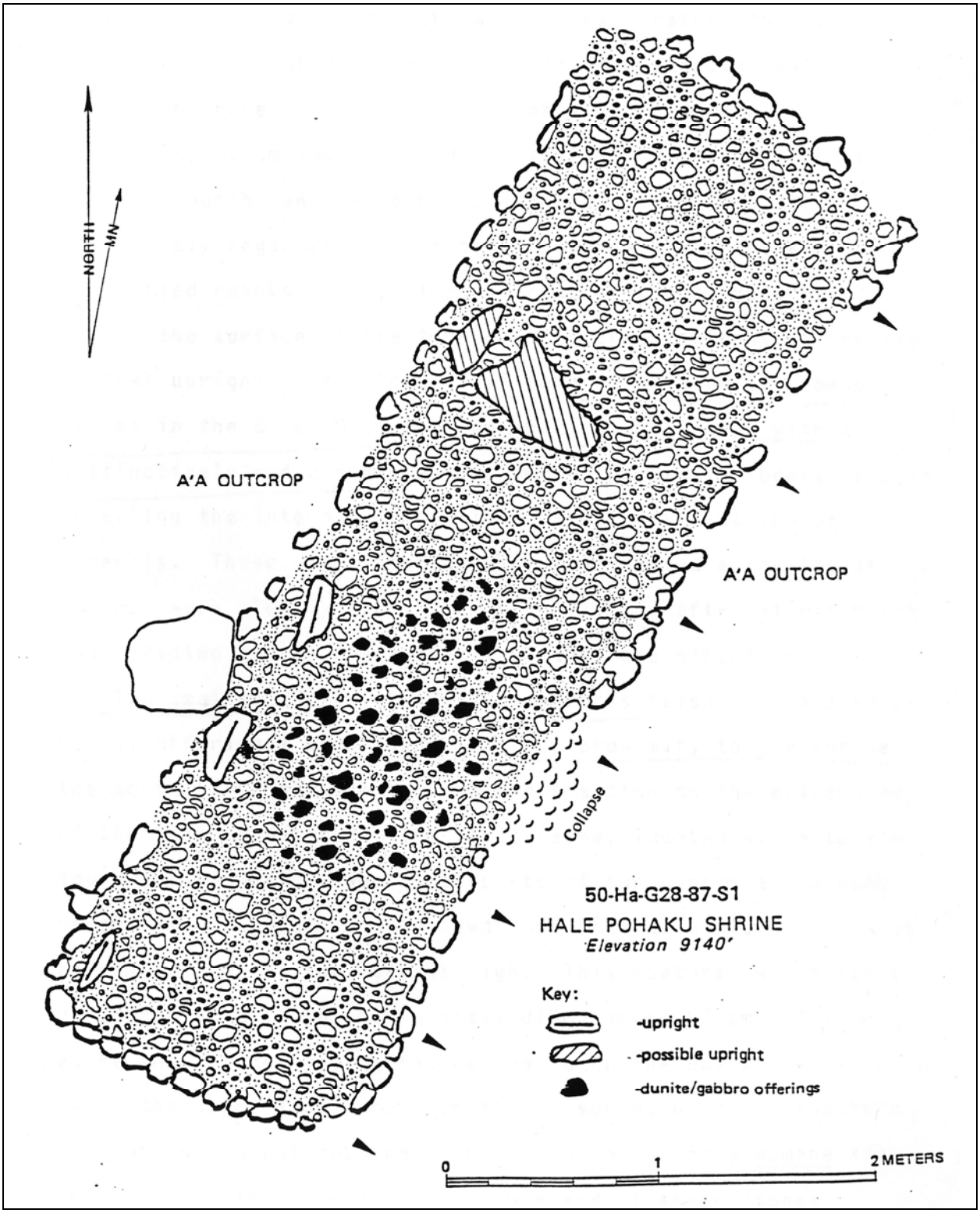

Figure 14. Plan-view diagram of SIHP # 50-10-23-10313 - Shrine 1 (B.P.B.M. Site 50-Ha-G28-87-S1) (from McCoy 1985:17)



Figure 15. SIHP # 50-10-23-10313 - Shrine 1, showing upright stones and dunite/gabbro offerings, view to north



Figure 16. SIHP # 50-10-23-10313 - Shrine 1, showing upright stones and dunite/gabbro offerings, view to west

4.1.2.2 SIHP # 50-10-23-10315 - Shrine 2

SITE TYPE: Shrine
FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 8.2 feet E/W x 5 feet N/S
CONDITION: Good
PROBABLE AGE: Pre-contact
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

SIHP # 50-10-23-10313 was designated as "Shrine 2" (and as B.P. Bishop Museum Site 50-Ha-G28-87-S2) by McCoy (1985) and was described as follows:

> The second shrine, located c. 47 m to the northeast of the first, is similarly located on the eastern edge of an *ʻaʻā* outcrop. A single upright of *ʻaʻā* lava, measuring 38 cm high, 35 cm wide, and 17 cm thick, is situated in the approximate center of a small terrace demarcated by the edge of the lava flow and a possible stone alignment on the southwest. A line through the north-south axis of the upright is oriented 8° E of magnetic north. The perpendicular azimuth through the middle of the up right is 78° W of magnetic north, which is aligned with the approximate center of one of the volcanic cone peaks. Five stones of the same type as those described above, including the same colored cortex, are located on the eastern side of the upright on the surface. A few meters northwest is a second possible artificial terrace measuring c. 2 by 2 m.

McCoy then provides the following discussion:

> A preliminary interpretation of the data obtained in this project has already been made in terms of the argument that the constellation of dispersed lithic scatters and shrines represent functionally integrated components of a single activity system. In support of this argument, reference has been made to the patterned association of workshops and shrines with comparable material offerings in the Mauna Kea Adze Quarry. It is on the strength of this evidence, denoting ritual as an integral part of the manufacturing process, that the same site definition criteria and rationale employed in the Mauna Kea Adze Quarry research have been adopted in the definition of the Puʻu Kalepeamoa site.

The site as observed on February 26, 2009 (Figures 17 & 18) was very much as described by McCoy in 1985.

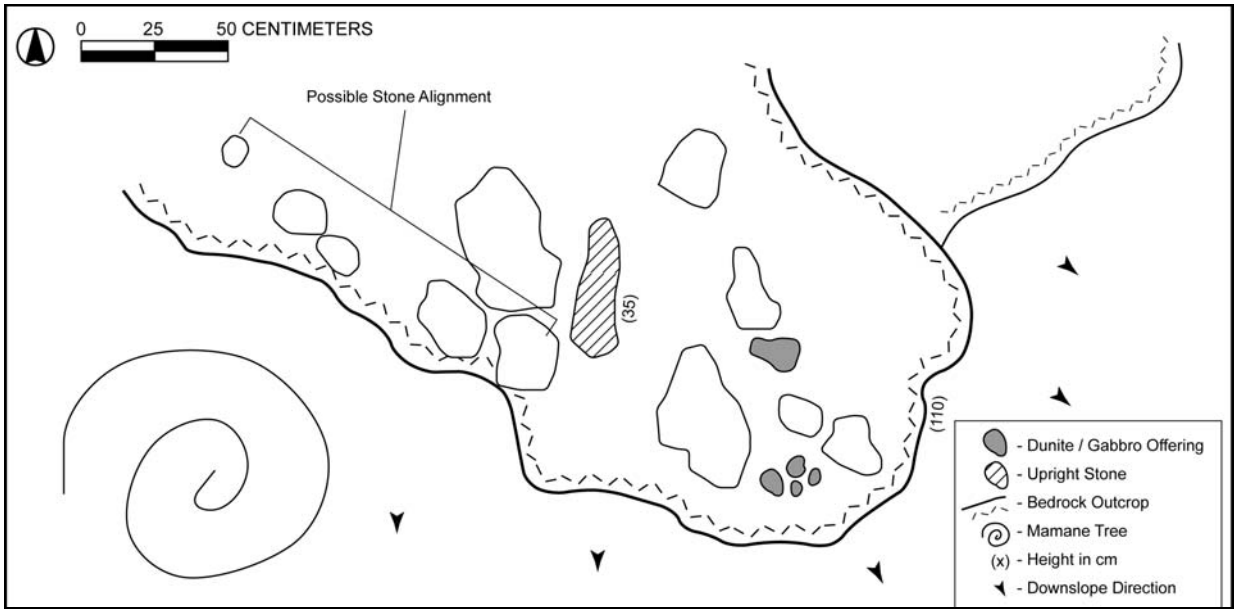

Figure 17. Plan-view diagram of SIHP # 50-10-23-10315 - Shrine 2 (B.P.B.M. Site 50-Ha-G28-87-S2)



Figure 18. SIHP # 50-10-23-10315 - Shrine 2, showing upright stone and dunite/gabbro offerings, view to northwest

4.1.3 “HELCO Substation” portion of the Project area

The HELCO Substation portion of the Project area (see Figures 10, 11 & 13) was associated with a number of find-spots including CSH 7 to CSH 13 along a trail ascending Pu‘u Lepeamoa on the southeast side and two contemporary shrines (CSH 4 and CSH 5) on the north side (see Figures 24 to 33 and description in Appendix A of this study). These were almost all understood as contemporary shrines. Confidence is high that these are contemporary in date, took only a few minutes to construct, do not meet established criteria of significance, and are of no formal historic-preservation concern. A find approximately 200 feet west of the northwest corner of the HELCO Substation enclosure fence merits further discussion (below).

4.1.3.1 SIHP # 50-10-23-10320 – Locality 8

SITE TYPE: Lithic Scatter
FUNCTION: Stone-Working
FEATURES: 4
DIMENSIONS: 1.2 m E/W x 0.5 m N/S
CONDITION: Good
PROBABLE AGE: Pre-contact
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

A small quantity of what appeared to be quarried lithic material (Figures 19 and 20) was observed approximately 200 feet west of the northwest corner of the HELCO Substation enclosure, adjacent to the upslope side of the jeep road and near utility pole # 118502. The lithic material is in the general vicinity of a previously identified lithic scatter designated SIHP # 50-10-23-10320 - Locality 8 by McCoy (1991). The lithic specimens include a broken, anomalous, water worn pebble of dense, polished vesicular basalt (Figure 19) that may be a possible “bird stone” that measured 2.0 inches x 1.1 inches wide x 0.6 inches thick. Three cobble-sized fragments of particularly dense lithic material (Figure 20) that appeared to be dunite/gabbro were noted in the immediate vicinity. None of the lithic specimens are believed to be in a natural deposition, but rather have been picked up and placed on the side of a modern road cut in recent times. It is possible that the lithic specimens had been exposed by erosion of the jeep road and were later moved to their present location alongside the road.

Based on consultation with Dr. McCoy, the identified lithic material is believed to be a component of the previously described SIHP # 50-10-23-10320 – Locality 8 lithic scatter. Dr. McCoy provided a current map (Figure 21) showing the locations of the previously identified components of the Pu‘u Kalepeamoa Site Complex. The lithic material observed during the current study is in the general vicinity of the lithic scatter designated Locality 8. Locality 8 (Figure 22) was described by McCoy (1991) as follows:



Figure 19. SIHP # 50-10-23-10320 – Locality 8 lithic material, showing water-rounded pebble (possible *pōhaku ʻeho* or “bird stone”)



Figure 20. SIHP # 50-10-23-10320 – Locality 8, cluster of lithic material, view to north

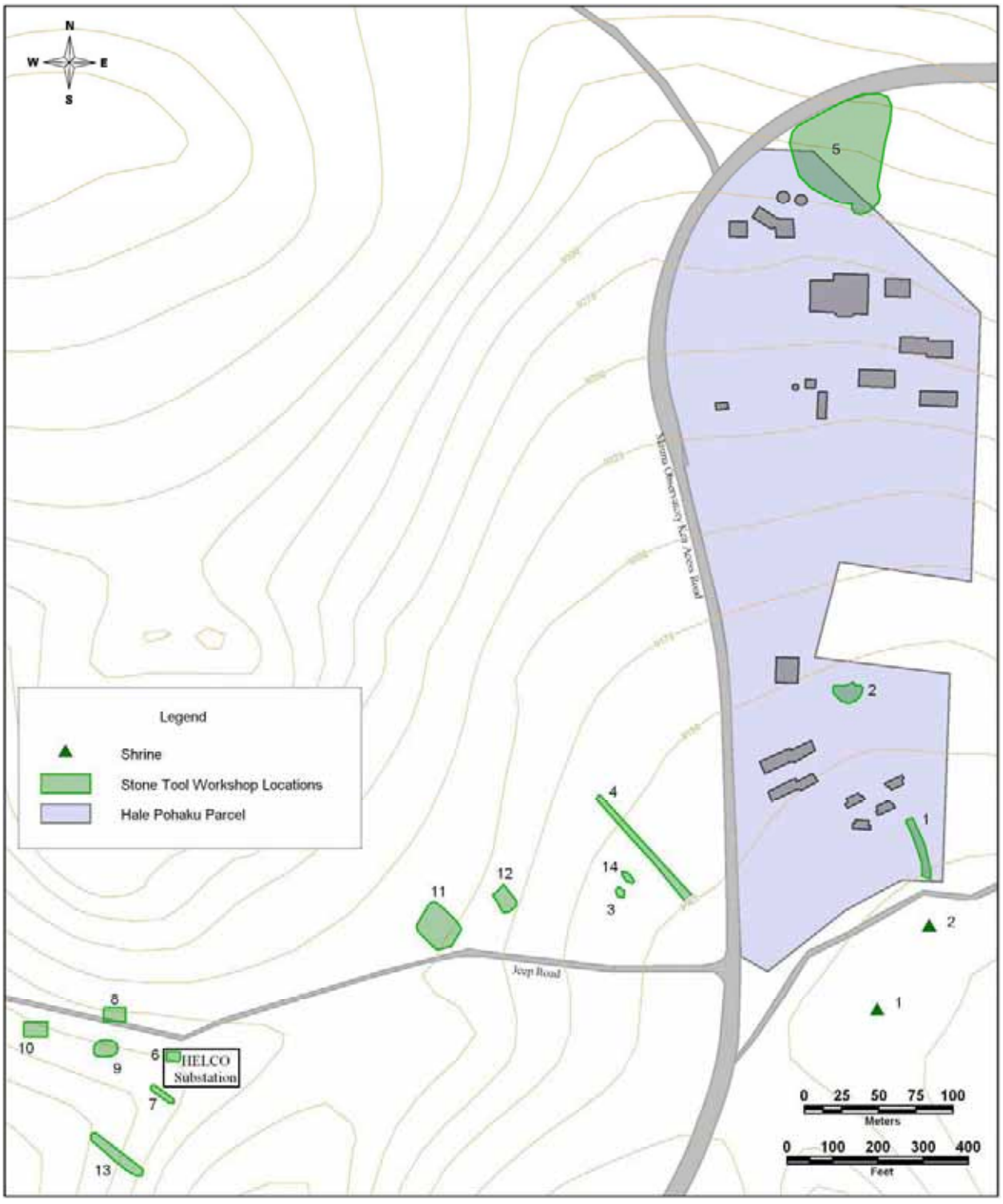

Figure 21. Map showing the locations of components of the Pu‘u Kalepeamoa Site Complex, including Shrines 1 and 2 (SIHP #s 50-10-23-10313 and -10315) and Locality 8 (SIHP # 50-10-23-10320) (map provided by Dr. McCoy, 2009)

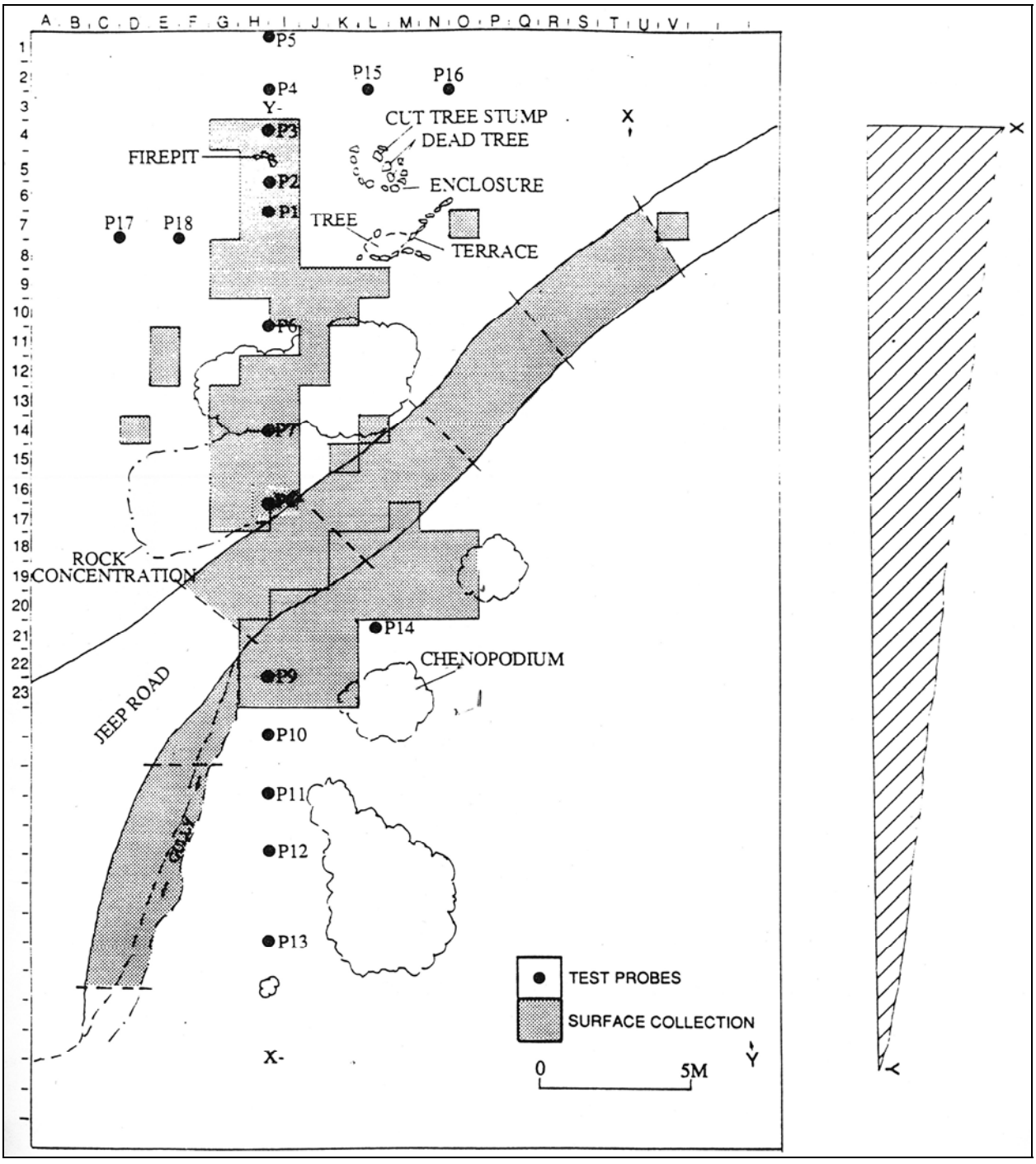

Figure 22. Plan-view diagram of SIHP # 50-10-23-10320 – Locality 8 (B.P.B.M. Site 50-Ha-G28-87) (from McCoy 1991:61)

> This locality [State Number 50-10-23-10,320], earlier judged as having the highest research potential of any known locality on the site, was the focus of the investigations. In the interim between the reconnaissance survey (Sinoto letter report dated May 29, 1987) and the current work considerable disturbance occurred in the upper east side. Two or more of the dead but still standing mamane trees are being pulled down and the branches broken up, presumably for firewood by campers. At the time of the fieldwork a modern fireplace was located nearby on the west side of the proposed substation. Access to this area is by jeep road which passes directly through the middle of the archaeological remains. The road traffic has already done, and most regrettably continues to do, a considerable amount of damage.
>
> The controlled surface collection area encompassed a total area of roughly 135m^2--75 1 m^2 grids and roughly 60m^2 from the road. Artifacts were collected in 1-meter square grids which were subdivided into four quadrants. Larger artifacts were plotted while smaller artifacts, primarily adze waste flakes, were counted and collected as a lot from within a quadrant. A different collection strategy was used for the material in the middle of the road and disturbed roadside. It was collected in arbitrary 5m long sections that varied in width with the curvature of the road. A total of 184 artifacts or 15.73% of the total 1169 specimens was collected from the road.
>
> The lithic scatter covers an area of roughly 200-250 m2. Test probes [see below] indicate that the surface area is probably a reasonably good representation of the subsurface distribution.
>
> The 1169 artifacts constitute by far the largest assemblage, representing 49.45% of the total artifacts collected. The assemblage is not only the largest but also the most diversified as might be expected. The only piece of volcanic glass from the entire site was found here in addition to most of the bird cooking stones and a large percentage of the utilized flakes and fabricators. Of the 1169 artifacts 1066 or 91.23% of the total is adze manufacturing by-products. A total of 78 small flakes [total weight 44gm] was recovered in the test excavation of unit H8 and 5 flakes from the sample taken from the fire pit in unit H5; the remainder are from the surface. All but two of the 12 adze rejects from the combined assemblages were collected here. [McCoy 1991:57-66]

In addition to the scattered lithic material, Locality 8 was also described as containing structural remains, including a partial enclosure or terrace and a rock concentration. Prior fieldwork conducted at SIHP # 50-10-23-13020 – Locality 8 included a surface collection of artifacts and limited subsurface testing. It was noted in the methods section of the report that “every visible piece of cultural material (lithic and shell) was collected from the surface, including small pieces of shatter and anything protruding from beneath the surface that only rarely required some digging to dislodge it” (McCoy 1991:36). With the exception of the four lithic specimens documented by the present study, no surface lithic material or structural remains were observed in the Locality 8 vicinity.

4.1.4 A Comment About Burials

The probability of any unmarked burials or human skeletal remains being present is regarded as very low inasmuch as: a) burials in the Maunakea uplands have only been reported at cinder cones; b) no burials have been encountered during development thus far in the Hale Pōhaku area; c) there are no burial markers or surface indicators of burials present; and d) the absence of caves in the area and the general desert pavement geology would not be conducive for burial location selection.

Section 5 Project Effect and Mitigation Recommendations

5.1 Project Effect

No historic properties were identified within the approximately 6-acre Project area. Three previously identified historic properties in the vicinity of the Project area were relocated and confirmed to be outside of the Project area. CSH's effect recommendation for the proposed Thirty-Meter-Telescope (TMT) Observatory Project, Hale Pōhaku Area, is "no historic properties affected."

5.2 Mitigation Recommendations

No historic preservation mitigation measures are recommended for the proposed TMT Project, Hale Pōhaku Area.

We do however recommend that should there be any proposed development more than 20 m north and west from the northwest corner of the HELCO Substation enclosure that there be prior consultation with Dr. Patrick McCoy regarding the previously identified SIHP # 50-10-23-10320 - Locality 8 lithic scatter to determine proper mitigation measures, potentially including data recovery.

As specified in a 2000 Mauna Kea Master Plan, it is understood that Project activities should maintain a 200-foot buffer from shrine sites such as the two shrines (SIHP #s 50-10-23-10313 and -10315, documented at a distance of 200-feet or more south of the Hale Pōhaku Project area). As long as Project activities remain within the designated Hale Pōhaku Project area, there should be no adverse impact to these historic properties.

The probability of any unmarked burials or human skeletal remains being present within the Project area is regarded as very low, inasmuch as: a) burials in the Maunakea uplands have only been reported at cinder cones; b) no burials have been encountered during development thus far in the Hale Pōhaku Area; c) there are no burial markers or surface indicators of burials present; and d) the absence of caves in the area and the general desert pavement geology would not be conducive for burial location selection. However, in the unlikely event that cultural resources including but not limited to human remains or other significant cultural deposits are encountered during the course of Project-related construction activities, all work in the immediate area should stop and the State Historic Preservation Division should be promptly notified.

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Appendix A Documentation of “Find Spots”

CSH 1

INITIALLY INTERPRETED SITE TYPE: *Ahu* (Cairn)
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 20 inches diameter
CONDITION: Excellent
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:012

DESCRIPTION:

This structure was the only construction documented within the Hale Pōhaku survey area. Located in the south central portion of the Hale Pōhaku survey area (see Figures 12 and 13), the construction (Figure 22) consists of approximately 15 cobble-sized pieces of the locally-available, scoria, *ʻaʻā* mounded on a small scoria, *ʻaʻā* outcrop. The bedrock outcrop is in a generally open area and measures approximately 31 inches by 31 inches by 24 inches high with the pile of scoria occupying an area of about 20 inches in diameter and adding another 8 inches above the outcrop. The absence of any dessert varnish, patterns of weathering or retained wind-blown sediment within the small construction suggest that the construction is quite recent. The use of such small pebbles would be atypical of pre-contact Hawaiian *ahu* construction. The structure is interpreted as a contemporary shrine. Our on-site Hawaiian cultural expert, Mr. Auli‘i Mitchell, supported the conclusion that the modest structure is in fact less than ten years old.



Figure 23. CSH 1, modern *ahu*, view to northwest

CSH 2

INITIALLY INTERPRETED SITE TYPE: Shrine
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 6.9 feet N/S x 3.9 feet E/W
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:012

DESCRIPTION:

This structure lies approximately 115 feet east (outside) of the northeast corner of the Hale Pōhaku survey area (see Figures 12 and 13) and just southeast and down slope of a visitor center parking lot and picnic area. This construction (Figure 23) consists of a single course of the locally-available, scoria, *ʻaʻā* cobbles delineating an oval perimeter retaining a soil interior that slopes significantly down to the south. The construction is approximately 3.9 foot NE/SW by 6.9 foot NW/SE and was located in the lee of a *māmane* (*Sophora chrysophylla*) tree. A 3.3 foot long piece of steel rebar was observed on the surface at the upslope end of the feature, passing between perimeter stones. Modern trash was observed 13 feet to south. The absence of any settling of the perimeter pebbles into the earth or build-up of wind-blown sediment suggested that the structure was modern. The small size of the selected stones and general casualness of construction suggest that it is not of any antiquity. The structure is interpreted as a contemporary shrine. Our on-site Hawaiian cultural expert, Mr. Auli‘i Mitchell, supported the conclusion that the modest structure is in fact less than ten years old.



Figure 24. CSH 2, modern shrine, view to north

CSH 3

INITIALLY INTERPRETED SITE TYPE: *Ahu* (Cairn)
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 3.9 feet diameter
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

This structure lies approximately 35 m west of the Maunakea Access Road and is hence approximately 42 m west (outside) of the south portion of the Hale Pōhaku survey area (see Figures 12 and 13). This cairn consists of approximately 30 large cobbles of locally-available, scoria, *ʻaʻā* piled in an area approximately 3.9 feet in diameter and 20 inches high (Figure 24). The absence of any settling of the lowest course of cobbles into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.

This *ahu* or cairn was indeed mapped as a portion of McCoy's (1991) Locality 4 and was believed by him to be modern – a conclusion which we fully support.



Figure 25. CSH 3, modern *ahu*, view to west

CSH 4

INITIALLY INTERPRETED SITE TYPE: Shrine
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 31 inches in diameter
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

This modest construction is located approximately 720 feet west of the Maunakea Access Road and approximately 260 feet northeast of the northeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). The structure consists of a circular ring of nine small boulders of locally-available, scoria, *ʻaʻā* with one upright on the east side (Figure 25). The absence of any settling of the lowest course of cobbles into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.



Figure 26. CSH 4, modern shrine, view to north

CSH 5

INITIALLY INTERPRETED SITE TYPE: Shrine
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 3
DIMENSIONS: 12.1 feet E/W x 7.9 feet N/S
CONDITION: Excellent
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

This construction is located approximately 200 feet north of the central portion of the northern fenced perimeter of the HELCO substation (see Figures 12 and 13). The structure is roughly oval, measuring approximately 12.1 feet E/W x 7.9 feet N/S with the perimeter alignment, 1-2 courses of small, locally-available, scoria, *ʻaʻā* boulders high, and 1-2 course of small boulders wide (Figure 26). The structure is built around a large bedrock *ʻaʻā* boulder, 3.3 feet x 3.3 feet wide and 31 inches high that dominates the central portion of the structure giving something of a heart-shaped appearance. A *māmane* (*Sophora chrysophylla*) branch was propped up on the large central boulder with piled cobbles. An upright stone is set at the down slope apex, with a stone alignment extending approximately 3 feet (1 m) down slope (SSE) from the upright. The interior surface is relatively clear and level soil. Branch points to Puʻu Kalepeamoa. A small *ahu* or cairn was noted a meter to the NE, approximately 24 inches x 20 inches wide and 24 inches high A similar, but collapsed, small *ahu* or cairn was noted approximately a meter to the NW. The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.

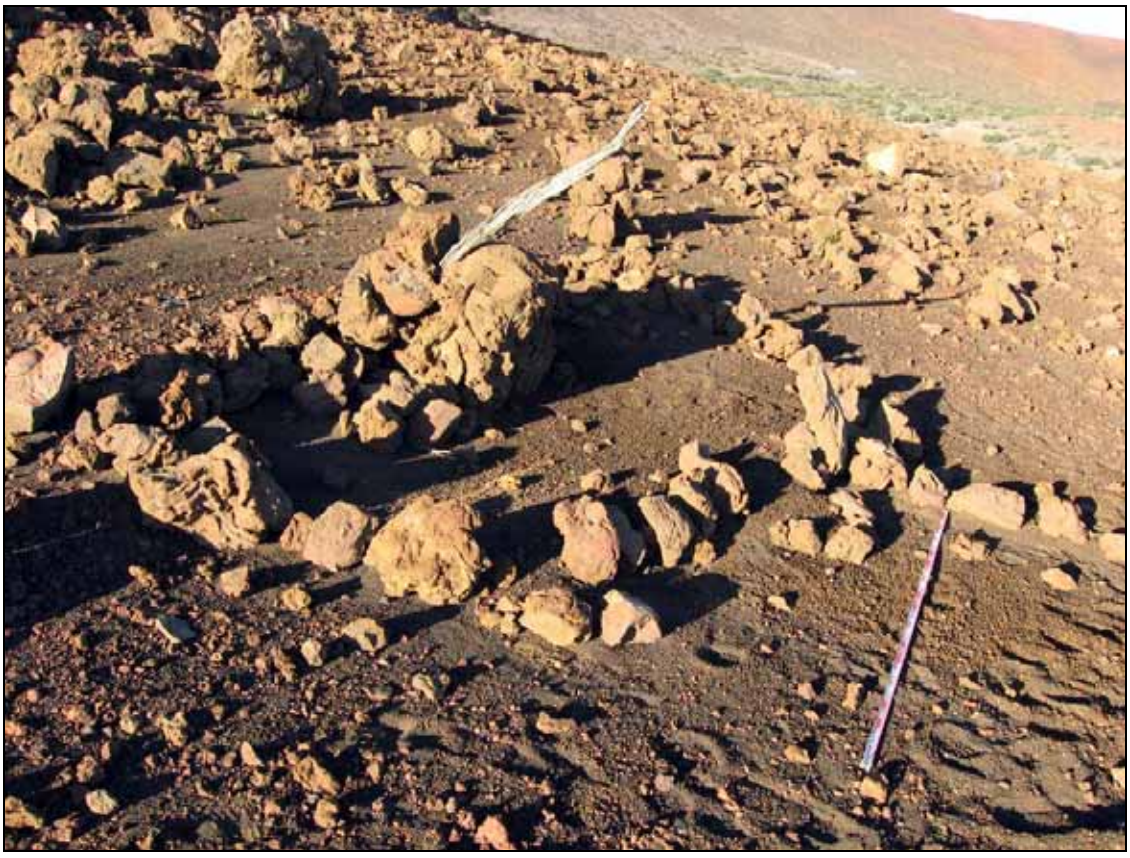

Figure 27. CSH 5, modern shrine, view to northeast

CSH 7

INITIALLY INTERPRETED SITE TYPE: Linear Mound/ Shrine
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 12.5 feet E/W x 6.9 feet N/S
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 7 is located just southeast of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 200 feet southeast of the southeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). This was the northeastern-most of several mounded piles of boulders along the trail. The structure measures 12.5 feet E/W x 6.9 feet N/S by 3.3 feet high (Figure 27). This linear mound showed no facing, and was constructed of rather informally piled locally-available, scoria, *‘a‘ā* boulders and cobbles with no clear uprights. Modern garbage was noted within structure. The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.

Remnants of lei or twisted rope offerings were observed within the structure (Figure 28).



Figure 28. CSH 7, linear mound, view to northeast



Figure 29. CSH 7, linear mound, showing lei offering

CSH 8

INITIALLY INTERPRETED SITE TYPE: Writing with Stones
INITIALLY INTERPRETED FUNCTION: Commemorative demarcation with arranged boulders (graffiti)
FEATURES: 1
DIMENSIONS: 5 feet NW/SE x 3.3 feet NE/SW
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 8 is located adjacent to CSH 7 and just southeast of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 200 feet southeast of the southeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). This construction consists of what appears to be three letters delineated with a single course of small of small, locally-available, scoria, *‘a‘ā* boulders (Figure 29). The letters (and meaning) were unclear - possibly “OHS” or “OWS”? The absence of any settling of the alignments of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as contemporary graffiti.



Figure 30. CSH 8, letters written with stones

CSH 9

INITIALLY INTERPRETED SITE TYPE: Mound
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 5.6 feet NE/SW x 4.6 feet NW/SE
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 9 is a small mound located in the immediate vicinity of CSH 7 and CSH 8 and just southeast of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 200 feet southeast of the southeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). The mound measures approximately 5.6 feet NE/SW x 4.6 feet NW/SE and approximately 28 inches high. The mound appears to be constructed of locally-available, scoria, *‘a‘ā* small boulders placed around a somewhat fragmented in situ large lava bomb rock formation (Figure 30). The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.



Figure 31. CSH 9 mound, view to southwest

CSH 10

INITIALLY INTERPRETED SITE TYPE: Linear Mound
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 34 feet NE/SW x 6.6 feet NW/SE
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 10 is a large mound located a few meters southwest of the CSH 7, CSH 8 and CSH 9 constructions and just southeast of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 213 feet southeast of the southeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). The mound measures approximately 34 feet NE/SW x 6.6 feet NW/SE and approximately 24 inches high (Figure 31). The mound averages 3.6 feet wide, is typically 2-3 courses high, and 6-7 courses wide of roughly piled locally-available, scoria, *‘a‘ā* boulders (Figure 30). There are no clear uprights. The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.



Figure 32. CSH 10, linear mound, view to northwest

CSH 11

INITIALLY INTERPRETED SITE TYPE: Mound
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 3.6 feet diameter
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 11 is a small mound located a few meters from CSH 10 and just southeast of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 213 feet (65 m) southeast of the southeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). The mound measures approximately 3.6 feet in diameter and approximately 24 inches high (Figure 32). The structure is really just a group of approximately twenty locally-available, scoria, *‘a‘ā* boulders a single course high. The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.



Figure 33. CSH 11, mound, view to west

CSH 12

INITIALLY INTERPRETED SITE TYPE: Shrine
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 31 inches diameter
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 12 is a small mound located in the immediate vicinity of CSH 13 and just southeast of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 230 feet south of the southeast corner of the fenced perimeter of the HELCO substation (see Figures 12 and 13). The mound measures approximately 31 inches in diameter and approximately 2.3 feet high. The mound appears to be constructed of locally-available, scoria, *‘a‘ā* small boulders (Figure 33). Offerings of American coins (dates of 1979, 1989, 1987, 2006, 1999), shell lei (including one of exotic *Cyprea annulus*) and a metal cross with green glass inlay were observed. The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. While we cannot rule out that the coins were a recent addition to an older structure it appears most likely they are roughly contemporaneous (i.e. the construction does not pre-date 2006 by much). We note in passing that the shell lei are of exotic shells native to the South Pacific but not Hawai‘i. Should such shells be identified in a pre-contact structure they would be of great interest! The structure is interpreted as a contemporary shrine.



Figure 34. CSH 12, modern shrine, view to west. Note metal cross and cowry shell lei offerings

CSH 13

INITIALLY INTERPRETED SITE TYPE: Linear Mound
INITIALLY INTERPRETED FUNCTION: Ceremonial
FEATURES: 1
DIMENSIONS: 14.7 feet (4.5 m) E/W 3.9 feet (1.2 m) N/S
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001

DESCRIPTION:

The find spot designated CSH 13 is a large mound located near the CSH 11 construction and just northwest of an unimproved foot trail ascending the NNE side of the Pu‘u Lepeamoa cinder cone approximately 230 feet south of the fenced perimeter of the HELCO substation (see Figures 12 and 13). The mound measures approximately 14.7 feet E/W by 3.9 feet N/S and approximately 31 inches high (Figure 34). The mound utilizes a large in situ boulder and is constructed of roughly piled locally-available, scoria, *‘a‘ā* boulders (Figure 34). There are no clear uprights. The absence of any settling of the lowest course of boulders into the earth or build-up of wind-blown sediment suggested that the structure was modern. The structure is interpreted as a contemporary shrine.



Figure 35. CSH 13, linear mound, view to southwest. Note trail to *pu‘u* summit in background

Modern Refuse Disposal Areas

INITIALLY INTERPRETED SITE TYPE: Artifact scatter
INITIALLY INTERPRETED FUNCTION: Late Twentieth century refuse disposal
FEATURES: 2
DIMENSIONS: Approximately 0.4 acres each
CONDITION: Good
PROBABLE AGE: Modern
TAX MAP KEY: [3] 4-4-015:001, 012

DESCRIPTION:

Two late Twentieth century scatters of bottles and cans ("Modern Garbage Area" and "Modern Garbage Area 2") were observed just east (outside) of the Hale Pōhaku Project area (see Figures 12 and 13).

Each of these scatters (Figures 35 and 36) was relatively dense with each having on the order of 150 bottles and cans within an area of approximately 0.4 acres (each) suggesting deliberate disposal of refuse. The presence of "No deposit No return" embossing on some bottles suggested late twentieth century disposal. The timeframe of disposal might be early 1960s. No particular import is attributed to these small refuse disposal areas but they are documented for future reference.



Figure 36. Modern garbage area, near Shrines 1 and 2, view to northeast



Figure 37. Modern garbage area 2, view to northeast

Appendix I. Archaeological Inventory Survey of the Astronomy Precinct in the Mauna Kea Science Reserve

Pacific Commercial Services Inc. (PCSI). 2010b. Final Report, Archaeological Inventory Survey of the Astronomy Precinct in the Mauna Kea Science Reserve, Ka‘ohe, Ahupua‘a, Hāmākua District, Hawai‘i Island, Hawai‘i. Prepared for Office of Mauna Kea Management. January 2010.

FINAL Report
Archaeological Inventory Survey of the Astronomy Precinct in the Mauna Kea Science Reserve, Ka`ohe Ahupua`a, H• m• kua District, Hawai`i Island, Hawaii.

TMK: (3) 4-4-015: 09 (por.)

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January 2010

FINAL REPORT

Archaeological Inventory Survey of the Astronomy Precinct
In the Mauna Kea Science Reserve
Ka`ohe Ahupua`a, Hāmākua District, Island of Hawai`i
TMK: (3) 4-4-015: 09 (por.)

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ABSTRACT

Under contract to the Office of Mauna Kea Management (OMKM), Pacific Consulting Services, Inc. (PCSI) conducted an archaeological inventory survey of the 525-acre Astronomy Precinct in the Mauna Kea Science Reserve. Although the inventory fieldwork was conducted in 2005, archaeological sites that comprise the inventory include sites identified in previous reconnaissance surveys (McCoy 1982a, 1982b, 1984b, 1999a) as well as sites recorded during 2005.

A total of seven historic properties have been identified within the Astronomy Precinct. These include six archaeological sites and one traditional cultural property. The six archaeological sites found during various fieldwork phases are comprised of 7 features. With one exception, all sites and features have been interpreted as shrines. The one exception, Site 21449, a terrace of unknown function, was excavated to aid in the determination of site function. The testing determined that this terrace was a natural gelifluction feature.

K• kahau`ula, a prominent landscape feature at Mauna Kea's summit, was deemed a Traditional Cultural Property (TCP) by SHPD in 1999, and designated as Site 50-10-23-21438. This landscape feature is also known as Pu`u Hau Oki, Pu`u Kea, and Pu`u Wekiu. A portion of K• kahau`ula extends into the Astronomy Precinct is part of the inventory of historic properties in the Astronomy Precinct.

A draft historic preservation plan (HPP) prepared in 1999 by SHPD for the lands managed by the University of Hawai`i on Mauna Kea proposed the recognition of what was called the Mauna Kea Summit Region Historic District. The district (50-10-23-28689), later determined eligible for inclusion in the National Register of Historic Places, includes the Astronomy Precinct. The seven historic properties in the Astronomy Precinct are contributing properties to this district and are significant under multiple criteria.

Seven "find-spots" were identified in the Astronomy Precinct in 2005, including a previously identified find-spot found during a 1997 survey (McCoy 1999a). Find spots are cultural resources that are either obviously modern features or features that cannot be classified with any level of confidence as historic properties because of their uncertain age and function.

All of the sites in the Astronomy Precinct and in the Mauna Kea Science Reserve are in preservation and will continue to be managed by the Office of Mauna Kea Management (OMKM). The data from this survey has been incorporated into a draft Cultural Resource Management Plan (McCoy et al. 2009). In the interim, recommendations are made that all future construction projects in the precinct proceed with caution and an increased awareness of the nature, location, and significance of historic properties in the Astronomy Precinct and the need to protect them. Relevant sections of the draft CRMP are listed that will aid in managing the historic properties identified in the Astronomy Precinct.

ACKNOWLEDGMENTS

Numerous individuals contributed to the successful completion of the work described in this report. Stephanie Nagata, currently Interim Director of the Office of Mauna Kea Management (OMKM) provided much appreciated logistical support in making arrangements for the field crew to stay at the Mid-Elevation Facility at Hale Pohaku.

The aerial photograph (Figure 2.1) was obtained from George McEldowney, father of Holly McEldowney, in the early 1980s, when Holly and the senior author co-authored the first cultural resource management report on the Mauna Kea Science Reserve. Her report continues to be one of the most important sources of ethnographic and ethnohistoric information on the summit region of Mauna Kea and is cited or quoted in a number of places in this report.

The authors are grateful for the hard work and perseverance under very trying conditions of our PCSI co-workers, Dennis Gosser and Reid Yamasato. The survey could not have been completed without their efforts.

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1.0 INTRODUCTION

The summit region of Mauna Kea, which is the highest and second largest of the five volcanoes that form the island of Hawai`i, is one of the premier centers for astronomy in the world. It is also by any standard of comparison one of the most culturally significant and archaeologically important places in the Hawaiian Islands. A number of Native Hawaiians regard Mauna Kea as the most sacred place on the island and some use the mountain as a place to conduct traditional and customary practices. The Mauna Kea Adze Quarry, located just below the summit, was placed on the National Register of Historic Places in 1962 as a National Historic Landmark. In 1999 the Mauna Kea Summit Region Historic District, which encompasses the adze quarry and many other significant sites in a vast cultural landscape, was determined eligible for listing on the National Register.

In addition to astronomers and Native Hawaiians, Mauna Kea is also used by the public for a variety of recreational, educational, research, and commercial purposes. With the establishment of the Mauna Kea Science Reserve (Figure 1.1), which was leased to the University of Hawai`i (UH) in 1968, came conflicts over the use of a large area of the upper mountain for primarily research and educational purposes. A number of Mauna Kea management plans have been prepared since the 1970s, when concerns were first raised about the increasing number of telescopes on the mountain and the effect these were having on the natural and cultural environment.

In 1995 the Board of Land and Natural Resources (BLNR) approved the Revised Management Plan for the UH management areas on Mauna Kea. The 1995 plan, while marking an improvement on previous plans, fell short of meeting the needs and expectations of the various stakeholders, including UH, the Department of Land and Natural Resources (DLNR), Native Hawaiian practitioners, conservationists, and other user groups.

After two legislative audits (1998 and 2005), the development of the 2000 Mauna Kea Science Reserve Master Plan (Group 70 International, Inc. 2000), and a decision rendered by the Third Circuit Court on January 19, 2007, the University of Hawaii prepared a Comprehensive Management Plan (CMP), which was approved by the BLNR on April 9, 2009. The CMP was approved with a number of conditions. Condition 4 stated:

> Within one year of the BLNR approval of the CMP, or the submission of a Conservation District Use Application, whichever occurs sooner, the University shall submit for review and approval the following sub plans:
>
> - A cultural resources management plan;
> - A natural resources management plan;
> - A decommissioning plan, including a financial plan; and
> - A public access plan

In August 2005, PCSI was contracted by OMKM to undertake an archaeological inventory survey of the Astronomy Precinct, located within the Mauna Kea Science

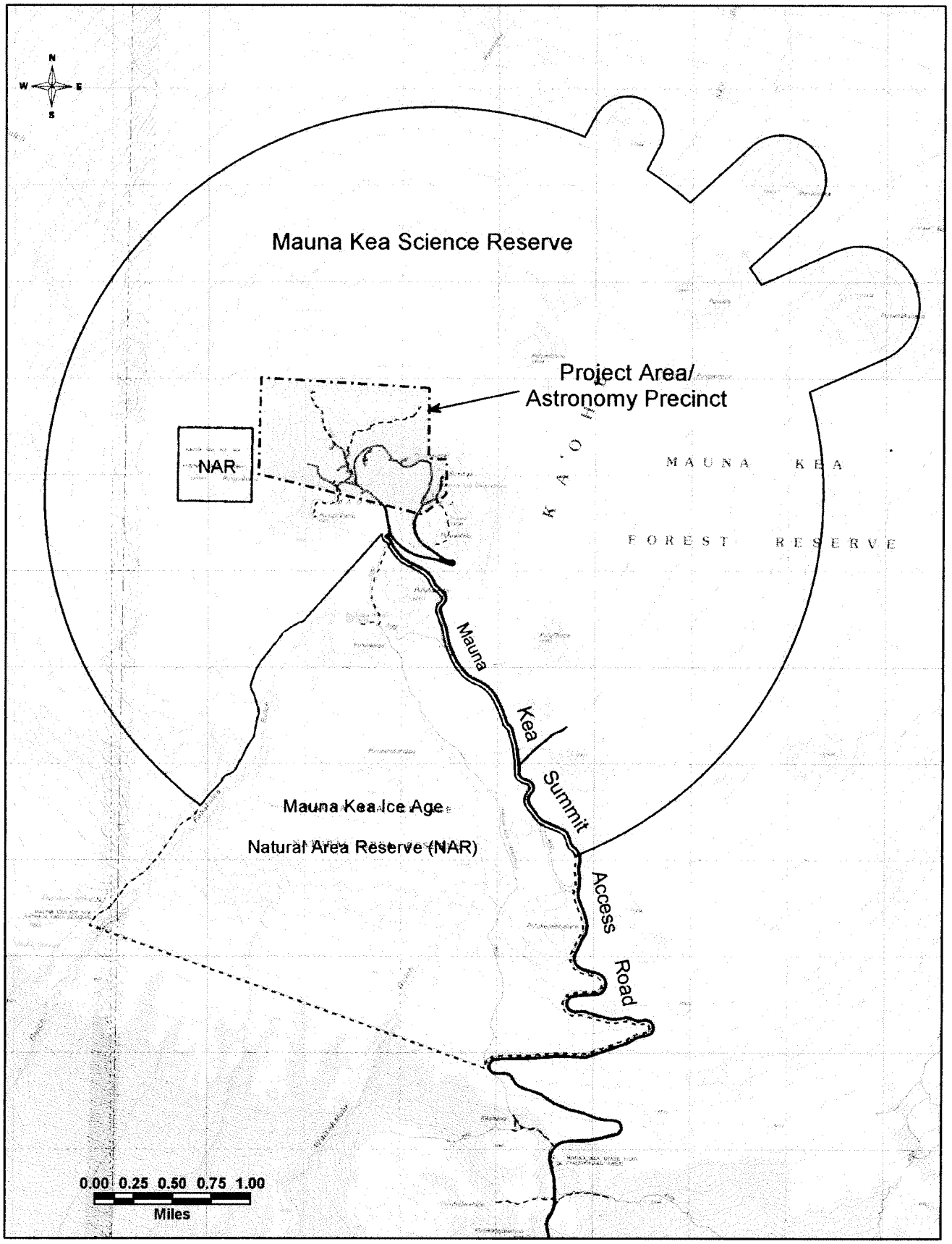


Figure 1.1 Project Area Location on U.S.G.S. Mauna Kea Quadrangle (1983).

Reserve (MKSR) (see Figure 1.1). The survey was guided by Hawaii Revised Statutes (HRS), Chapter 6E, and Title 13 of the Hawaii Administrative Rules (HAR), Subtitle 13 (State Historic Preservation Division Rules), Chapter 276 (Rules Governing Standards for Archaeological Inventory Surveys and Reports) to ensure that the survey and reporting is in compliance with these rules and regulations. This report presents the results of this archaeological inventory survey.

PCSI was contracted by OMKM to prepare a Cultural Resource Management Plan (CRMP) in 2007, prior to the Third Circuit Court ruling and the recently approved CMP.

1.1 Report Organization

The report is divided into eight sections excluding the list of references.

Section 1: Introduction--the report begins with a description of the scope of work and project objectives; the organization of the report, and a brief description of the project area location, fieldwork schedule and list of personnel that took part in the survey.

Section 2: Project Area Background--provides a description of the environment and culture-historical context of the Mauna Kea summit region, and an overview of the geologic origins, flora and fauna, early historic accounts, and the name and cultural practices that take place at the lake.

Section 3: Previous Archaeological Investigations in the Project Area--summarizes earlier archaeological research, traditional property assessments, cultural impact assessments and mitigation plans for the higher elevation regions of Mauna Kea.

Section 4: Methodological and Theoretical Issues--discusses data requirements, site and feature definitions, site form and function and the formal and function site classification employed in this report.

Section 5: Summary of Work--includes a discussion of field methods, limitations of the survey, a presentation of the findings and description of the small surface collection of artifacts that was made.

Section 6: Summary and Discussion--presents a brief analysis of the data collected in the current project and their relevance to an understanding of the cultural significance of the area.

Section 7: Significance Evaluations--presents a discussion of the significance of the historic properties found during the survey in the context of a previously established historic district that encompasses the current project area.

Section 8: Recommendations--are made regarding the protection and continued preservation of the historic properties in the Astronomy Precinct.

Section 9: References Cited.

1.2 PROJECT AREA LOCATION, FIELDWORK SCHEDULE, AND PERSONNEL

The Mauna Kea Science Reserve was established in 1968 on lands owned by the State of Hawaii when the Board of Land and Natural Resources (BLNR) approved a 65-year lease to the University of Hawai`i for a 13,321-acre area centered on the summit of Mauna Kea, extending out an average distance of 2.5 miles from the University of Hawai`i 44-inch telescope and encompassing all of the land above the 12,000 ft elevation. The boundary on the northeast side of the Science Reserve (see Figure 1.1) extends further down the mountain to include Pu`u Makanaka and two other large cinder cones. The rationale for creating such a large Reserve is stated in the lease:

> The land hereby leased shall be used by the Lessee as a scientific complex, including without limitation thereof an observatory, and as a scientific reserve being more specifically a buffer zone to prevent the intrusion of activities inimical to said scientific complex.

The Science Reserve is bordered on all sides by State land. The boundaries of the Science Reserve changed in 1981 when some 2,033.2-acres of land were withdrawn from the lease for the creation of the Mauna Kea Ice Age Natural Area Reserve (NAR). The NAR consists of two separate parcels of land, a 1,889.7-acre pie-shaped parcel that encompasses most of the Mauna Kea Adze Quarry and Lake Waiau, and a 143.5-acre parcel surrounding Pu`u P• haku (see Figure 1.1). The Science Reserve now encompasses an area of roughly 11,215 acres. The 2000 Master Plan divided the Science Reserve into a 10,760-acre Natural and Cultural Preserve and the 525-acre Astronomy Precinct.

The 525-acre Astronomy Precinct, the subject of this report, is located in the Summit Region of Mauna Kea (Figure 1.2). The 2000 Mauna Kea Science Reserve Master Plan and Environmental Impact Statement shows the Astronomy Precinct as a roughly rectangular-shaped parcel with the southeast corner extending out to the west (see Figure 1.2). Since the boundaries of the Astronomy Precinct are not marked, GPS readings were used to identify the boundaries in the field.

The archaeological field survey for the Astronomy Precinct and surrounding lands in the Mauna Kea Science Reserve was conducted over an 8-day period between August 29 and September 6, 2005, by Co-Principal Investigators Patrick McCoy and Dennis Gosser, and two other PCSI staff, Richard Nees, and Reid Yamasato. The field crew used the weekend of August 27-28 to acclimate to the high elevation of the project area. On August 28 the field crew climbed the summit cone, Pu`u Wekiu, to set the elevation of our two GPS units at the United States Geological Survey (USGS) marker (13,796 ft). The final day was devoted to the review and organization of field records, and to downloading and logging digital photographs and GPS data. PCSI staff members Pat McCoy, Rich Nees, Keola Nakamura, and Valerie Park revisited Site 21449 in the Astronomy Precinct on August 25, 2008 to conduct a brief testing program.

1.3 ASTRONOMY PRECINCT FACILITIES

The primary user group in terms of the number of institutions and a full-time physical presence on Mauna Kea are the astronomers. There are currently 13

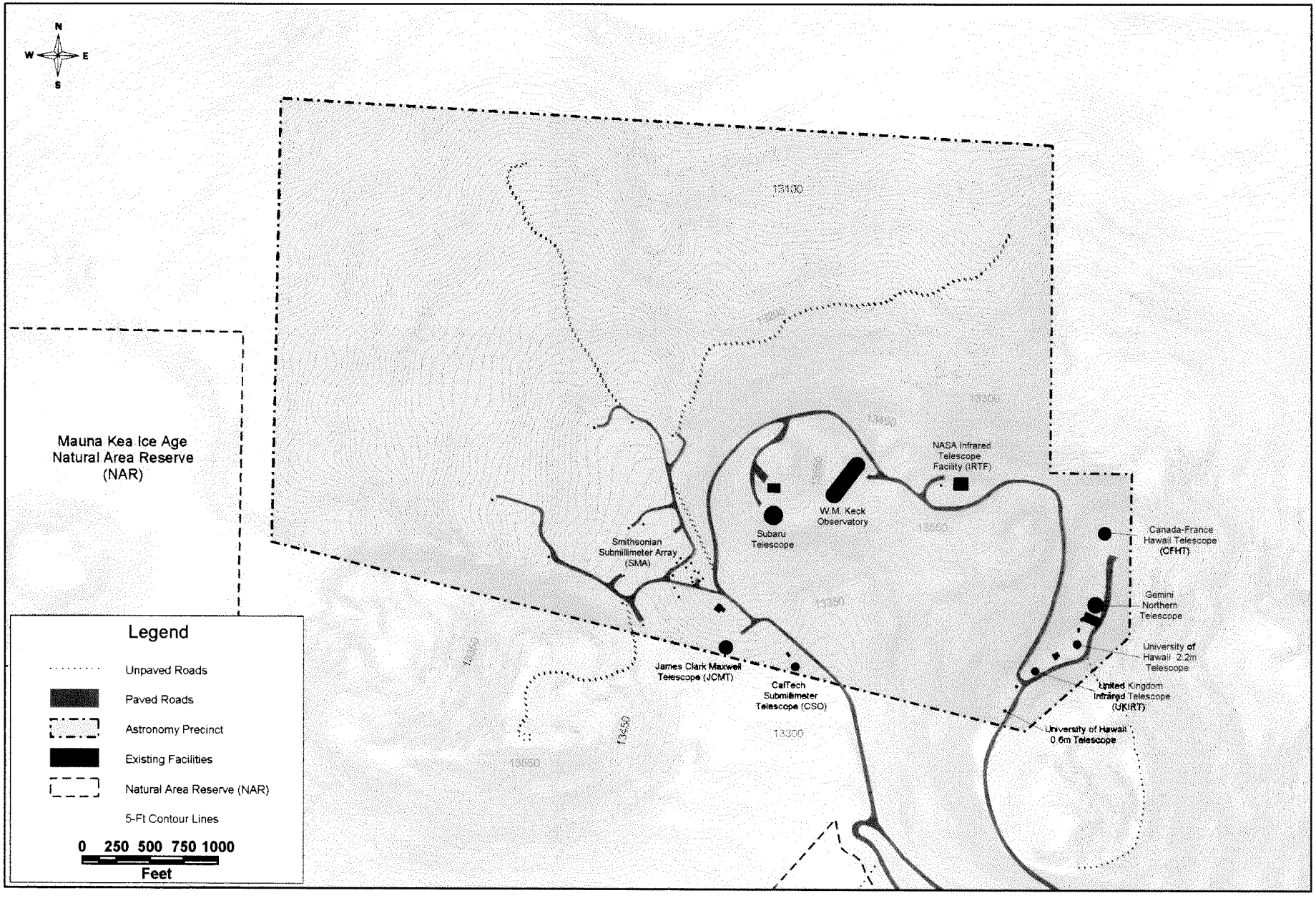


Figure 1.2 Approximate Boundary of the Astronomy Precinct and Existing Facilities

observatories (see Figure 1-2) that employ a large number of support staff. The observatories and their starting date of operations are presented below in Table 1.1.

Table 1-1 Mauna Kea Observatories and Starting Dates of Operations.

Observatory	Starting Date of Operations
**Lunar and Planetary Station	1964
University of Hawaii (UH) 24inch	1968
University of Hawaii 88 inch	1970
Canada-France-Hawaii Telescope (CFHT)	1979
NASA Infrared Telescope Facility (IRTF)	1979
United Kingdom Infrared Telescope (UKIRT)	1979
Caltech Submillimeter Observatory (CSO)	1987
James Clark Maxwell Telescope (JCMT)	1987
Very Long Baseline Array (VLBA)	1992
W.M. Keck Observatory 1	1992
W.M. Keck Observatory 2	1996
Gemini North Telescope	1999
Subaru	1999
Smithsonian Submillimeter Array (SMA)	2002

** no longer in operation

2.0 PROJECT AREA BACKGROUND

For humans the environment of the summit area is a particularly difficult environment in which to work and live because of the physiological effects of high altitude, low temperatures, and biotic impoverishment. It has been characterized elsewhere as a "non-subsistence" environment because of the lack of food and other essentials, such as fuel for fireplaces or hearths (McCoy 1990).

2.1 GEOECOLOGY OF THE MAUNA KEA SUMMIT REGION

The following overview of the environmental setting of the Mauna Kea summit region is taken primarily from other reports and papers (McCoy 1982a, 1990). The environment on the upper slopes of Mauna Kea evinces similarities to other high mountains, including the marked interdependency of biotic and abiotic processes that has given rise to the term "geoecology" in the recent literature on arctic and alpine environments (Troll 1972; Winterhalder and Thomas 1978; Webber 1979). The complexities that the term geoecology engenders prevent a total environmental analysis in a report of this length. The focus of attention is on what are believed to be the most relevant biogeoclimatic characteristics for understanding the archaeological record of the summit region, including the Lake Waiau project area. The summit region as defined here encompasses the vast alpine desert ecosystem on the top of the mountain.

2.1.1 Geologic History, Landforms, Topography, and Soils

Mauna Kea, the highest (13,796 ft asl) and second largest of the five shield volcanoes that form the island of Hawai`i, is estimated to be between 600,000 and 1.5 million year old (Moore and Clague 1992; DePaolo and Stolper 1996; Wolfe et al. 1997; Sharp and Rene 2004). The earliest stage of volcanism consists of a basaltic shield. The latest stage, which caps the mountain, consists of andesitic lavas (Macdonald and Abbott 1970:142; Wolfe and Morris 1996; Wolfe et al. 1997; Sherrod et al. 2007). Even though the last eruption occurred sometime between 4,580 and 8,200 years ago (Sherrod et al. 2007:470), the U.S. Geological Survey (USGS) considers Mauna Kea to be an active post-shield volcano (U.S. Geological Survey 2002).

There are numerous cinder cones and associated lava flows on what is popularly known as the summit plateau (Figure 2.1):

> Above 11,000 to 12,000 feet is the summit plateau, a rudely circular dome 5 or 6 miles in diameter rising between 500 and 1000 feet per mile to a central area above 13,000 feet (Wentworth and Powers 1941:1197).

Mauna Kea was for many years the only known mountain in the tropical mid-Pacific with evidence of Pleistocene glaciation (Daly 1910; Porter 1972, 1975, 1979a, 1979b, 1987). Evidence for glaciation has apparently been found recently on Haleakal• (Moore et al. 1993). A number of geologists have studied the glacial deposits on Mauna Kea (e.g., Gregory and Wentworth 1937; Wentworth and Powers 1941; Stearns 1945), but the definitive study was undertaken by Stephen in the 1970s. Porter mapped a succession of four glacial drift sheets, located between the ca. 2,800 m (9,184 ft) and

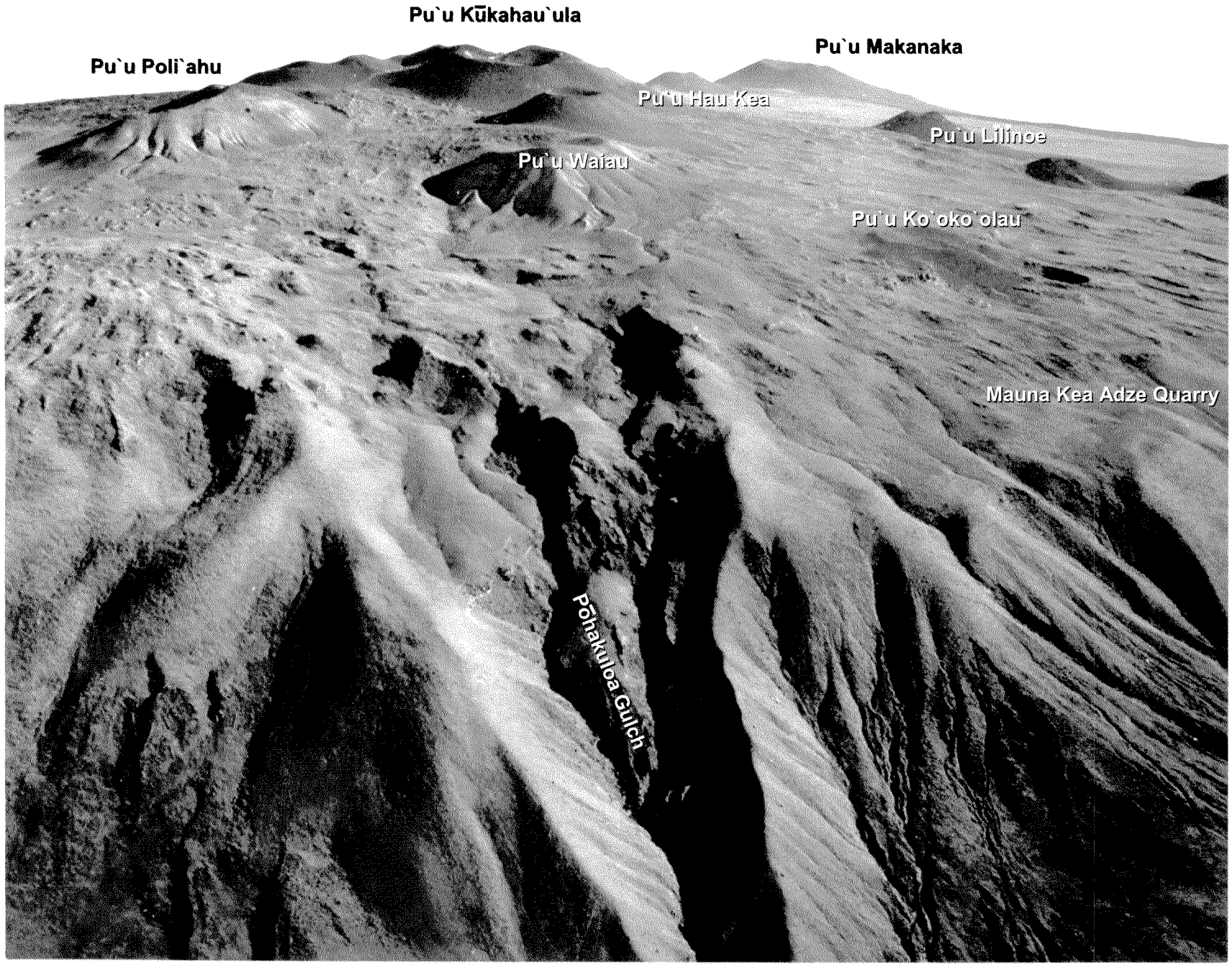


Figure 2-1. Aerial View of Summit Plateau and Dissected Landscape Below in the Pohakuloa Gulch Area.

4,200 m (13,776 ft) elevations, which correspond to four periods of glaciation. From earliest to latest the glacial deposits were named, using local place names, the P• hakuloa Formation, Waihu Formation, and the Makanaka Formation. The latter includes an older drift and a younger drift (Porter 1979b: Figure 2). More recent investigations suggest that there may have only been three major stages of glaciation, rather than four (Wolfe et al. 1997).

Porter provides a good description of the effects of glaciation on the topography of the summit plateau:

> Behind the belt of end moraines lies a broad zone of dominantly erosional topography irregularly mantled by thin patches of drift. Within this zone, lava-flow surfaces have been abraded into stoss-and-lee forms and are extensively striated, and the flanks of cinder cones have been oversteepened by glacial erosion so they stand at angles of 30 to 34, instead of the more typical 24 to 26 (Porter 1972; 1975:247).

The stoss and lee forms to which Porter refers are *roches moutonees* (Davies 1972:171), also commonly known as "whaleback ridges" (Porter 1975:247) and "muttonback ridges".

Another good description of the glaciated landscape was made by Herbert Gregory and Chester Wentworth, who conducted a series of geological investigations on Mauna Kea in the 1920s:

> Over the glaciated area of Mauna Kea the wedge-work of ice is conspicuous. The bed rock has been shattered, and spalls and slabs by thousands are strewn over the surface. In addition to the little-weathered, light gray fragments transported by glacial ice, large quantities of broken talus lie at the bases of cliff ledges, and, in many places stand in great stacks of flat or curved slabs only little removed from the bedrock itself. Some of the frost blocks are chunky or roughly columnar in form. Especially at the sides and downslope ends of thick lava flow or tube masses, the rock has spalled off in straight or slightly curved slabs, one to several inches thick and several square feet in area (Gregory and Wentworth 1937:1738).

The presence of fossil ice (permafrost) in the summit region is further testimony to earlier glacial conditions (Woodcock et al. 1970; Woodcock 1974). According to Porter, there is no evidence for renewed glaciations since the disappearance of the last ice cap more than 9,100 years ago (Porter 1975:250; 1979a:184-185).

The summit region resembles a stony alpine desert. The soils, like those in alpine environments generally, are poorly developed (Ugolini n.d.). In the absence of a vegetative cover and, thus, a surface organic layer, the ground surface in many places is a desert pavement (Ugolini 1974:189).

2.1.2 Geomorphic Processes

Mechanical weathering by frost is the most important mass-movement process in the periglacial regime and attains real significance in landscape evolution in the absence of trees (Caine 1974; Davies 1972:11). On current evidence the effective lower limit of this regime on Mauna Kea is tree line (Ugolini n.d.). The primary evidence of a

periglacial climate and geomorphic processes is the occurrence of diverse forms of patterned ground, such as stone stripes (Figure 2.2) and polygons that are widespread in the cold regions of the world (Washburn 1956, 1979). The most common type of mass-movement landform in the summit region of Mauna Kea is the stone-banked terrace or lobe (Davies 1972:49-51) which is variably called either a solifluction or gelifluction terrace and lobe. Here we follow Washburn (1979) and Embleton and King (1975:97) who have noted the advantage of the term gelifluction in clearly denoting a periglacial regime as opposed to other climatic regimes, including low elevation deserts, where similar forms of patterned ground are also found (Cooke and Warren 1973:129).

While there is no evidence of renewed glaciations in the last 9,000 years or so, there is a possibility of a change to a colder and/or wetter climate having occurred during the last 1,000 years. The evidence for this change is based on Porter's interpretation of gelifluction lobe development (Porter 1975:250, 1979a:184-85).

2.1.3 Modern Climate

The climate of the higher elevations on Mauna Kea is like all mountain climates kaleidoscopic, consisting of a great number of individual elements that are continually changing through space and time. It exhibits all of the universal changes that occur in the atmosphere with increasing altitude (e.g., decreasing temperature, air density and water vapor) in addition to local effects directly related to latitude and the "mountain mass effect" (Barry 1981; Price 1981).

The summit region climate is both dry and cold, but there are few available statistics for evaluating annual and cyclical variability. At this latitude (19-20 degrees N) there is little difference in the mean minimum and mean maximum temperature ranges throughout the year in contrast to pronounced diurnal variation. Precipitation at the higher elevations frequently averages less than one inch in every month of the year, primarily in the form of sleet, hail and snow, which rarely accumulates below the 3,050 m elevation, however. The prevailing winds are from the east-northeast. Fog and other forms of ground condensation are not uncommon and appear to be generally associated with increased cloudiness at midday (Powers and Wentworth 1941).

The modern climate is periglacial, a term that is inconsistently used with reference to a variety of cold climates as well as geomorphologic regimes (Davies 1972:9; Embleton and King 1975:2). Mauna Kea is an example of what Tricart (1970) has called the "low latitude mountain variety" of periglacial climate. There are frequent frosts but they are of low magnitude or intensity, penetrating to only shallow depths (Davies 1972:13). Features attesting to a modern periglacial environment include permafrost (Woodcock 1974), gelifluction lobes and terraces (Ugolini n.d.), stone stripes and polygons, and pot-lid or ring crack fractures on smoother rock surfaces. Intensive freeze-thaw cycles are also evidenced in the splitting and upheaving of rocks on the edges of lava flows that also exhibit the plucking and abrasive effects of glacial ice movement (Gregory and Wentworth 1937; Wentworth and Powers 1941).



Close-up of Stone Stripes. View to the Southwest.



Stone Stripes from a Distance; View to Southwest.

Figure 2.2. Stone Stripes on the Interior South Side of Pu`u Waiau, Mauna Kea.

2.1.4 Biota

The biota is predictably impoverished in this oceanic, high mountain ecosystem as the result of extreme isolation which is reflected in a high degree of endemism among a few closely related taxa. The alpine ecosystem on Mauna Kea, as with all high mountain ecosystems, is "at the upper ends of environmental and evolutionary gradients that originate in the surrounding lowlands" (Billings 1979:101). In the summit region there is an "aeolian zone" occupied by a variety of insects (Howarth and Montgomery 1980; Papp 1981) that are believed to have been the only resident fauna in the alpine desert prior to European contact.

The vegetation above the 3,000 m elevation has been classified as semiarid, barren alpine tundra (Krajina 1963). It consists of lichens, mosses, and a few bunch grasses such as *Trisetum glomeratum* and *Agrostis sandwichensis* (Hartt and Neal 1940; Krajina 1963; Mueller-Dombois and Krajina 1968; Smith et al. 1982). A lower xerophytic scrub zone, extending down as far as the 2,100 m elevation, is characterized by the presence of *Styphelia douglasii, Vaccinium peleanum* and *Coprosma* spp. in addition to the higher elevation species. There is some evidence, including the discovery in the course of archaeological investigations of the adze quarry in 1975-76 of the remains of a silver sword colony (*Argyroxiphium sandwichensis*) at the 3,475 to 3,658 m elevation, that this zone formerly contained a much richer flora, such as the arborescent Dubautias (Allen 1981:46). Porter (1979a:178-185), in a discussion on the paleoclimatic implications of the latest ice-cap glaciations, suggests that the tree line was depressed to about the 2,000-m (6,560 ft) elevation.

W.D. Alexander's account of his survey trip in 1892 [see below] noted that "The upper limit of the *m• mane* tree is not far from 10,000 feet. The Raillardia, apiipii, extends a thousand feet higher. The beautiful Silver Sword (Argyroximphium), once so abundant is nearly extinct, except in the most rugged and inaccessible localities" (Alexander 1892).

2.1.5 The "Effective Environment"

On current evidence the "effective environment" of the summit region, defined as the ecosystem that humans adapt to and influence (Smith and Winterhalder 1981:8), has been since the end of the last ice age an alpine desert ecosystem. Elsewhere McCoy has summarized what he believes to have been the primary environmental constraints on life and work in this region and the adze quarry in particular:

> For humans, it is a particularly difficult environment in which to work and live because of the physiological effects of high altitude (Van Wie 1974), low temperatures and biotic impoverishment. It is at the same time a highly predictable environment in terms of the probable effects of these and other stresses on work organisation and subsistence, leading to the expectation of a major concern with time-budgeting and efficiency (Torrence 1983) (McCoy 1990:91).

The quarry environment is above all else a 'non-subsistence' environment, incapable of supporting a population of any size for any length of time without the introduction of food, clothing, and firewood. The only sources of fuel above tree line are the few arborescent plants and silver swords (Westervelt 1902:15) which would have been hardly adequate or sufficient in terms of the amount of heat they give off and their

long-term availability. The biotic environment is an undependable resource and in fact the only subsistence requirement that this environment afforded in any abundance were the margins of lava flows that could be utilized as shelters (McCoy 1990:91-92).

2.2 CULTURE-HISTORIC CONTEXT

Much of what is known concerning the traditional culture history of the summit region of Mauna Kea was summarized by Holly McEldowney in a 1982 report, based on a review of early journal accounts and maps, ethnographic collections, and the Boundary Commission Book for Hawai`i (McEldowney 1982). More recent research by Kepa Maly (1998, 1999) and Charles Langlas (Langlas et al. 1997; Langlas 1999), both of whom have conducted oral interviews in addition to archival research, have provided additional information on the traditions associated with Mauna Kea and its cultural and spiritual significance for Hawaiians today. A major compilation of native traditions, historical accounts, and oral history interviews on Mauna Kea and surrounding lands can be found in a study entitled "Mauna Kea—Ka Piko Kaulana o Ka `Aina (Mauna Kea—the Famous Summit of the Land) by Maly and Maly (2005), which was commissioned by the Office of Mauna Kea Management (OMKM). The overview that follows is based on these studies, which should be consulted for more detailed information.

2.2.1 Socio-Political Context

The summit of Mauna Kea is located in an *ahupua`a* (a territorial unit generally equated with the community) called Ka`ohe in the Hamakua District (Figure 2.3). Ka`ohe is perhaps the classic example of the unusually large *ahupua`a* found in what Lyons referred to as the "almost worthless wastes of interior Hawaii" in the following account:

> Then there are the large ahupuaas which are wider in the open country than the others, and on entering the woods expand laterally so as to cut off the smaller ones, and extend toward the mountain till they emerge into the open interior country; not however to converge to a point at the tops of the respective mountains. Only a rare few reach those elevations, sweeping past the upper ends of all the others, and by virtue of some privilege in bird-catching, or some analogous right, taking the whole mountain to themselves...The whole main body of Mauna Kea belongs to one land from Hamakua, viz., Ka`ohe, to whose owners belonged the sole privilege of capturing the ua`u, a mountain-inhabiting but sea-fishing bird.
>
> These same lands generally had the more extended sea privileges. While the smaller ahupuaas had to content themselves with the immediate shore fishery extending out not further than a man could touch bottom with his toes, the larger ones swept around outside of these, taking to themselves the main fisheries much in the same way as that in which the forests were appropriated. Concerning the latter, it should here be remarked that it was by virtue of some valuable product of said forests that the extension of territory took place. For instance, out of a dozen lands, only one possessed the right to *kalai waa*, hew out canoes from the koa forest. Another land embraced the *wauke* and *olona* grounds, the former for *kapa*, the latter for fish-line (Lyons 1875:111).

The boundaries of Ka`ohe, as shown on modern maps, are open to question. A map of the adjoining *ahupua`a* of Humu`ula made by S.C. Wiltse in 1862 (Register Map

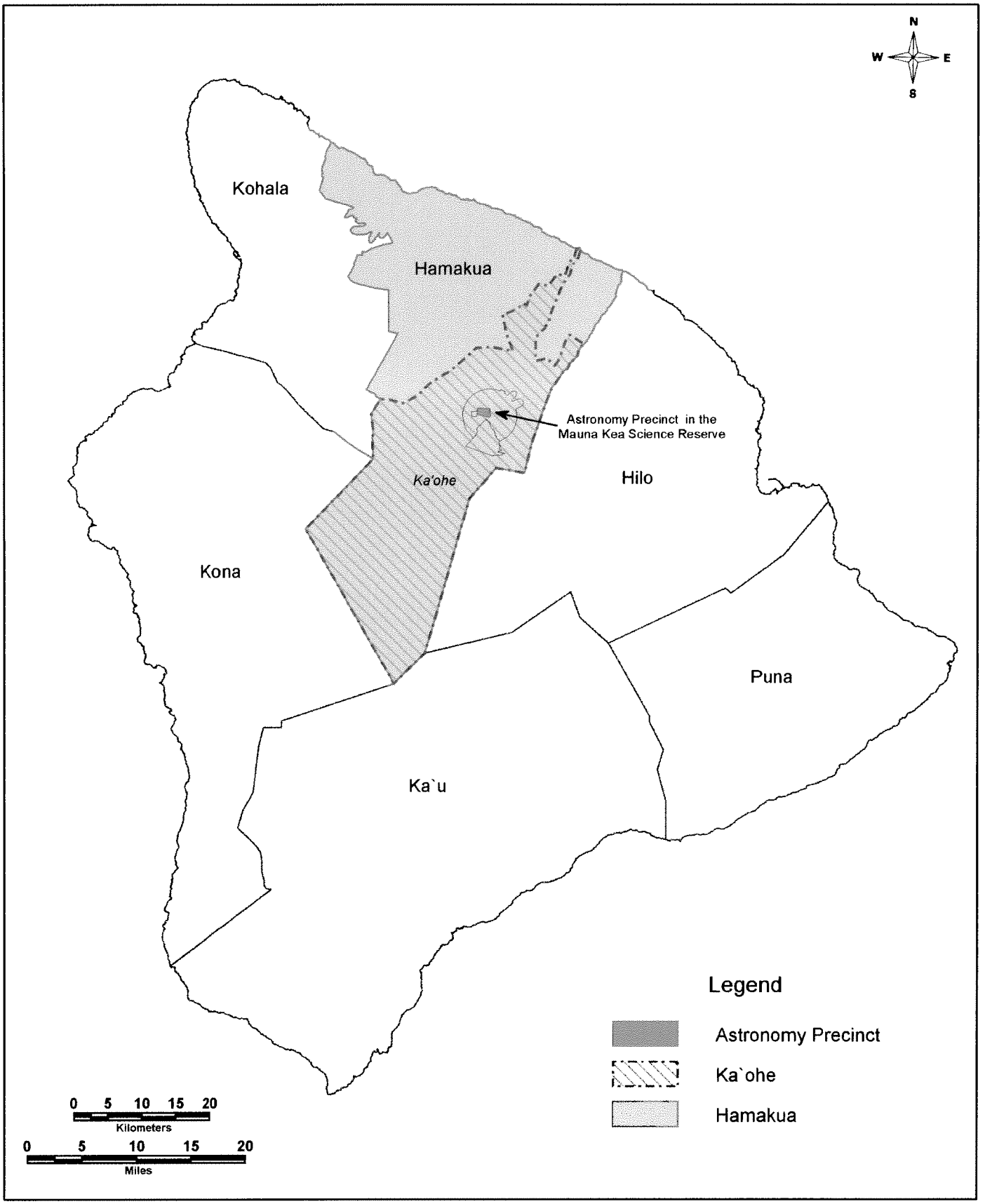


Figure 2.3. Socio-Political Map of Hawai`i Island Showing the Astronomy Precinct Location in Ka`ohe Ahupua`a, Hamakua District.

No. 668) included the adze quarry and Lake Waiau, which was labeled on the map as "Pond Poliahu" (Figure 2.4). Maly and Maly note that "By the time the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them in 1874, disputes over the boundary of Humu`ula and Ka`ohe had arisen" and "by the time of settlement in 1891, the boundary of Humu`ula was taken down to around the 9,000 foot elevation, with Ka`ohe taking in the entire summit region" (Maly and Maly 2005:280). The testimony of Kahue of Humu`ula, presented in Maly and Maly (2005:287), mentions the boundary running from a gulch called Kahawai Koikapue, where *mele* were sung, to Waiau and then to the summit which was called Pu`u o K• kahau`ula. In parentheses there is a notation that "half of the water in the gulch belonging to Ka`ohe and half to Humu`ula". The name of the gulch does not appear on any known maps, but in all probability is what is now called P• hakuloa Gulch, since this is not only the major gulch below the lake but the only one on the south side of the mountain that is described in historic and modern times as containing running water. The reference to Waiau is presumably to the cinder cone, rather than the lake, which according to the name on the 1862 Wiltse map was associated with the goddess Poli`ahu, although Waiki [or Haiki], a contemporary of Kahue, claimed the lake was called Waiau.

Waiki, who gave testimony at the same time as Kahue (McEldowney 1982:1.7), claimed that Kaluakaakoi, "the cave where they used to get stone adzes out" was in Ka`ohe as was Poli`ahu, which he described as a cave where L•l•noe used to live (Maly and Maly 2005:291).

> They told me Ka`ohe bounded Humu`ula from P• hakuhanalei down Mauna Loa, on the Kona side. I never heard my parents say that Ka`ala`ala joined Humu`ula. The pond of water called Waiau is on Ka`ohe and not on Humu`ula. My parents told me Humu`ula went to Kaluaka`akoi and Poli`ahu. We used to go there after adzes for the Humu`ula people (Maly and Maly 2005:292).

2.2.2 Land Uses

On present evidence the slopes of Mauna Kea, above the limits of agriculture and permanent settlement, were a vast montane "wilderness" probably known to only a small number of Hawaiians engaged in primarily "special purpose" activities, such as bird-catching, canoe making, stone-tool manufacture, or burial of the dead (McEldowney 1982). Ethnographic information relating to a specific locality in this and other mountainous regions in Hawai'i is either incomplete, or, as is more frequently the case, lacking altogether.

Little is known ethnographically about the uses of the alpine and sub-alpine zones on Mauna Kea except for brief accounts about adze manufacture and burials. Most of what is known regarding traditional land uses is the result of archaeological investigations undertaken since the mid-1970s.

2.2.3 Myths, Legends, and Traditional Histories

The origins of Mauna Kea and its central place in Hawaiian genealogy and cultural geography are told in myths and chants. Pualani Kanaka`ole Kanahele and her deceased husband, Edward Kanahele, who were interviewed by Dr. Charles Langlas for the Hawaii Defense Access Road and Saddle Road Improvement Project in 1998,

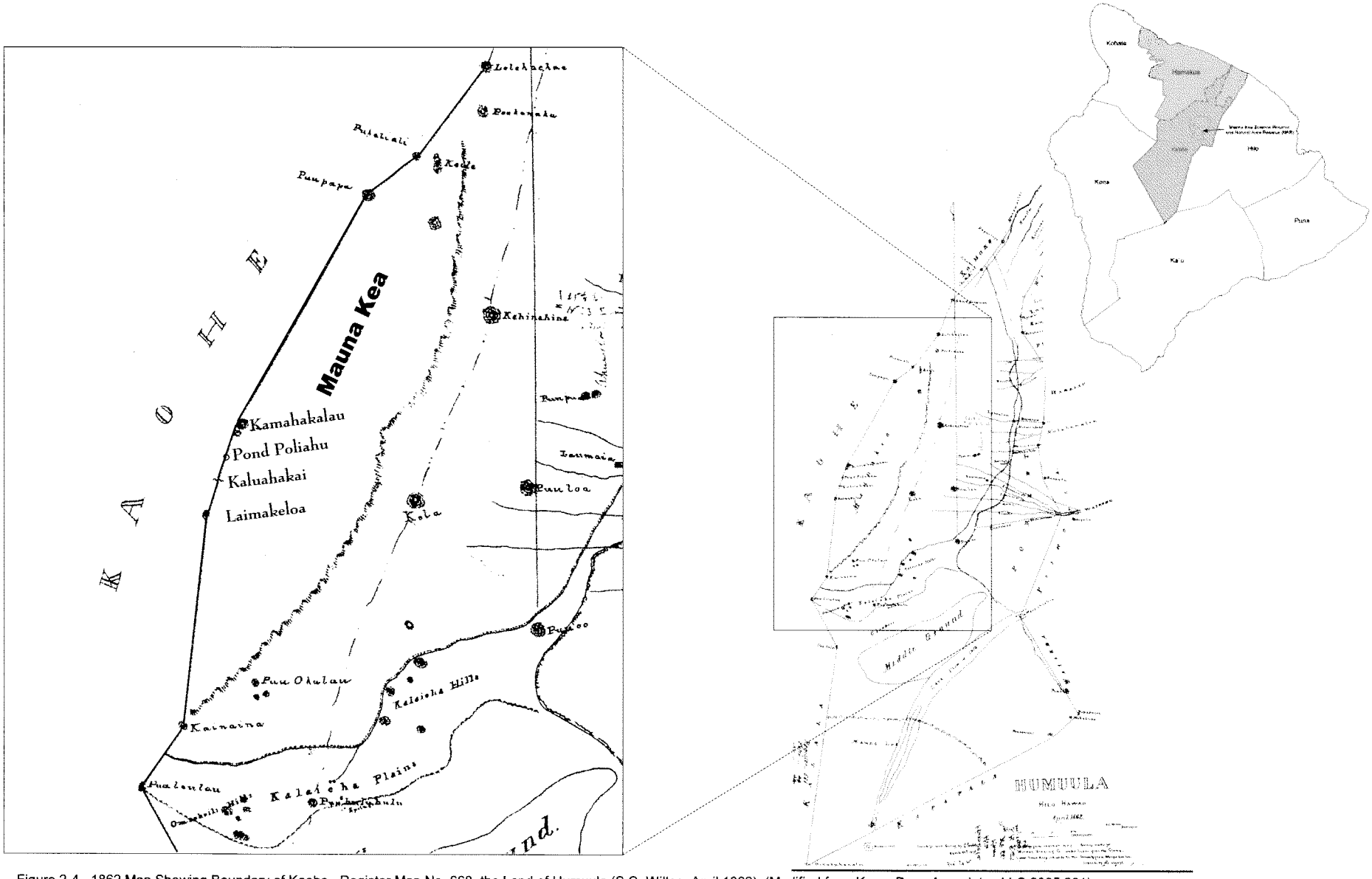


Figure 2-4. 1862 Map Showing Boundary of Kaohe. Register Map No. 668, the Land of Humuula (S.C. Wiltse, April 1862). (Modified from Kumu Pono Associates LLC 2005:281).

referred to two chants, Mele a Paku`i and `O H• nau ka Mauna a W• kea, that

> describe, respectively, the birth of Hawai`i island from the union of Papa and W• kea, the ancestors of Native Hawaiians, and the birth and "budding upward" of Mauna Kea a mountain named for Wakea. As the firstborn of Papa and W• kea, Hawai`i island is the *hiapo*, the respected older sibling of all Native Hawaiians. The mountain of Mauna Kea is the *piko* or origin point for the island, more specifically for its northern half, and therefore is a place of great *mana*. Because of the *mana* of the mountain and of Lake Wai`au at its summit, Queen Emma went there to bathe in the water in 1874 (Langlas 1999:7).

There are several myths concerning two goddesses, Poli'ahu and L•l•noe. W.D. Westervelt claimed that Poliahu was one of four snow goddesses "who embodied the mythical ideas of spirits carrying on eternal warfare between heat and cold, fire and frost, burning lava and stony ice" and who, according to several legends, was the rival of the fire-goddess, Pele (Westervelt 1963:55). Poli`ahu, who battled Pele on numerous occasions, is credited by Westervelt as having "kept the upper part of the mountain desolate under her mantle of snow and ice..." (Westervelt 1963:62). Poli`ahu continues to be commonly referred to as the "The beautiful snow goddess of Mauna Kea" (Pukui and Elbert 1971:396).

The second goddess of Mauna Kea is L•l•noe, who according to Pukui and Elbert (1971:392), was "a goddess of the mists and younger sister of the more famous Poli`ahu." Westervelt claimed that L•l•noe was another of the four snow goddesses. McEldowney (1982:1.3-1.4) recounts that Fornander included L•l•noe as a person in his genealogies and legends, including a reference to her as the "wife of Nu`u, the "Noah", of the discredited Hawai`i Loa legend involving a great flood. McEldowney (1982:1.4) noted that "Kamakau called L•l•noe "the woman of the mountains" and named her as ancestress of Pae, a *kahuna* of Umi's time (Kamakau 1961:215)."

Waiau is also mentioned as a goddess in several legends. Westervelt wrote that she was another of the snow-goddesses or maidens, as he sometimes referred to them (Westervelt 1963:56). Langlas reports that Pua Kanahele told him that three *pu`u*—Poli`ahu, L•l•noe, and Waiau, were sister goddesses who are female forms of water and that all three of the cinder cones or *pu`u* that bear their names are important religious sites.

While there are a number of myths and legends associated with the summit area of Mauna Kea, the higher elevation areas of the mountain do not figure prominently in Hawaiian traditional histories, which McEldowney points out:

> revolve mainly around the lives and exploits of prominent chiefs, as passed down through genealogies, chants, and stories, and recorded primarily in works by Fornander an Kamakau (Barrere 1962:62-63). No major events from these histories occur within the summit plateau of Mauna Kea (McEldowney 1982:1.4).

2.2.4 Trails

There are two major named trails in the summit region of Mauna Kea, the Mauna Kea-Humu`ula Trail and the Mauna Kea-Umikoa Trail (Figures 2.5, 2.6, 2.7, and 2.8). The better known of the two, is the Humu`ula Trail which apparently began in the Kalaieha area where the Humu'ula Sheep Station is located (Figure 2.7). The earliest map showing the upper part of the trail was made by W.D. Alexander's survey party in

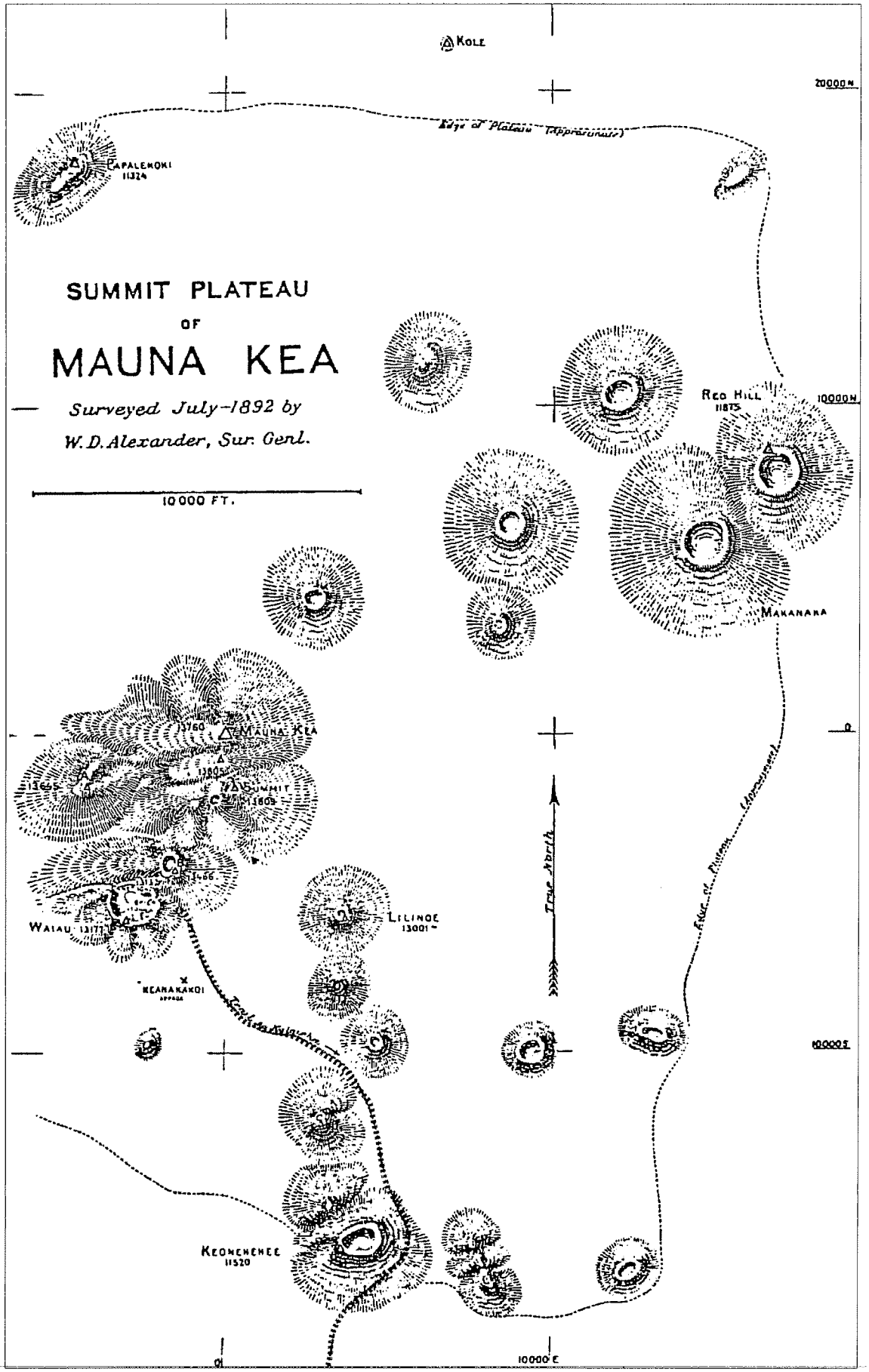


Figure 2.5. 1892 Alexander Map of the Summit Plateau and Alignment of the Humu`ula Trail.

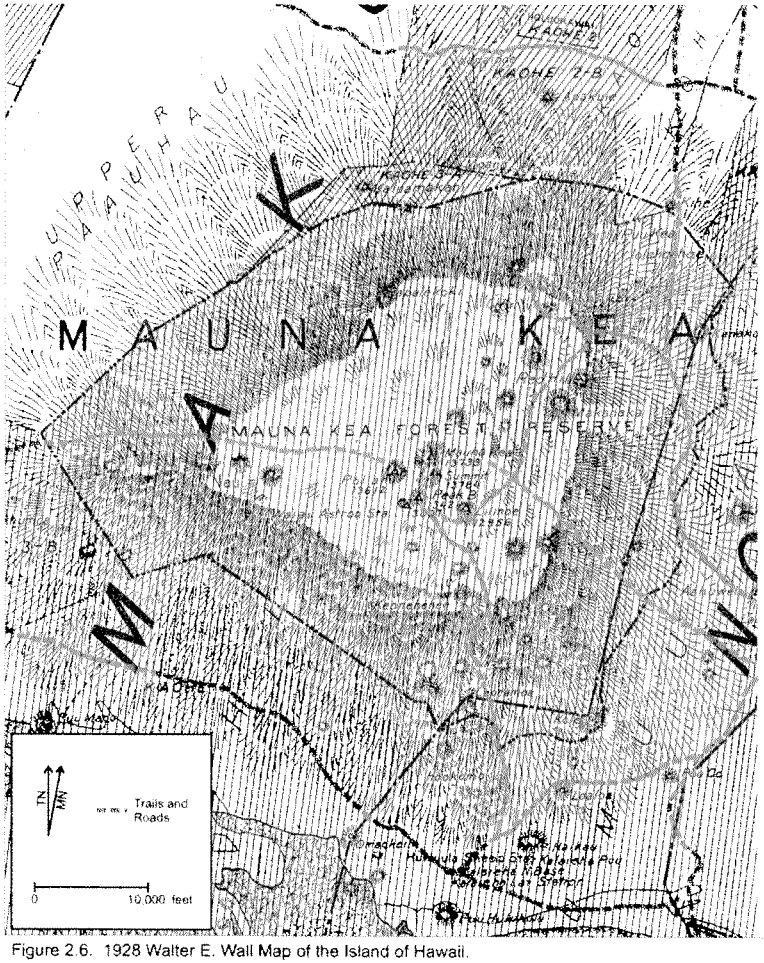


Figure 2.6. 1928 Walter E. Wall Map of the Island of Hawaii.

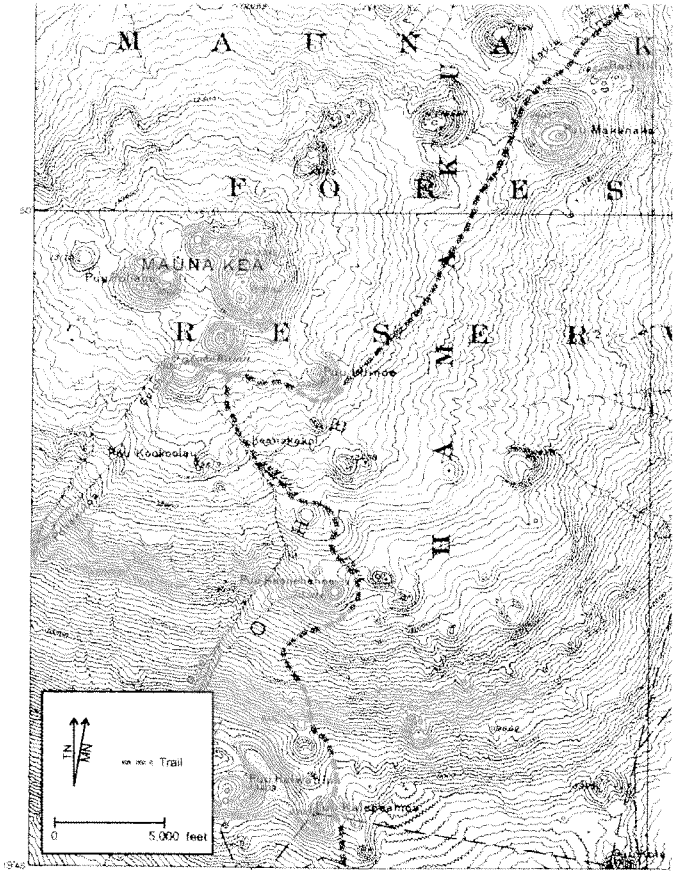


Figure 2.7. 1930 U.S.G.S. Mauna Kea Quadrangle Map Showing Trails in the Summit Area and Lower Elevations.

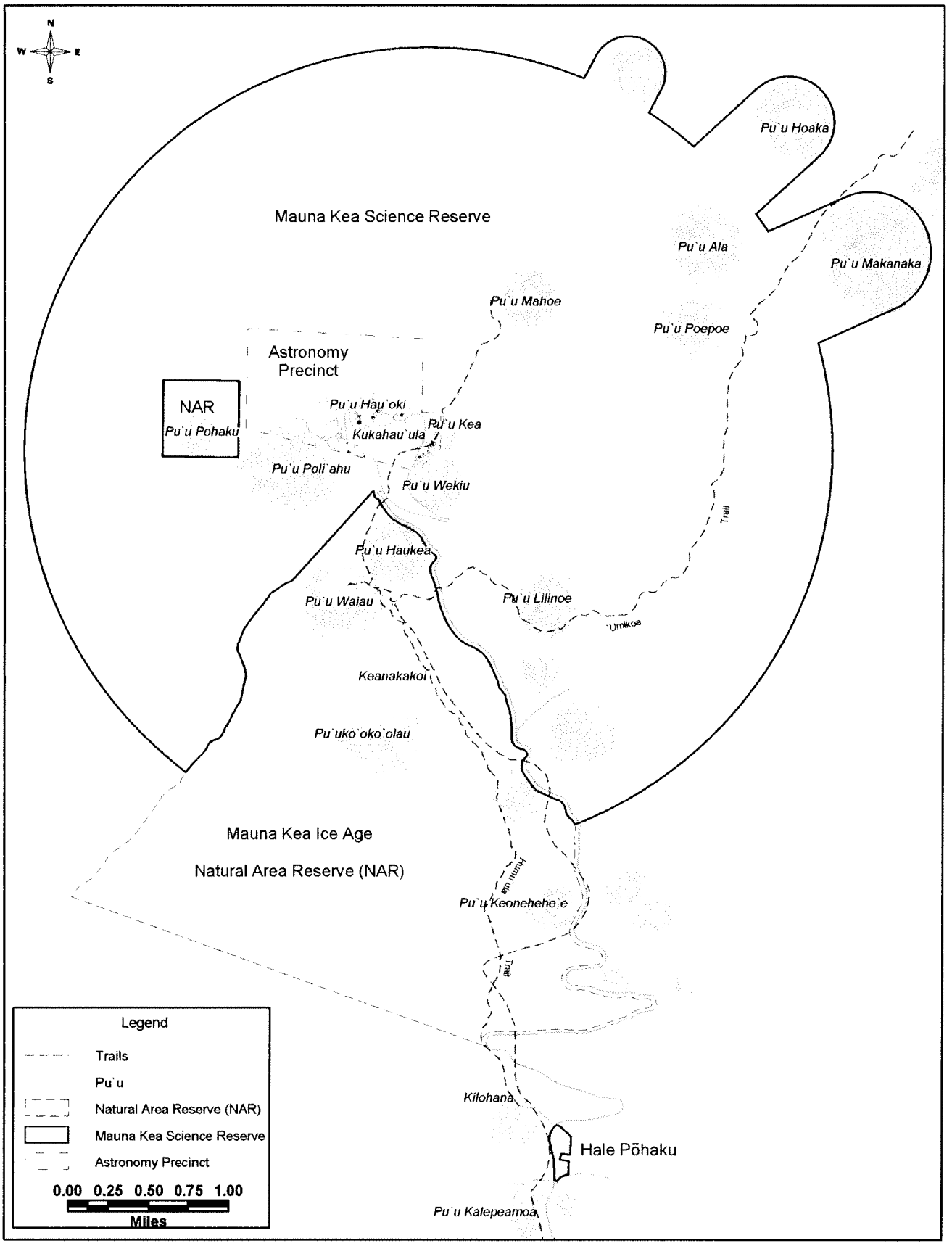


Figure 2.8. Hawaiian Place Names and Trails in the Summit Region of Mauna Kea.

1892 (Alexander 1892; Preston 1895). The Alexander map (see Figure 2.5), the 1928 Walter E. Wall map of the island of Hawaii (see Figure 2.6), and the 1930 edition of the USGS Mauna Kea Quadrangle map (see Figure 2.7) all show the trail going around the eastern flank of Pu`u Keonehehe`e and onward up the mountain to Lake Waiau (see Figures 2.5 and 2.6). This alignment closely follows the modern road.

An account of the Alexander survey, published in the *Pacific Commercial Advertiser* of September 14, 1892, indicated that the Humu`ula Trail did not pass through the adze quarry and that the site marked on later maps as Keanakako`i was in fact some 100 yards west of the trail.

> The trail next turned to the east, winding around an immense sand crater called "Keonehehe`e," 11,500 feet in elevation, which stands on the edge of the summit plateau. Further to the southeast we were shown a pillar of stones which was raised to commemorate Queen Emma's journey over the mountain to Waimea in 1883 [1882]—(Maly and Maly 2005:183).

The Alexander map of the summit plateau published in Preston (1895:602, Illustration 34) also shows the trail, which is labeled Trail to Kalaieha, cutting across the south and eastern slope of Keonehehe`e. This indicates that the Queen Emma memorial was southeast of the trail, contrary to the Maly's interpretation that an *ahu* located on Pu`u Ko`oko`olau is the remnant of the Queen Emma "pillar" (Maly and Maly 2005:Figures 8b and 8c). Preston mentions that there was more than one cairn:

> Some interesting pyramids of stones, built to commemorate Queen Emma's visit, were seen on the edge of the plateau, and at elevation of 12,000 feet was found Keanakakoi, a famous quarry opened by the natives many centuries ago for the manufacture of battle axes (Preston 1895:601).

The 1928 Walter E. Wall map of the Island of Hawai`i (see Figure 2.7) shows both the Humu`ula and Umikoa trails, neither of which are labeled as such, however. The map shows two other unnamed trails in the summit area. One leads to Pu`u Poli`ahu from a junction with the old Waimea Road that passed through the area between Mauna Kea and Mauna Loa that is commonly referred to as the "Saddle." The second trail, which is joined to the Pu`u O`o Trail on the eastern side of the mountain, is a straight line path that crosses over the Umikoa Trail and ending at the summit (see Figure 2.7).

The 1930 USGS Mauna Kea quadrangle map shows the Humu`ula Trail joining a second trail just below the lake (see Figure 2.7). This trail, which is not named, is labeled on the later USGS maps as the Umikoa Trail (see Figure 2.8). This trail is not mentioned in any early accounts, however. While it may very well have been an ancient trail, the name would appear to be modern and most likely derived from the Umikoa Ranch, where some of the horseback trips to the summit area in the early part of the 20th century and possibly earlier began. The unpublished manuscript of the 1935 Hawaiian Academy of Science Expedition noted that "In recent years a few people have visited the summit in small parties on horseback, with a guide from Umikoa or Humu`ula" (Wentworth et al. n.d.:1-2).

A new section of the Humu`ula trail was built by the CCC in the 1930s that took a straighter course to the west of Pu`u Keonehehe`e (see Figure 2.8). The new trail was described by L. Bryan in a 1939 article in *Paradise of the Pacific*:

> During the past few years this lake has been visited by increasingly large numbers of visitors. Three years ago the Civilian Conservation Corp reconstructed an old trail from near the Humu`ula Sheep Station (Kalaieha), past Ho`okomo and Halep• haku to Lake Waiau and thence to the summit. This trail is well made and carefully marked on the ground with *ahu* or piles of stones and the trip to the lake and on to the summit can easily be made by strangers without the assistance of a guide (Maly and Maly 2005:257).

The Umikoa Trail, which is labeled the Mauna Kea-Umikoa Trail on some maps, first appears as a named trail on the advance sheet of the Lake Waiau Quadrangle that was based on the mapping by J.O. Kilmartin in 1925-26. This trail, and the Mauna Kea-Humu`ula Trail are shown as terminating at Lake Waiau on the Kilmartin map. The absence of the Umikoa Trail on the 1892 map may be significant.

McEldowney came to the conclusion that the Humu`ula and Umikoa trails are probably recent names:

> After comparing the evidence for trails on historic maps, in descriptions of routes taken throughout the historic period, and in native boundary testimonies, it appears that the major trails or formalized routes as shown on the present U.S.G.S. Quadrangle are of recent origin, and that any specific trails or routes existing in the early historic or possibly prehistoric periods are no discernible in the literature (McEldowney 1982:1.12).

The locations of a number of lithic scatters containing adze manufacturing by-products found during the inventory survey of the Science Reserve, in 2005-2007, (McCoy and Nees, in prep.) indicate a couple of routes on the eastern flank of the mountain that must have been used by adze makers on leaving the quarry. One route is found in the same general area as the Umikoa Trail, thus suggesting that the general route is an old one.

2.2.5 Place Names

The place names in the summit region are a mix of traditional names and modern names (see discussion in McEldowney 1982 and Tables 1.1 and 1.2 from her report). The origin and meaning of some names is unknown. The name Mauna Kea itself is open to various interpretations. The commonly accepted, literal translation as "White Mountain" appears in this early account by the Rev. William Ellis who toured the island of Hawai'i in 1823:

> The snow on the summit of the mountain, in all probability, induced the natives to call it Mauna-Kea, (mountain white), or, as we should say, white mountain. They have numerous fabulous tales relative to its being the abode of the gods, and none ever approach the summit—as, they say, some who have gone there have been turned to stone. We do not know that any have been frozen to death; but neither Mr. Goodrich, nor Dr. Blatchely and his companion, could persuade the natives, whom they engaged as guides up the side of the mountain, to go near its summit (Ellis 1979:292).

As already noted, the reference to Mauna Kea as the abode of the gods is emphasized in some native Hawaiian traditions in which the word "Kea" is taken to be an abbreviated form of W• kea, the male god who procreated with Papa to form the mountain. In an account of Queen Emma's trip to the lake in 1881 or 1882 and the *mele*

that were written about that trip, Kihei and Mapuana de Silva present some more detail about the names of the mountain and the lake. They note, following Puakea Nogelmeier, that Emma's poets refer to the summit as Piko o W• kea and that:

> Although Maunakea is popularly translated as "white mountain," Kea is also an abbreviated form of W• kea, the sky father who, with Papa, the earth mother, stands at the apex of Hawaiian genealogy. Mauna W• kea is thus viewed traditionally as the sacred meeting point of sky and earth, father and mother, W• kea and Papa. Emma's poets were well-acquainted with the older name and its lasting significance; they refer to Waiau as "ka piko on W• kea"—as the mountain's navel/genital/umbilical/connecting-point/center (de Silva and de Silva 2007: footnote 7).

The name for the summit, which unlike many mountain summits does not consist of a single peak, is now widely accepted as K• kahau`ula ("K• kahau`ula of the red-hewed dew or snow") instead of the formerly used name Pu'u Wekiu. On present evidence the name K• kahau`ula referred to both a legendary figure and to a character in traditional histories and genealogies. The latter includes references to K• kahau`ula as the husband of Lilinoe and as an *`aumakua* (family deity) of fishermen (Hibbard 1999). The place name evidence indicates that the "summit" was at the very least a legendary place or *wahi pana* (Pukui and Elbert 1971). Maly and Maly (2005:vi) give the name as Pu`u o K• kahau`ula, which they say was "named for a form of the god K• , where the *piko* of new-born children were taken to insure long life and safety. This practice is still participated in at the present time." According to Maly and Maly (2005:vi):

> The name Pu`u of K• kahau`ula is the traditional name of the summit cluster of cones on Mauna Kea, appearing in native accounts and cartographic resources until c. 1932. The recent names, Pu`u Wekiu, Pu`u Hau`oki and Pu`u Haukea, have, unfortunately, been used since the 1960s (since the development of astronomy on Mauna Kea), and have displaced the significant spiritual and cultural values and sense of place associated with the traditional name, Pu`u o K• kahau`ula.

Other traditional place names that appear on the earliest maps and in journal accounts include Pu'u L•noe and Pu'u Waiau (Table 2.1). Contrary to popular belief, Pu`u Poli`ahu is a modern name applied by the surveyor W.D. Alexander in 1892 (McEldowney 1982:114).

Some other place names date to the 1930s (Table 2.2). Gregory and Wentworth made a point of noting that they assigned names to cinder cones that did not have official names at the time (Gregory and Wentworth 1937:1725 footnote 14):

> As an aid in description, names have been adopted for the following cones not recorded on official maps: Puu Mahoe (Twin Cones), Puu Poepoe (Round Cone), Puu Hoaka (Crescent Cone), Puu Ala (Trail Cone), Puu Waiau (incloses Lake Waiau), Puu Kea (White Cone), Goodrich Cone (Joseph Goodrich, Hawaiian missionary, 1823), Macrae Cone (James Macrae, botanist of the *Blonde*, 1825), Douglas Cone (David Douglas, Hawaiian botanist, 1884), Summit Cone (highest point on Mauna Kea).

Table 2.1. Earliest Recorded Place Names for the Mauna Kea Summit Plateau Region.

					Within Summit Plateau	
Documentation	**Summit**	**Waiau and Lake**	**Poliahu**	**Adze Quarry**	**South Section**	**North Section**
Wiltse Map (1862)		Pond Poliahu	Pond Poliahu	Kaluahakai	Laimakeloa	Kamahakalau
Boundary Commission Book for Hawaii (1873)	Puu o Kukahauula (highest peak)	Waiau (water in gulch)	Poliahu (on side of the mountain)	Kaluahaakoi (a cave...stone adzes)	Lanikepue (a pali)	Makanaka (a large ahu)
		Waiau (pond of water)	Poliahu (cave where Poliahu lived)	Kaluakaakoi (two times)		Kamakahalau (a hill)
		Waiau (three times)	Poliahu (five times)			Kamakahalau (one time)

NOTES: Place names are grouped only by similar name or probable location, as most could not be consistently or reliably correlated with specific topographic features. Desriptive characteristics (e.g., hill, pond, pali, etc.) are listed with each place name when given in the native testimonies. Names mentioned without descriptions are listed with the total number of times that name appears in the Humuula testimonies. (Source: McEldowney 1982: Table 1.1).

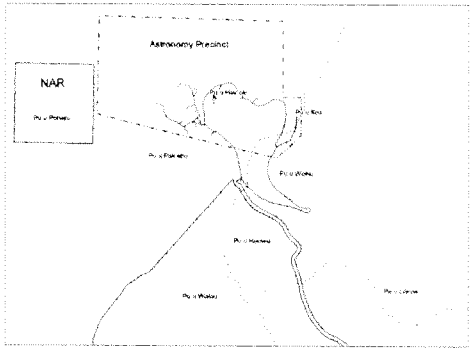
Table 2.2. Correlations Between Named Cinder Cones (and Peaks), Mauna Kea Quadrangle (modified after McEldowney 1982).

Map	Place Names of the Summit Region Cones (between 1884-1956)									Place Names of the Summit Plateau Region (between 1884-1956)									
1884-91 Lyons[1]	Summit Kukahauula						Waiau		Lilinoe									Kaupo Red Hill	White Hill Makanaka
1892 Alexander	Summit[2]	M Kea		Poliahu[2]			Waiau	Waiau[2]	Lilinoe	Keonehehee[2]		Keanakakoi						Red Hill Kaupo	Makanaka
1925-26 U.S. Coast and Geodetic Survey	Summit			Puu Poliahu			Lake Waiau	Waiau Crater	Lilinoe	Keonehehee[2]	Puu Kookoolau	Keanakakoi						Red Hill	Puu Makanaka
1928 U.S.G.S.	Summit	Mauna Kea		Poliahu		Peak B	Waiau Astrom. Station		Lilinoe	Keonehehee								Red Hill	Makanaka
1937 Gregory and Wentworth		Puu Kea	Macrae Cone	Puu Poliahu	Douglas Cone	Goodrich	Lake Waiau	Puu Waiau	Puu Lilinoe	Keonehehee[2]		Keanakakoi	Puu Mahoe	Puu Poepoe	Puu Ala	Puu Hoaka			Puu Makanaka
1956 U.S. Geological Survey	Puu Wekiu[3]	Puu Kea	Puu Hauoki[3]	Puu Poliahu	Puu Pohaku[3]	Puu Hau Kea[3]	Lake Waiau	Puu Waiau	Puu Lilinoe	Keonehehee[2]	Puu Kookoolau	Keanakakoi	Puu Mahoe	Puu Poepoe	Puu Ala	Puu Hoaka	Red Hill		Puu Makanaka
Currently Used Place Names	Kukahauula	Pu`u Kea	Pu`u Hau`oki	Pu`u Poli`ahu		Pu`u Haukea	Lake Waiau	Pu`u Waiau	Pu`u Lilinoe	Pu`u Keonehehee	Pu`u Ko`oko`olau		Pu`u Mahoe		Pu`u Ala				Pu`u Makanaka

[1] Some place names and accompanying notes on this map appear to have been written at different times and/or by different people. These variations are in keeping with the map's title (i.e., Information Map) and time span given on the label, but they raise the possibility that names from different time periods were added.

[2] Names reported by Alexander to be "genuine native names" with the exception of Poliahu. He attached the name Poliahu to this "nameless peak" in honor of the "demi-goddess" who appears in the "Legend of Laieeikawai." In Alexander's table, the highest peak is listed as Kukakauula, although this name does not appear on his 1892 map (Preston 1895:596).

[3] Names given to L.W. Bryan "by the old Hawaiians in the early 1920's (Schmitt 1974a).



In a 1973 letter to Libert Landgraph, District Forester, L.W. Bryan wrote that he had obtained the following names from the "old Hawaiians" in the 1920s.

- The summit cone, 13,796 is called Puu Wekei.
- Goodrich cone is called Puu Hau Kea
- Macrae Cone is known as Puu Hau Oki
- Douglas Cone is called Puu Pohaku

He added that he had no objection to Pu`u Mahoe, Pu`u Ala and Pu`u Poepoe, but that "I wonder how Lake Waiau and Pu`u Waiau secured their names? Waiau is not descriptive of the lake. Hau Oki would be more applicable" (Bryan 1973). In a letter dated January 16, 1974 Robert Schmitt, Chairman of the Advisory Committee on Geographic Names, presented recommended changes in some place names, particularly those named after Europeans. He suggested that Pu`u Wekei be changed to Pu`u Wekiu because he could not find the word *wekei* in the dictionary whereas *wekiu* was included and translated as summit. He added that the Pukui and Elbert book on Hawaiian place names wrote Pu`u Hau Oki as Pu`u Hau'oki. Place names currently in use for localities and trails in the summit area are shown on Figure 2.8.

Below Lake Waiau, on the west side of P• hakuloa Gulch, are three named springs –Hopukani, Waih• and Liloe. None of the springs are listed in Place Names of Hawaii (Pukui et al. 1974). The names of all three springs first appeared on the 1927 U.S.G.S. Ahumoa Quadrangle (1:31,680) topographic map. On this same map there is a second locality labeled Waih• , a short distance below Liloe Spring. This may be a general place name since there is a similar name (Waiku) in the same area on the 1911 edition of the United States Coast and Geodetic Survey map of the island of Hawaii. According to the Ka-Miki legends translated by Maly the proper name of Waih• Spring is Ka-wai-h• -a Kane as noted in the following account:

> ...at that time, the guardians [P• hakuakane and P• hakuloa] saw the water rippling, and overflowing from the spring. As they went to investigate, they saw a shadow pass them. Because of the overflowing of the water, the spring came to be called Ka-wai-hu-a-kane (The-overlowing-waters-of-Kane), and so it remains named to this day [Figure 6]. It overflowed because Ka-Miki scooped the water, filling the *`awa* bowl of the god (Maly and Maly 2005:47).

Maly (1999: D-26) notes variations of Hopukani, including Houpo-o Kane and Ka-houpo-o-kane. Maly (1999:D-26) added, "Interestingly, at Ka-haupo-o-kane are found the waters of P• hakuloa, Hopukani, and Waih• (also known by the name "Ka-wai-h• -a Kane."

2.2.6 Chronological Summary

For the purposes of this report the culture history of the Mauna Kea summit region, has been arbitrarily divided into three time periods: (1) the Pre-Contact Period (pre-1778); (2) the Post-Contact Period, which is often referred to as the historic period, and (3) the Modern Period, beginning at the turn of the 20th century.

3.0 PREVIOUS ARCHAEOLOGICAL AND CULTURAL RESOURCE MANAGEMENT STUDIES IN THE ALPINE AND SUB-ALPINE ZONES OF MAUNA KEA

A number of research and cultural resource management (CRM) studies have been undertaken in the alpine and sub-alpine zones of Mauna Kea. The two zones essentially correspond to the ecosystems above and below tree line, which varies between roughly 9,200 and 9,500 ft amsl. The majority of the studies have been cultural resource management (CRM) projects conducted in areas managed by the University of Hawai`i (UH) for astronomical research. The UH management areas include: (1) the 11,288-acre Mauna Kea Science Reserve; (2) a 19.3-acre parcel at Hale P• haku where the Mid-Level Facility is located, and (3) a 400-yard wide easement on either side of the Mauna Kea Access Road from Hale P• haku to the lower boundary of the Science Reserve except for the area that borders the Mauna Kea Ice Age Natural Area Reserve (NAR) (Figures 3.1 through 3.3). The CRM studies that have been conducted for the UH management areas include: (1) archaeological surveys and mitigation projects; (2) traditional cultural property assessments; (3) cultural impact assessments; (4) preparation of a burial treatment plan, and (5) preservation and cultural resource management plans. CRM studies have also been undertaken west of P• hakuloa Gulch at Hopukani, Waihu, and Liloe Springs (Figure 3.4).

In contrast to the long history of geological research on Mauna Kea the only area that has been the subject of problem-oriented archaeological research is the Mauna Kea Adze Quarry Complex, which encompasses parts of the NAR, the Science Reserve, the Mauna Kea Forest Reserve, and other state lands in the vicinity of Hopukani, Waihu and Liloe Springs. The overview of CRM and problem-oriented research that follows is organized primarily by modern administrative units. In some cases there is an overlap between two or more administrative units. There are also a couple of studies that covered a larger area of the mountain, including one traditional cultural property assessment and two preservation/management plans covering all three UH management areas. These are discussed separately.

The history of archaeological investigations in each of the primary administrative units and management areas are described below. Table 3.1 presents a chronological summary of projects, including the date of the study and references.

3.1 MAUNA KEA SCIENCE RESERVE

The Mauna Kea Science Reserve (TMK: (3) 4-4-15:09) was established in 1968 when the Board of Land and Natural Resources (BLNR) approved a 65-year lease (Lease No. S-4191) to the University of Hawai`i (UH) for a 13,321-acre scientific complex on the top of Mauna Kea. The Science Reserve, which encompasses all of the land above the roughly 12,000 ft elevation, has an average radius of 2.5 miles from the UH 44-inch telescope located on the summit. The boundary on the northeast side of the Science Reserve extends further down the mountain to include Pu`u Makanaka and two other large cinder cones (see Figure 3.1) which appear to have been viewed at the time as potential observatory sites. The rationale for creating such a large reserve is explained in the lease:

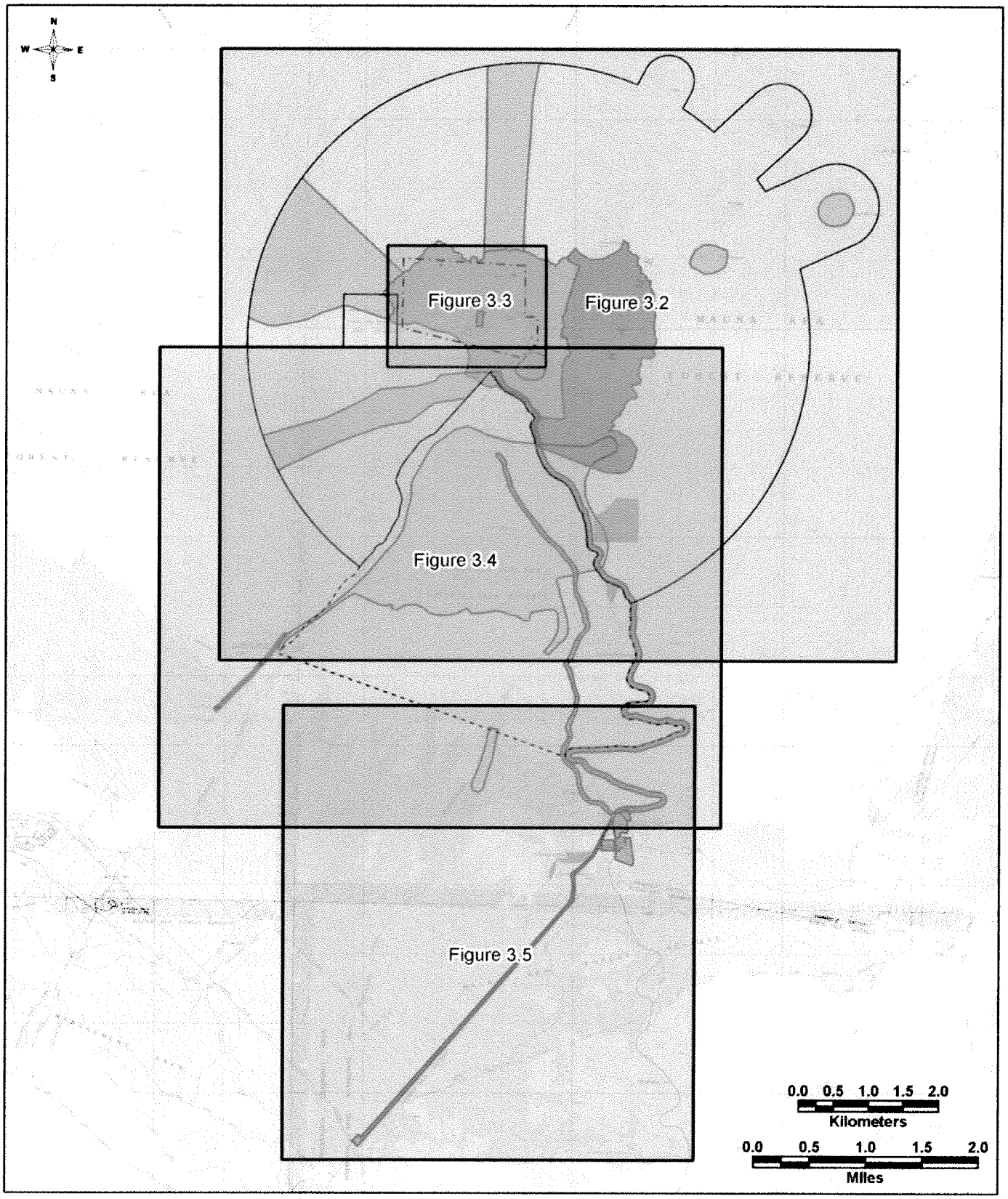
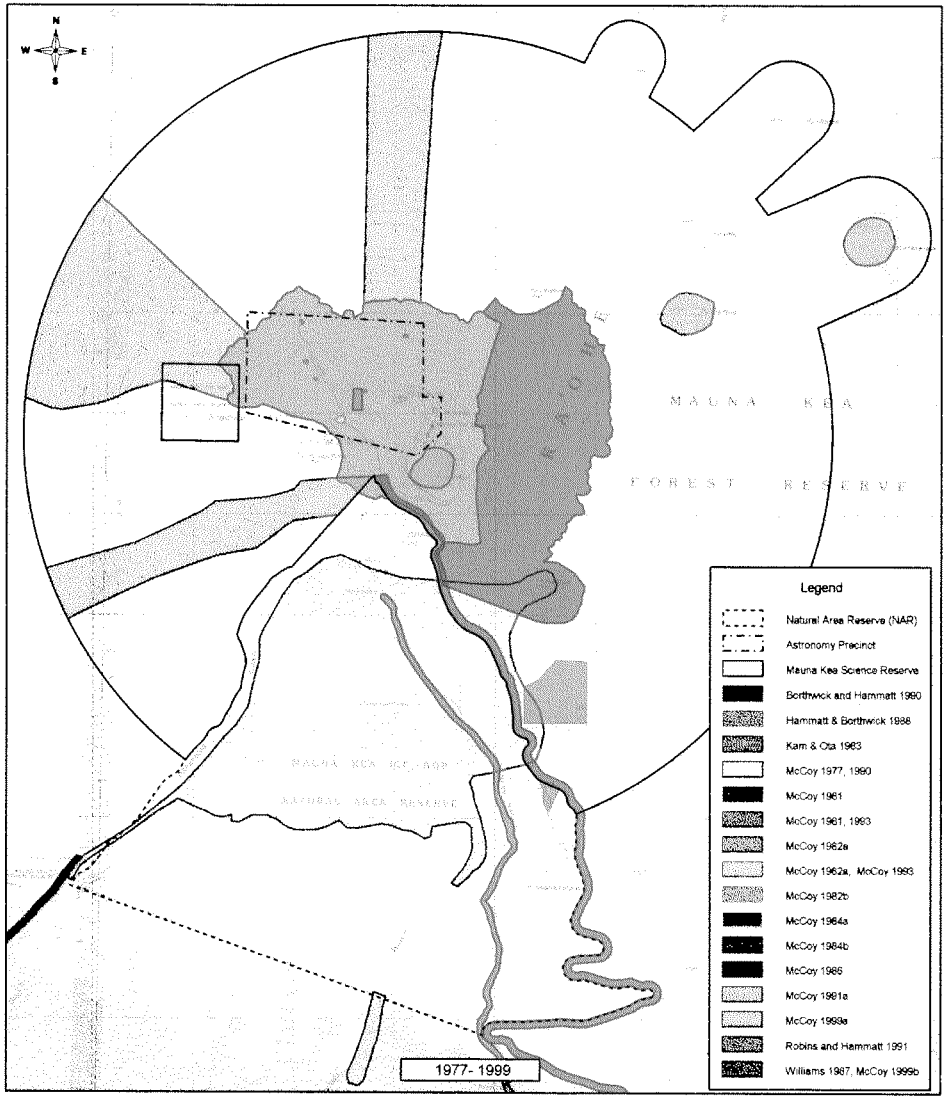


Figure 3.1 Index of Maps Showing the Location of Previous Archaeological Investigations in the Alpine and Sub-Alpine Zones on the South Flank of Mauna Kea.



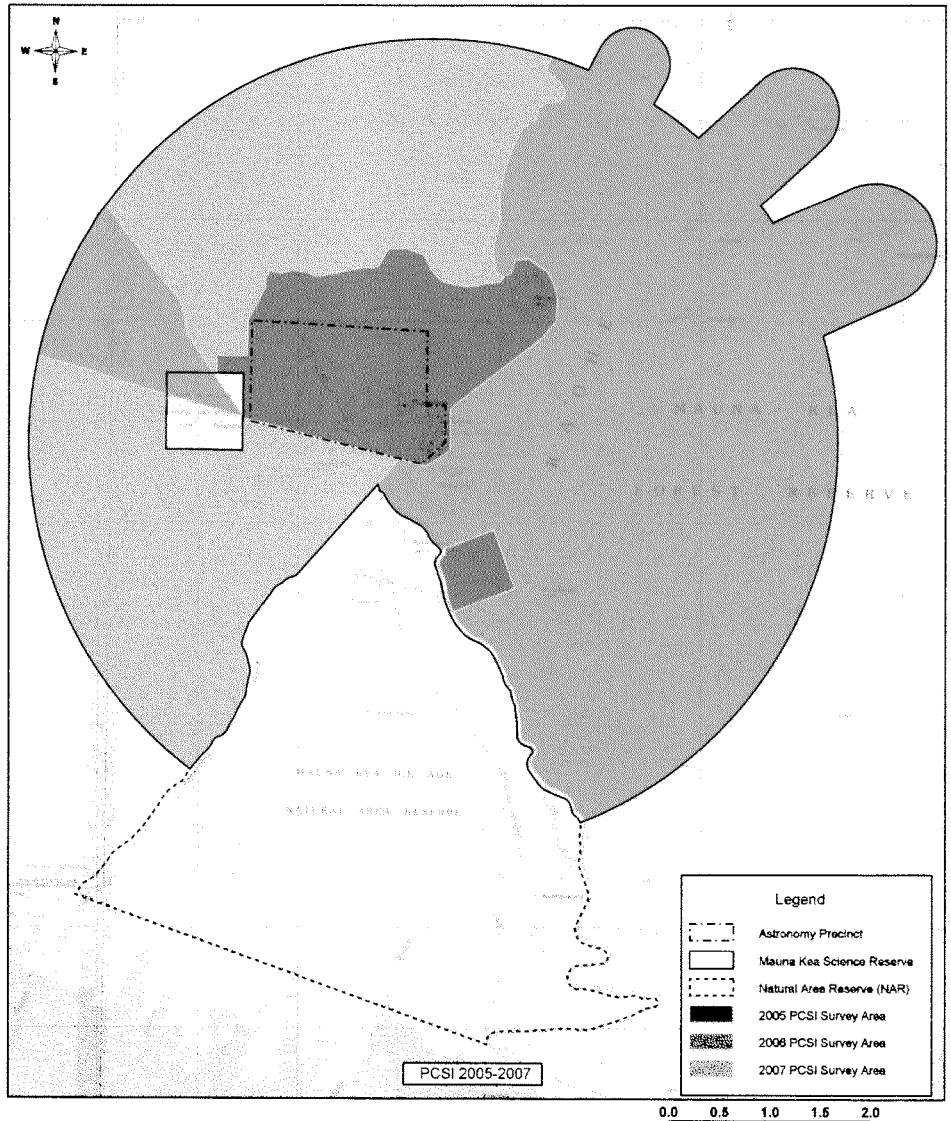


Figure 3.2 Location of Previous Archaeological Investigations in the Mauna Kea Science Reserve (1977-1999 and 2005-2007)

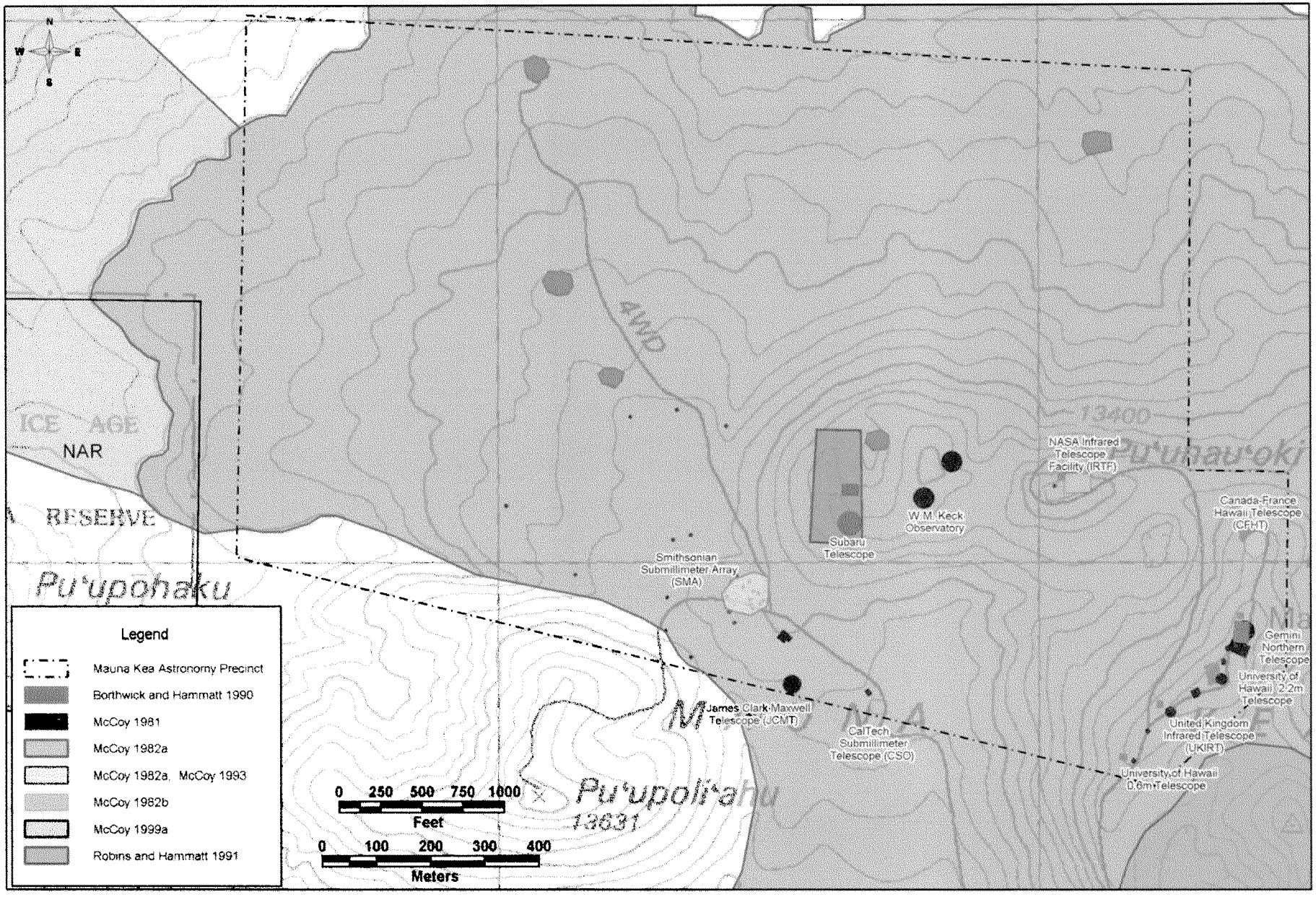


Figure 3.3 Location of Previous Archaeological Surveys for Observations, Telescopes, and Arrays in the Astronomy Precinct Portion of the Mauna Kea Science Reserve.

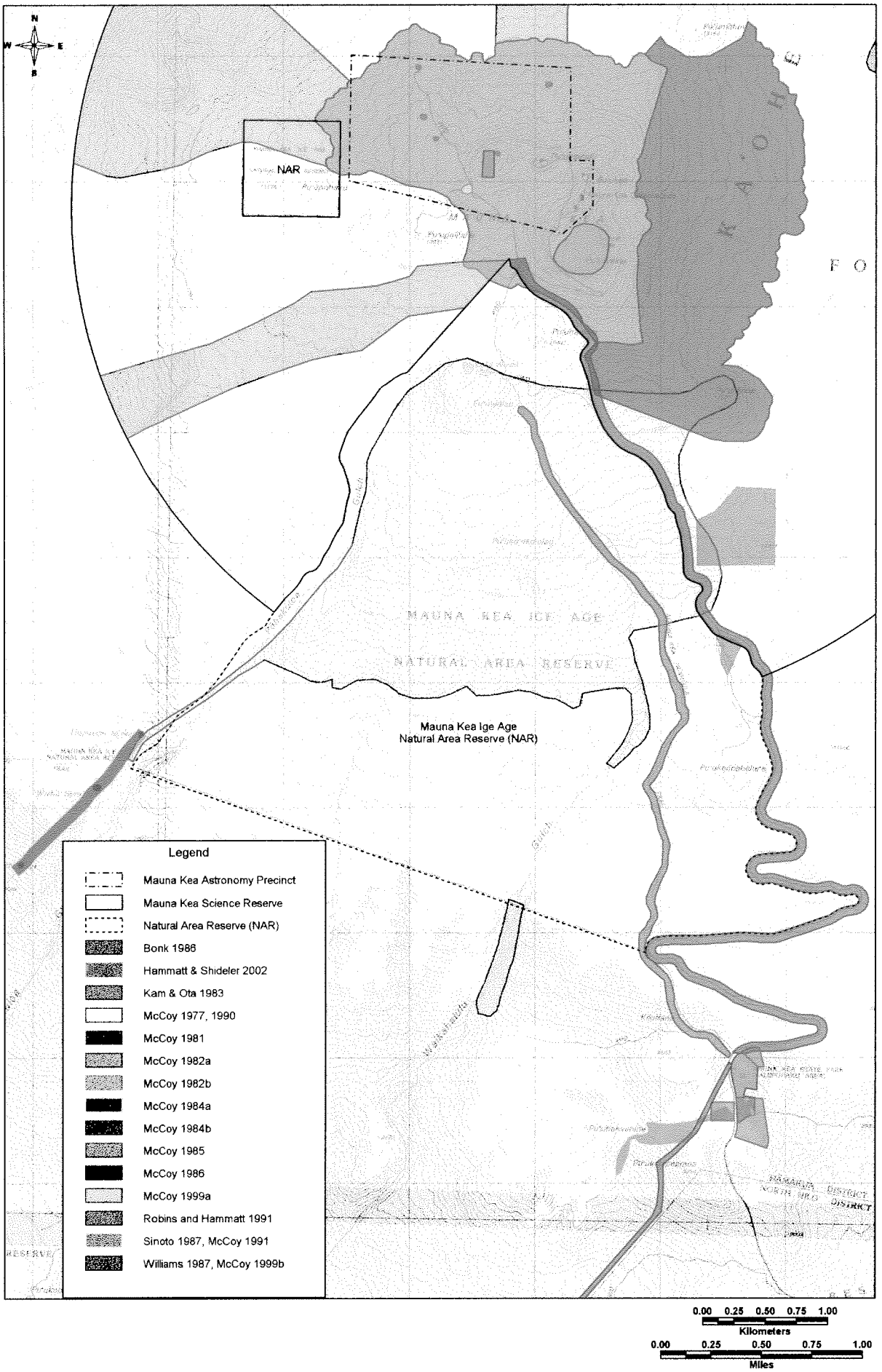


Figure 3.4 Location of Previous Archaeological Surveys and Data Recovery Projects in the Natural Area Reserve, along the Mauna Kea Observatories Access Road, and in the Hopukani, Waihu and Liloe Springs Areas.

The land hereby leased shall be used by the Lessee as a scientific complex, including without limitation thereof an observatory, and as a scientific reserve being more specifically a buffer zone to prevent the intrusion of activities inimical to said scientific complex.

Table 3.1. Previous Archaeological Research and Cultural Resource Management Studies in the Mauna Kea Science Reserve.

Year	Project	Study	Location	Reference
1975-76	NSF Research Project on the Mauna Kea Adze Quarry	Reconnaissance and inventory survey	MKSR & NAR	McCoy 1977, 1978, 1990; Cleghorn 1982; Allen 1981; Williams 1989
1981	Kitt Peak National Observatory	Reconnaissance	MKSR	McCoy 1981
1982	Hawaii Institute for Astronomy	Reconnaissance	MKSR	McCoy 1982a; McEldowney 1982
1982	Caltech Telescope	Reconnaissance	MKSR	McCoy 1982b
1983	Mauna Kea Observatory Power Line	Reconnaissance	MKFR, MKSR and NAR	Kam and Ota 1983
1984	NSF Grant-in-Aid Survey	Reconnaissance	MKSR	McCoy 1984b
1987	Summit Road Improvement	Reconnaissance	MKSR & Access Rd.	Williams 1987; McCoy 1999b
1988	VLBA Telescope	Reconnaissance	MKSR	Hammatt and Borthwick 1988
1990	Subaru Telescope	Reconnaissance	MKSR	Robins and Hammatt 1990
1990	Gemini Telescope	Reconnaissance	MKSR	Borthwick and Hammatt 1990
1991	Independent Research	Reconnaissance of Pu`u Makanaka	MKSR	McCoy field notes
1992	Smithsonian Astrophysical Observatory	Relocation of two known sites	MKSR	McCoy 1993
1995	SHPD site relocation and GPS recording	Reconnaissance	MKSR	McCoy 1999a
1997	SHPD transect survey	Reconnaissance	MKSR	McCoy 1999a
1999	SHPD survey of Pu'u Wekiu	Reconnaissance	MKSR	McCoy 1999a
1999	Hawaii Defense Access Road and Saddle Road	TCP Assessment	Mauna Kea summit region	Langlas 1999
1999	Mauna Kea Science Reserve Master Plan	Cultural Impact Assessment	MKSR	PHRI 1999
2000	Mauna Kea Science Reserve Master Plan	Draft HPP	UH Management Areas	SHPD 2000
2000	Mauna Kea Science Reserve Master Plan	Summary Report	MKSR	McCoy 1999a
2005	EIS for Keck Outrigger Telescopes	Burial Treatment Plan	MKSR	NASA 2005
2005-2007	PCSI survey of the Science Reserve	Inventory	MKSR	McCoy and Nees 2006; in prep.
2008	Cultural Resource Management Plan	CRMP	UH Management Areas	McCoy et al. 2008 (draft)

MKSR=Mauna Kea Science Reserve; MKFR=Mauna Kea Forest Reserve, NAR=Natural Area Reserve

The boundaries of the Science Reserve changed in 1981 when 2,033.2-acres of land were withdrawn from the lease for the creation of the Mauna Kea Ice Age Natural

Area Reserve (NAR). The Science Reserve now encompasses an area of roughly 11,288 acres.

The first archaeological investigations in the Mauna Kea Science Reserve were carried out in 1975-76 in the context of a National Science Foundation funded research project on the Mauna Kea Adze Quarry (McCoy 1977, 1990; Cleghorn 1982; Allen 1981; Williams 1989) (see Figure 3.2). A reconnaissance survey undertaken in 1975 to determine the boundaries of the quarry, a National Historic Landmark, found one site just inside the Science Reserve boundaries on the eastern side of the summit road, between the ca. 12,250 and 12,300 ft elevations. The site (BPBM Site No. 50-Ha-G28-1; State Site No. 50-10-23-16204) as defined at the time, using the site definition criteria employed in the quarry project, consists of five shrines, 25 open-air enclosures (shelters) and a diffuse lithic scatter of adze manufacturing by-products (McCoy 1977, 1999b). Two other sites were found in the Science Reserve in the 1976 field season, which involved more intensive survey and site recording. One site (BPBM Site No. 50-Ha-G28-38; State Site No. 50-10-23-16163) is a shrine with a diffuse scatter of flakes located on a ridge top at the ca. 12,880 ft elevation. The second site (BPBM Site No. 50-Ha-G28-76; State Site No. 50-10-23-16195) are the remains of two stone mounds on the rim of Pu`u Lilinoe. These would appear to be the remnants of the burial interment features noted by W.D. Alexander's survey party in 1892.

The first major survey in the Science Reserve was conducted by the Bishop Museum over 5 1/2 days between July 12 and 17, 1982 for the Hawaii Institute for Astronomy (IfA) and encompassed roughly 1,000 acres of land on the summit and northern slope of the mountain, down to the ca. 13,000-ft elevation (see Figure 3.2). Few, if any, archaeological sites were predicted to occur within the boundaries of the project area, given the high altitude location and presumed absence of exploitable resources, including adze-quality stone, which was believed to be restricted to the south slope of the mountain. A total of 22 sites were recorded in this survey (McCoy 1982a). For field purposes, all but one site, an open-air shelter, were classified as "shrines," earlier defined by Buck (1957:527) as "a convenient term to designate a simple altar without a prepared court." The open-air shelter, which contained modern debris, was later deleted from the historic places inventory because of the belief that it is a modern feature. The number of historic properties found in the 1982 survey has thus been changed to 21. A survey of the Caltech Telescope site was conducted at the same time as the larger survey. No sites were found within the proposed project area, but two sites were found in close proximity (McCoy 1982b).

In 1983 SHPD conducted a reconnaissance survey of a proposed underground power line from Hale Pohaku to the summit (Figure 3.5). The survey, which did not identify any historic properties, was undertaken before the final alignment had been determined, however.

Archaeological survey of the Science Reserve was resumed in 1984 by the Bishop Museum with the support of a National Historic Preservation Grant-in-Aid. The 1984 survey (see Figure 3.2), which was carried out over a period of 6 days between July 23 and 28, was aimed at completing an inventory of archaeological remains on the east-southeast flank of the mountain adjoining the proposed northern boundary of the Mauna Kea Adze Quarry (McCoy 1978). The survey strategy and methodology were the same as those employed in the 1982 fieldwork. A total of 21 dispersed and aggregated sites was recorded in the survey (McCoy 1984b), which covered ca. 1,000 acres on the

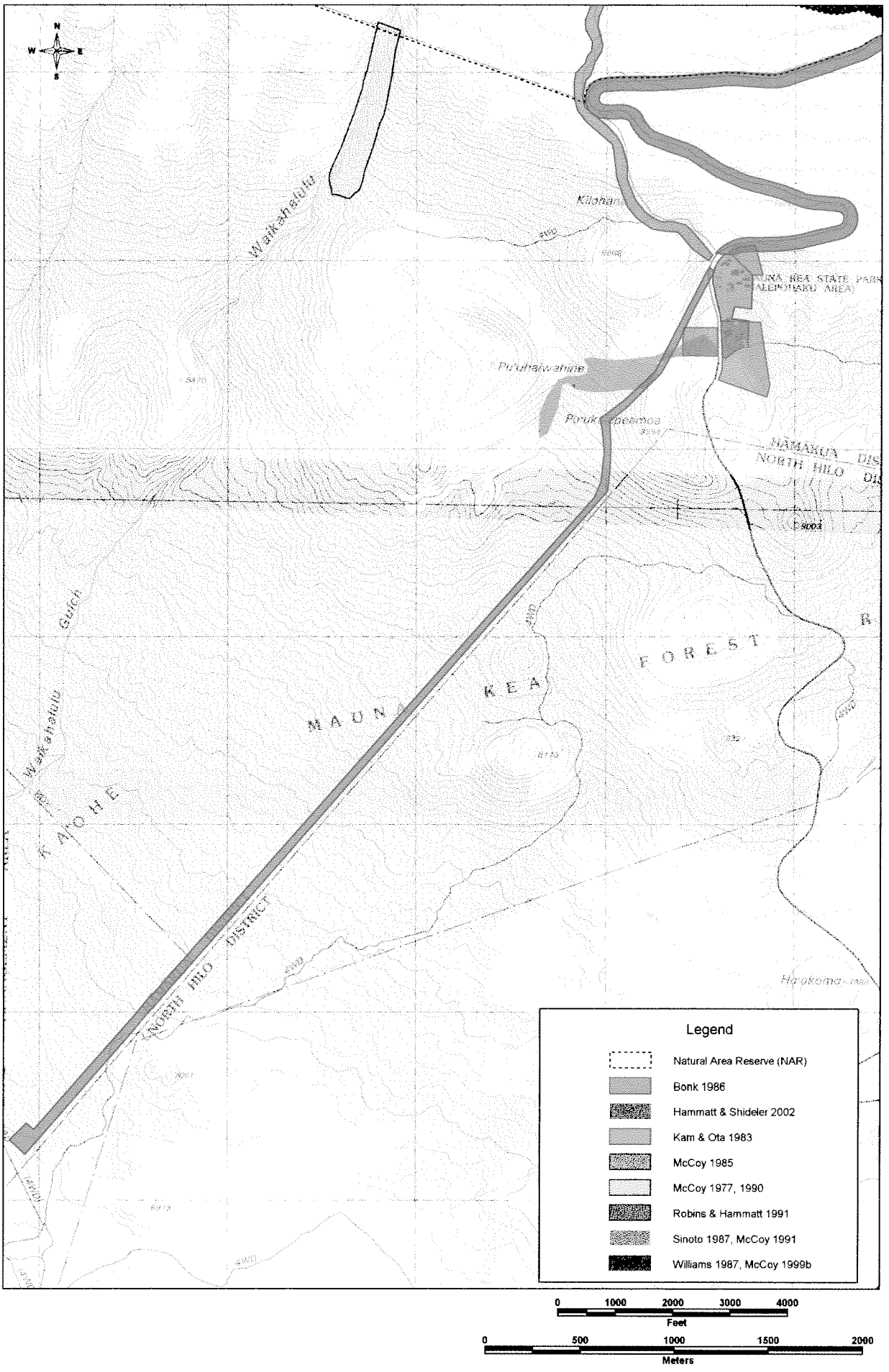


Figure 3.5 Location of Previous Archaeological Surveys and Data recovery Projects in the Hale Pōhaku Area

eastern slope of the mountain. Time did not permit survey of the upper slopes and summit of Pu`u Mahoe as originally planned.

In 1988 Cultural Surveys Hawaii, Inc. conducted a reconnaissance survey of two areas that were being considered as alternative sites for the National Radio Astronomy Observatory (now called the Very Long Base Array). No archaeological sites were found in the survey of the first area, an area of some 15 acres located between the 11,560 and 11,840 ft elevations near the junction of the summit road and a utility road (Hammatt and Borthwick 1988:1). Four archaeological sites were recorded in the survey of the second alternative site, an area of some 100 acres located on the east side of the summit road at the 12,100 to 12,225 ft elevations. Three sites of the sites (11076, 11077, and 11079) were interpreted as possible shrines; the fourth site (11078) is a small rock shelter (Hammatt and Borthwick 1988:21).

Two archaeological surveys were undertaken in the Science Reserve in 1990, both by Cultural Surveys Hawaii, Inc. The first involved a resurvey of a portion of Pu`u Hau Oki for the proposed Japan National Large Telescope (JNLT-- later renamed the Subaru Telescope) (see Figure 3.3). No sites were found in this survey, which covered an area of 5.1 acres (Robins and Hammatt 1990). The second survey was done for the proposed Galileo Telescope (later renamed the Gemini Telescope) (see Figure 3.3). Two alternative sites were inspected, both of them located on what the authors called the "summit ridge" (Borthwick and Hammatt 1990). No sites were found in either area.

In 1991 an unofficial one-day reconnaissance of the top of Pu`u Makanaka was undertaken by Holly McEldowney and Marc Smith (SHPD) and Patrick McCoy (Mountain Archaeology Research Corp.) to relocate previously reported burials (see Figure 3.2). The survey, which was interrupted by bad weather, found a number of burials, none of which were mapped, however (McCoy 1991 field notes). A single state site number was assigned to the burials on the *pu`u* at that time.

As part of their Section 106 compliance, Mountain Archaeology Research Corp. was contracted by the Smithsonian Institution Astrophysical Observatory in December 1992 to relocate two previously recorded sites in the general vicinity of one of the pads (see Figure 3.3). The two sites (50-10-23-16164 and 16165), which were found in the 1982 survey and described as shrines (see discussion of site types below) were found to be located well outside of the observatory footprint. Flagging of the two sites was recommended as a precautionary measure (McCoy 1993).

In 1995 the State Historic Preservation Division, with financial support from the Hawaii Institute for Astronomy, initiated a project designed to result in a historic preservation management plan for the Science Reserve. The first task, which was begun in 1995, involved the relocation and GPS locational mapping of the sites recorded in the 1982 and 1984 surveys (see Figure 3.2). In the course of the fieldwork 18 new sites were found and recorded (McCoy 1999a).

In 1997 SHPD undertook a reconnaissance survey of five previously un-surveyed areas aimed at obtaining a better idea of site distribution patterns for both management and research purposes. The 1997 survey area included three transects on the north, northwest and southwest slopes of the mountain from the summit area to the lower boundary of the Science Reserve at the ca. 12,000 ft elevation and two other areas—Pu`u Poepoe and a small piece of land located near the Science Reserve boundary

downslope of the CalTech observatory (see Figure 3.2). A total of 29 new sites were found in the 1997 project, which was conducted over a period of 6 days (McCoy 1999a).

The 1997 survey also began the process of recording what were initially referred to as "locations" but are now being termed "find spots"--a general term referring to man-made remains that are either obviously modern features (e.g., camp sites with tin cans, pieces of glass and other modern material culture items), or features that cannot be classified with any level of confidence as historic sites because of their uncertain age and function (e.g., a pile of stones on a boulder).

Archaeological surveys undertaken between 1975 and 1999 identified a total of 93 sites (McCoy 1977, 1982a, 1984b, 1990, 1999a; Hammatt and Borthwick 1988; Borthwick and Hammatt 1990) in an area encompassing some 3,711 acres, which represents roughly 33% of the 11,288 acre Science Reserve. With the exception of a survey undertaken as part of a research project on the Mauna Kea Adze Quarry Complex, all of these surveys were reconnaissance level studies, which by definition are limited in terms of coverage and completeness.

The need for an archaeological inventory survey of the entire Mauna Kea Science Reserve was recognized by the Office of Mauna Kea Management (OMKM). PCSI was contracted by OMKM in 2005 to undertake such a survey and to develop a cultural resource management plan. The survey was undertaken over a period of 14 weeks in the summers of 2005-2007 (see Figure 3.2). A total of 222 historic properties were found in the survey (McCoy et al. 2005; McCoy and Nees 2006; in prep.). This includes two of the three locations designated Traditional Cultural Properties (TCP's) by SHPD in 1999 (Figure 3.6). The locations of historic properties, including TCP's, and "find spots" in the Science Reserve are shown in Figure 3.7.

3.2 HALE P• HAKU AREA

The second area that is managed by UH is a 19.3-acre site at Hale P• haku (CDUP No. HA-1819, Tax Map Key 4-4-15:12) encompassing the Onizuka Center for International Astronomy (OCIA), the Visitor Information Station, and an old construction laborer camp (see Figure 3.5). Some of the cabins in the old camp are now used by the OMKM rangers; others are available for rent by the public for short-term use. Table 3.2 presents a summary of the previous archaeological studies at Hale P• haku.

Table 3.2. Previous Archaeological Investigations at Hale Pohaku.

Year	Project	Investigation	Reference
1979	Hale P• haku Mid-Level Facilities Complex Development Plan	Reconnaissance survey	McCoy 1979
1984-85	Supplemental EIS for Construction Laborer Camp	Reconnaissance survey	McCoy 1985
1986	HELCO transmission line and substation	Reconnaissance survey	Bonk 1986
1987	HELCO transmission line and substation	Reconnaissance survey	Sinoto 1987
1987	HELCO substation and surrounding area	Data recovery	McCoy 1991
1990	Japan National Large Telescope Dormitories	Reconnaissance Survey	Robins and Hammatt 1990
1993	Japan National Large Telescope Dormitories	Data Recovery	Hammatt and Shideler 2002
2005	Septic Tank Excavations	Monitoring	McCoy 2005

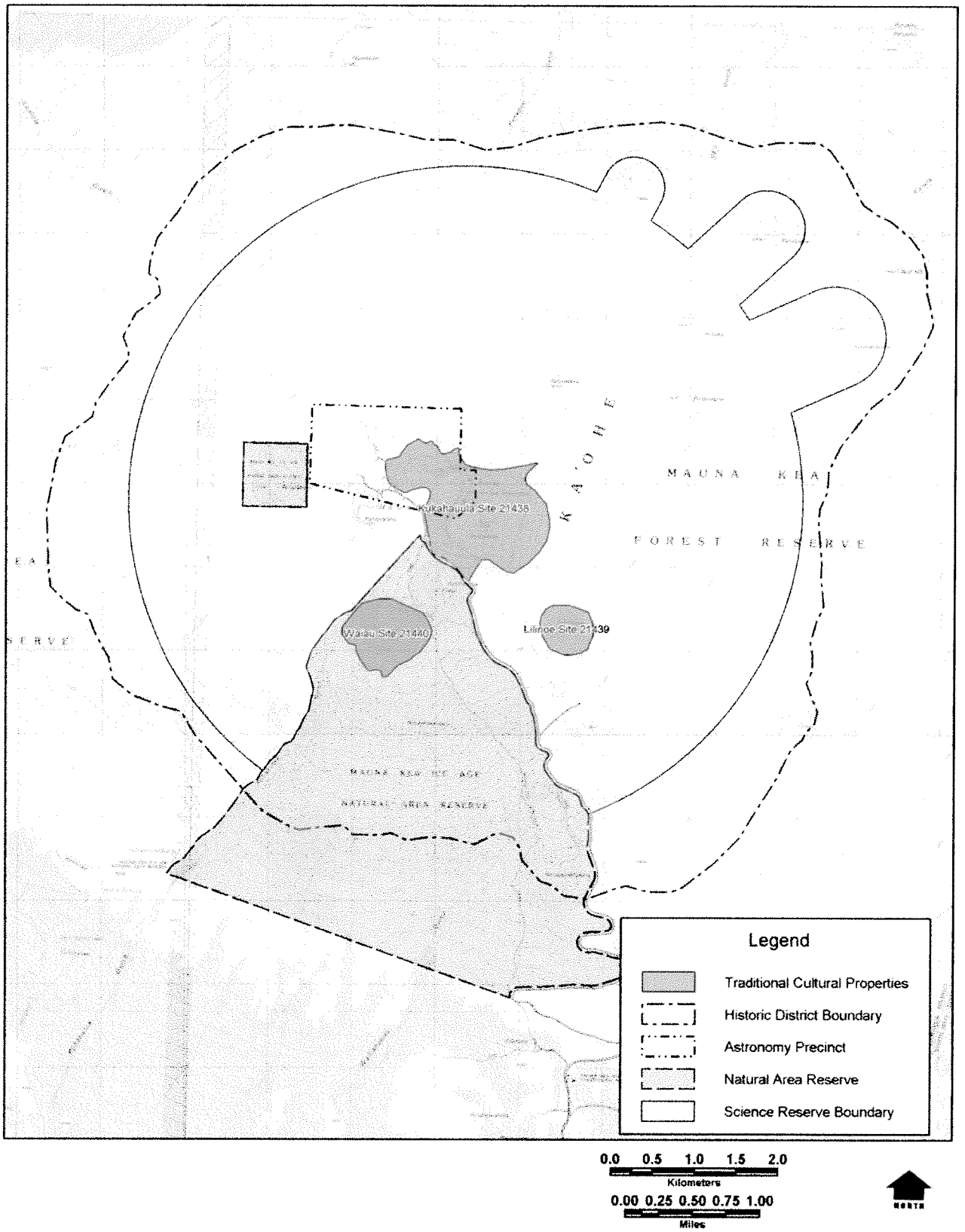
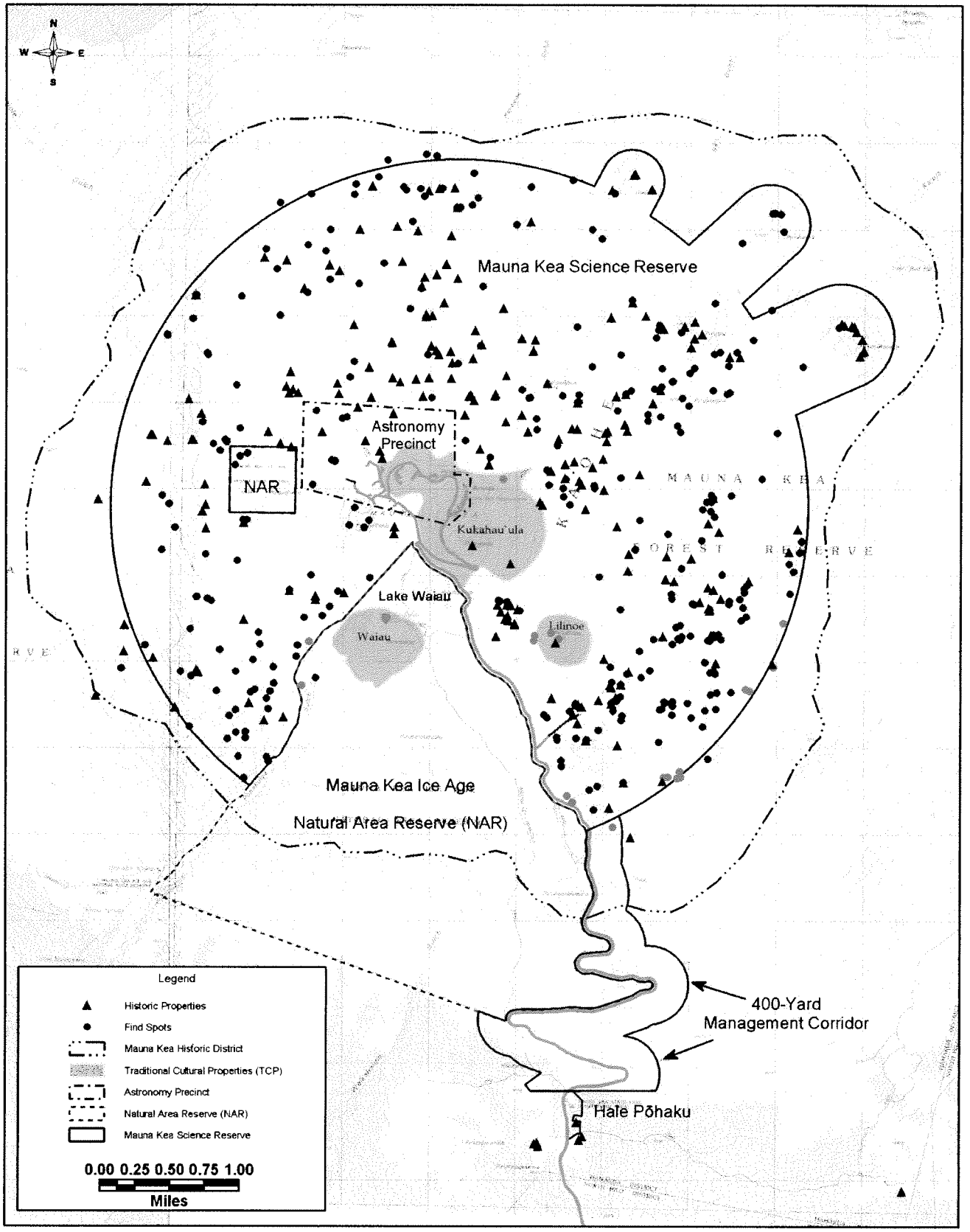


Figure 3.6 Location of Designated Traditional Cultural Properties in the Mauna Kea Summit Region.



Source: McCoy and Nees in prep

Figure 3.7. Historic Properties, Traditional Cultural Properties, and Find Spots

A number of archaeological investigations have been conducted at Hale P• haku, both in and outside of the 19.3-acre parcel, beginning with a one-day reconnaissance survey by the Bishop Museum in 1979 for the Hale P• haku Mid-Level Complex Development Plan. No sites were found at that time (McCoy 1979). Three more surveys were conducted by the Bishop Museum between July 1984 and June 1985 as part of the preparation of a supplemental EIS for a permit to build a new construction laborer camp (McCoy 1985). Two shrines and five lithic scatters comprised of adze manufacturing by-products and octopus sinker manufacturing by-products were recorded in the surveys, which encompassed roughly 40 acres on the west and east sides of the Mauna Kea Observatory Access Road between the ca. 9,080 and 9,200 ft elevations.

The lithic scatters and shrines, one of which has octopus manufacturing by-products on it that have been interpreted as offerings, were designated the Pu`u Kalepeamoa Site (Bishop Museum site number 50-Ha-G28-87) after the name of one of the large cinder cones at Hale P• haku (McCoy 1985). This cone, through which the summit access road passes, is the source of the stone (primarily dunite and gabbro) used in the manufacture of the sinkers. The two shrines and some of the lithic scatters found in the 1984-85 work are located outside of the Mid-Level facility parcel, as are some other 9 recorded lithic scatters found in later work (see Figure 3.5). SHPD arbitrarily assigned Statewide Inventory of Historic Places (SIHP) numbers to the two shrines and 12 lithic scatters (Cordy 1994). The Bishop Museum designations and corresponding SIHP numbers are presented in Appendix C of the draft Cultural Resource Management Plan for the UH management areas on Mauna Kea (McCoy et al. 2008).

In early 1986 the late William Bonk of the University of Hawaii at Hilo conducted a reconnaissance survey of a proposed new HELCO transmission line and substation located at Hale P• haku. No historic sites were found in the survey which extended from an existing 69 KV powerline north of the Saddle Road and west of the Mauna Kea Access Road, (Bonk 1986) to the substation location at Hale Pohaku (see Figure 3.5).

The subsequent discovery of lithic artifacts in the vicinity of the HELCO substation led to a data recovery project that involved additional survey and surface collections at 11 different lithic scatters and limited test excavations of two of the scatters (Sinoto 1987; McCoy 1991). A total of 2,364 artifacts and 129 faunal remains were collected. In addition to the debris related to adze and octopus sinker manufacture some 20 special purpose bird cooking stones called *pohaku `eho* were found. Three radiocarbon dates from charcoal recovered in fire pits indicate that the site, which has been interpreted as a temporary camp occupied on the ascent to and descent from the Mauna Kea Adze Quarry, is of late pre-contact age (ca. AD 1600-1700).

Cultural Surveys Hawaii conducted another reconnaissance survey at Hale P• haku on August 9, 1990. The survey, which was done in conjunction with the construction of dormitories for the Japan National Large Telescope (later renamed the Subaru Telescope), covered a portion of the area surveyed by the Bishop Museum in 1985. The survey, which relocated two lithic scatters, recommended data recovery investigations prior to construction of the dormitories (Robins and Hammatt 1990). The data recovery work was conducted October 19-20, 1993 by Cultural Surveys Hawaii.

Two radiocarbon dates were obtained that support the idea of a late prehistoric camp site (Hammatt and Shideler 2002).

The most recent work at Hale P• haku, conducted in March 2005, involved archaeological monitoring of four septic tank excavations (McCoy 2005). The monitoring report noted that while all of the known surface features in the lease area have undergone data recovery and no longer exist, there is a possibility that buried cultural deposits might exist in some undisturbed areas (McCoy 2005). There is one other historic property, the stone cabins constructed by the CCC in the 1930's, in the Mid-Level Facility parcel that is currently in the process of being documented and evaluated.

3.3 MAUNA KEA ACCESS ROAD

The third UH management area is the summit access road from the OCIA at Hale Pohaku to the Science Reserve boundary at the approximately 12,000-foot elevation. This includes a corridor approximately 400 yards wide on either side of the road, except for sections that fall within the boundaries of the Natural Area Reserve (see Figure 3.4).

In 1987 the Bishop Museum was contracted by the Facilities Planning and Development Office of the University of Hawaii to undertake an archaeological reconnaissance survey of the Mauna Kea Observatories Access Road above Hale Pohaku, the former cement batch plant located in the Natural Area Reserve, and a stockpile area as part of the planning process for road improvements and new parking areas (see Figure 3.4). The survey covered a 100-foot wide corridor on both sides of the road. A post-field letter report dated July 7, 1987 (Williams 1987) indicates that no new sites were found during the road survey and the resurvey of the batch plant and stockpile area. New data on Site 16204 (see description below), located in close proximity to the road, was obtained during the project (McCoy 1999b). A final report on the road survey was never prepared by the Museum.

3.4 MAUNA KEA ICE AGE NATURAL AREA RESERVE

As noted above, the Mauna Kea Ice Age Natural Area Reserve was created in 1981. The NAR consists of two separate parcels, a 3,750-acre pie-shaped parcel (TMK: (3) 4-4-15:10) that encompasses most of the Mauna Kea Adze Quarry and Lake Waiau, and a 143.5-acre parcel (TMK: (3) 4-4-15:11) surrounding Pu`u Pohaku, where fossil ice has been found (see Figure 3.4). Table 3.3 presents a list of previous archaeological research and investigations conducted within the NAR since 1935.

Several 19th century expeditions to the summit region spent some time passing through what is now the Mauna Kea Ice Age Natural Area Reserve and occasionally stopping at one well known locality named Keanakako`i. This name, which literally translates as "cave of the adze," appeared for many years appeared on USGS quadrangle maps and according to some is the traditional name for what has become to be called the Mauna Kea Adze Quarry Complex. The existence of the adze quarry was reported in the first recorded European ascent of Mauna Kea by Joseph Goodrich in 1823. Short accounts of the quarry complex appear in the records of other late 19th century and early 20th century expeditions to the mountain. One of the most informative is the account of W.D. Alexander's party, in 1892. About half an hour after leaving Lake

Table 3.3. Previous Archaeological Research and Cultural Resource Management Studies in the Natural Area Reserve

Year	Project	Study	Reference
1935	Hawaiian Academy of Science Expedition	Reconnaissance	Wentworth et al. nd
1937	Independent Research on Mauna Kea Adze Quarry	Reconnaissance	Emory 1938
1956	Independent Research on Mauna Kea Adze Quarry	Mapping and Description of a rockshelter	Y. Sinoto field notes
1971	Geo-Archaeological Research on Mauna Kea Adze Quarry	Test Excavation of Site 50-Ha-G28-6	Barrera field notes
1975-76	NSF Research Project on the Mauna Kea Adze Quarry	Reconnaissance and inventory survey	McCoy 1977, 1978, 1990; Cleghorn 1982; Allen 1981; Williams 1989
1984	Bishop Museum	Reconnaissance of Lake Waiau and Pu`u Hau Kea	Carter and Peterson field notes
1997	SHPD	Reconnaissance of Lake Waiau	SHPD field notes

Waiau on the descent back to base camp the party came to what they called the "axe-makers" cave called Keanakakoi:

> This is situated about a mile south of Waiau, and a hundred yards west of the trail, in a ledge of that hard, fine-grained kind of rock, which ancient Hawaiians preferred for their stone implements. Here we saw the small cave in which the axe-makers lodged, their fire place, and remains of the shell fish they ate. In front of it is an immense heap of stone flakes and chips some 60 feet across and 20 or 30 feet high. Near by several hundred unfinished axes are piled up just as they were left by the manufacturers, when the arrival of foreign ships and the introduction of iron tools had ruined their trade...It was here that the late Dr. Hillebrand found a curious idol, which is still in the possession of his family (Maly and Maly 2005:189).

Robert Aitken, a member of the 1935 Hawaiian Academy of Science Expedition, made some general observations about the quarry which are summarized in the unpublished manuscript of the expedition (Wentworth et al. n.d.). In 1937 Bishop Museum archaeologist Kenneth Emory visited the quarry over a three day period. He photographed and briefly described some of the shrines and rockshelters. A popular account of Emory's visit appeared in *Paradise of the Pacific* (Emory 1938:21-22).

Dr. Yosihiko Sinoto sketched and described one rockshelter in 1956. In 1971, the late William Barrera partially excavated a 50 cm square test pit in the floor of a rockshelter that was subsequently recorded as Bishop Museum Site 50-Ha-G28-6-R1 (SIHP Site 50-10-23-16209). The excavation was undertaken in conjunction with geological and soil studies by Drs. Stephan Porter and Fiorenzo Ugolini of the University of Washington. No report was ever prepared on the excavations (McCoy 1977:223-224).

The first major archaeological investigations of the adze quarry were conducted over a 7-month period in the summers of 1975-76. The primary research objectives of the Mauna Kea Adze Quarry Project as originally conceived were to:

1. develop a technological model of adze manufacture based on a characterization of techniques, stages, and activity pattern variability within and between sites in the quarry complex;
2. provide new data on chronological changes in Hawaiian adze types; and
3. determine the relationship of this particular quarry industry to other forms of economic specialization and the development of socio-political complexity (McCoy 1978, 1986:7).

The 1975-76 project, which did not cover the whole of the quarry, identified 37 sites, two of which are located in the Science Reserve. The sites included 263 workshops comprised of 1566 "chipping stations" with 182 open-air enclosures; 39 rockshelters (this includes what were originally called overhang shelters); 40 shrines; 2 rock art localities and 1 basaltic glass source and workshop.

The Mauna Kea Adze Quarry Complex, one of the most significant historic sites in the Hawaiian Islands, was placed on the National register of Historic Places in 1962 as a National Historic Landmark (NHL). The boundaries of NHL have yet to be officially established by the National Park Service. Boundary recommendations were made in 1978 following the research in the best known and most accessible part of the quarry in 1975-76 (McCoy 1978:Figure 2). On present evidence the quarry covers not only more area but also contains a larger volume of manufacturing by-products and related archaeological remains than all of the other known adze quarries in the Hawaiian Islands combined (McCoy 1977; McCoy and Gould 1977). Fieldwork west of P• hakuloa Gulch, in 1984-85 and again in 2007, indicates that the quarry encompasses a larger area than what was reported earlier, at the conclusion of the first phase of research in 1975-76 (McCoy 1977; McCoy and Gould 1977). Most of the quarry complex is located in the NAR, but some sites are located in the Science Reserve. Quarry and workshop sites have also been found on Mauna Kea Forest Reserve lands.

A reconnaissance survey of the Lake Waiau area was conducted in 1976 during the second field season of the Mauna Kea Adze Quarry research project (McCoy 1977, 1978). Little time was devoted to the survey of the lake area after finding that there was no tool-quality basalt in the immediate environs. No artifacts linking the lake to the adze quarry were found in the survey, but the lake was included in the proposed boundaries of the Mauna Kea Adze Quarry National Historic Landmark based on the assumption that not only was the lake a part of the "effective environment" used and possibly modified by Hawaiian adze makers, but because of the potential of the lake to aid in the interpretation of paleoenvironmental changes through the study of fossil pollens contained in the lake sediments (McCoy 1978:17-18). In addition, it was assumed that the location of the lake, just below the summit of the mountain, held special cultural significance for the adze makers and other Hawaiians. One site, a cluster of cairns located above the northwestern side of the lake, was recorded and assigned a site number in 1976 (BPBM Site No. 50-Ha-G28-36). The site marks the northwest corner of the proposed NHL boundary (McCoy 1978:Figure 2).

A sketch map showing cultural features at the lake and on the rim of Pu`u Hau Kea was made on July 28, 1984 at the end of the reconnaissance survey of ca. 1,000 acres of land on the east slope (McCoy 1984b). A number of features were noted on the rim of the Pu`u Waiau and below, along the margins of the lake. Two possible cairns were noted in a quick reconnaissance around the rim of Pu`u Haukea (Carter and Peterson, unpublished field notes).

Prior to the current project only one site at Lake Waiau had been given a Statewide Inventory of Historic Places (SIHP) number. A cluster of five cairns and two uprights was assigned Bishop Museum site number (50-Ha-G28-36) in 1976 for the purpose of marking one corner of the recommended boundaries for the Mauna Kea Adze Quarry National Historic Landmark (McCoy 1978: Figure 2). The site was later given a SIHP number (50-10-23-16232) by Cordy during the writing of his *Regional Synthesis of the Hamakua District* (Cordy 1994).

While a number of other features were observed in 1976, 1984 and at other times, it was not until 1997 that a conscientious effort was made to begin recording all of the sites and features at the lake. The survey initiated by SHPD in 1997 was constrained by time, with the result that many sites and features were left unrecorded. The quality of much of the data that were collected was, moreover, not up to inventory survey standards. In view of the obvious need for a more comprehensive survey no SIHP numbers were assigned to the remains recorded in 1997.

Material support for the theory that the lake was frequented by the adze makers was found in the 1997 survey. A flake, presumed to be a waste flake from the adze quarry based on its texture and color, was found near the outlet to lake. While there is no way of knowing when the flake was introduced, it is not part of any modern construction and was in fact found in close proximity to a petroglyph, the first recorded at the lake.

3.5 Hopukani, Waihu, and Liloe Springs

The first published reference to the existence of archaeological sites in the Pohakuloa Gulch area is contained in a report by Wentworth and Powers (1943) who made the following observations during the course of their geological investigations in 1939:

> One section of the valley is isolated by the steep walls of thick lava flows, above and below which are stone walls built many years ago as a trap in which to impound wild cattle that frequented the spring area. The last of the wild cattle have been killed, but a few skulls were to be seen in 1939.
>
> In the area to the east and up the slope from the springs are numerous small heaps of pre-European stone adz workings. Certain lava caves contain evidence of habitation, suggesting that the springs were frequented by adz workers. The latter not only secured adz material from lava flows in places but carried on a surprising amount of casual prospecting on dense basalt boulders included in the moraines and outwash strewn several thousand feet down the mountain (Wentworth and Powers 1943:544).

In a later report on this area, Richardson and Woodside (1954:326-7) noted the presence of dark-rumped petrel (*Pterodroma phaeopygia)* bones and artifacts in a site they named Hopukane Shelter Cave, located at the ca. 10,000 ft. elevation. This must be one of the habitation caves seen by Wentworth and Powers in 1939. It appears, more precisely, to be site 50-Ha-G28-34 (renamed Hopukani Rockshelter) based on information obtained from Woodside (personal communication).

The first systematic archaeological investigations in the P• hakuloa Gulch area were undertaken in 1976, during the second field season of the Mauna Kea Adze Quarry Project (see Figure 3.4). A reconnaissance survey of the P• hakuloa Gulch area,

between Lake Waiau and Mauna Kea State Park, was conducted over a two-day period (August 14-15, 1976). Five sites were recorded in this survey (unpublished field notes). Two of these sites (50-Ha-G28-34 and 35) are located along or in close proximity to the PTA waterline. The proposed western boundary of the National Historic Landmark (McCoy 1978: Fig. 2) was established on the basis of the findings made during this survey.

In 1984 six archaeological sites and a number of find spots were identified in a reconnaissance survey of the P• hakuloa Training area (PTA) waterline catchments and pipeline at Hopukani, Waihu, and Liloe springs, located between the ca. 10,400 and 8,640 ft elevations in the western sector of the Mauna Kea Adze Quarry Complex (McCoy 1984a). The 1984 reconnaissance survey consisted of an intensive survey within a 100 meter radius of each spring and a walk-through survey of the intervening areas, covering roughly 50 meters on either side of the pipeline. The survey area encompassed approximately 16 hectares (McCoy 1984a:3). Five adze manufacturing sites and one historic corral were identified in the survey, which confirmed expectations of a significantly larger number and variety of sites in this part of the quarry complex which includes sites located above and below modern treeline at the ca. 9,500 ft elevation. Indications of even more sites to the west of the major P• hakuloa Gulch drainage area suggest the probability of a future boundary amendment and need to reassess what has been implicitly regarded as a fringe or marginal area of the larger quarry complex.

A data recovery project was undertaken in 1985 to mitigate the possible adverse effects of proposed repairs to the pipeline on the sites identified in 1984 (Table 3.4). Test excavations of a small overhang shelter at Hopukani Spring (10,400 ft) revealed a small assemblage of waste flakes, hearths and faunal remains suggestive of a temporary, short-term occupation. A much larger and more diversified collection of lithic artifacts and organic materials was recovered in the survey and test excavations of Hopukani Rockshelter (10,160 ft), the only previously known base camp in this region of the quarry. Investigations of the isolated site in the subalpine forest at Liloe Spring (8,921 ft) resulted in the definition of site boundaries and acquisition of data pointing to the existence of an open camp site at this lower elevation locality.

The chronology for this area of the quarry, based on a total of eight radiocarbon dates for the three excavated sites, spans a period of some 700-800 years beginning ca. A.D. 1000 and terminating some time prior to 1800. Some preliminary ideas regarding the significance of adze

Table 3.4. Previous Cultural Resource Management Studies at Hopukani, Waihu, and Liloe Springs.

Year	Project	Study	Location	Reference
1984	PTA Waterline Improvement	Reconnaissance	Hopukani, Waihu, and Liloe Springs	McCoy 1984a
1985	PTA Waterline Improvement	Data Recovery	Hopukani and Liloe Springs	McCoy 1986

manufacturing sites and other sites located in the two major drainages on the south slope of the mountain were presented in a 1984 report:

> The sites located in the mid-elevation reaches of the Pohakuloa and Waikahalulu Gulch drainage systems are of particular importance with regard to questions relating to ascent routes, resource ownership, and general relationships to the main quarry area at the 12,200 to 12,400 ft. elevations. Material recovered in the excavations of Waikahalulu Rockshelter (Site 50-Ha-G28-11-R1) at the c. 10,000 ft. elevation on the gulch of the same name, suggest a strategically located mid-elevation base camp on a southerly ascent route to the primary sources of raw material further up the mountain. Both this site and Hopukani Rockshelter (50-Ha-G28-34) are located just above present treeline in close proximity to freshwater springs, thus providing ready access to water, firewood, and other forest products, including birds, of which there are a number of species in the Waikahalulu camp site (McCoy 1983). The final provisioning of some task groups of adze makers residing in the rockshelters at higher elevations probably took place at these two intermediate camp sites and possibly much of the cooking of foods such as taro and yams as well, although there is as yet no direct archaeological evidence for these activities. There is the added implication, again admittedly speculative, that these upper montane forest base camps were occupied by family groups, including women, engaged in a variety of activities directly related to adze production and, perhaps, other unrelated economic pursuits as well (e.g., feather, fiber and wood crafts).
>
> Equally significant from an historical perspective on later land-use and socio-economic patterns are the walls and corral that functioned as a wild cattle trap. This site reflects a socially, and environmentally critical period in the early post-contact era of Hawaiian-European relations in Hawaii and the Mauna Kea-Waimea-Kawaihae areas in particular (McCoy 1984a:26-27).

3.6 Assessments and Mitigation Plans

Cultural assessment studies have been undertaken for two of the more recent projects. One is a traditional cultural property assessment and the other a cultural impact assessment, which is now required under Chapter 343 for Environmental Impact Statements. A draft Historic Preservation Plan (HPP) was developed for the UH Management Areas on Mauna Kea in 1999 and PCSI is in the process of developing a cultural resource management plan for the same areas.

3.6.1 Traditional Cultural Property Assessments

At the request of SHPD, Dr. Charles Langlas of the University of Hawaii at Hilo conducted a TCP assessment of Mauna Kea in 1997 as part of the cultural resource management studies for the Hawaii Defense Access Road and Saddle Road Project. Langlas' work was undertaken in conjunction with a social impact assessment of the proposed road improvements on the *mamane-naio* forest (Kanahele and Kanahele 1997). The studies had two objectives: "(1) to evaluate the two areas as to their potential eligibility for the National Register of Historic Places, and (2) if eligible, determine the effect of the project and how to mitigate any adverse effect" (Langlas 1999:1). A letter written in March 1999 that accompanied the submittal of a supplement to the main study (Langlas et al. 1997), indicated that "the author intended to conclude that although the whole upper zone of Mauna Kea should be considered eligible as a traditional cultural property for the National Register of Historic Sites (as a historic

district), he cannot recommend that the summit peak be considered eligible as a specific site, because he cannot make public the information he collected by Kupuna X" (Langlas 1999).

During the preparation of the Master Plan and draft HPP in 1999-2000, SHPD designated three areas as TCP's because of their association with legendary figures and on-going cultural practices. Two of the TCPs are located in the Science Reserve. These include the summit (K• kahau'ula) and Pu'u L•l•noe. The third is Lake Waiau, which is located just outside of the Science Reserve in the Mauna Kea Ice Age Natural Area Reserve. Each area was given a state site number and the boundaries marked on a map (SHPD 2000:Figure 1). The boundaries shown in Figure 3.6 are based on geological map units (Wolfe et al. 1997: Plate 2).

Tom King, in the declaration he submitted as part of the contested case hearing for the Keck Outrigger project (King 2003) stated his opinion that the landscape on the upper slopes of Mauna Kea meets the eligibility criteria for inclusion in the National Register as a TCP (King 2003:6-7). There are other individuals who believe that all of the lands above the 6,000 ft elevation should be recognized as a TCP (NASA 2005:xv).

3.6.2 Cultural Impact Assessments

A cultural impact assessment study was undertaken by Paul H. Rosendahl, Ph.D. Inc. (PHRI) for the Environmental Impact Statement (EIS) for the Master Plan under "Chapter 343-Environmental Impact Statements" (HRS) and "Title 11, Chapter 200-Environmental Impact Statement Rules" (HAR, Department of Health). Office of Environmental Quality Control (OEQC) guidelines were employed in the study, which was focused on determining what effects implementation of the Master Plan would have on Native Hawaiian cultural practices, features and beliefs. The primary sources of information used in the assessment were oral histories and consultations undertaken by Kepa Maly, who at the time was employed by PHRI. Another of Maly's reports was included in the Master Plan as Appendix I (Maly 1999).

The cultural impact assessment identified a number of traditional and customary practices, several potential traditional cultural properties and several kinds of contemporary cultural practices, some of which may represent continuity of older practices, but also including practices where "no clear specific basis in traditional culture can be clearly established or demonstrated" (PHRI 1999:Table 2, 40). The PHRI report summarized Native Hawaiian perspectives on the Master Plan, from which Maly presented six recommendations, and a concluding discussion of potential mitigation measures.

3.6.3 Preservation and Burial Treatment Plans

In 1999-2000 the State Historic Preservation Division of the Department of Land and Natural Resources began preparing a Historic Preservation Plan (HPP) for the UH management areas on Mauna Kea. A final HPP was never completed before the authors of the plan left SHPD, but parts of the HPP were included in the Mauna Kea Science Reserve Master Plan as appendices. These included "Mauna Kea Historic Preservation Plan Management Components" (Appendix F, SHPD 2000) and "Mauna Kea Science Reserve Archaeological Site Inventory: Formal, Functional, and Spatial Attributes" (Appendix K, McCoy 1999a).

The SHPD Plan identified all of the major activities and actions that could have a potential adverse effect on historic properties located in the state lands managed by UH and the means by which such effects could be mitigated to ensure the long-term protection of individual historic properties and the Mauna Kea Summit Region Historic District as a whole. It also summarized existing management policies, which included the NAR, and made a number of additional policy recommendations.

In 1999 NASA proposed the addition of four and possibly as many as six outrigger telescopes to the W.M. Keck Observatory. After consultation with SHPD, NASA determined that the proposed project, which was classified as a undertaking under Section 106 of the National Historic Preservation Act would have an adverse effect on the summit, which had been recognized as a significant historic property. The finding of adverse effect prompted the development of a Memorandum of Agreement (MOA). One of the stipulations in the MOA was the need to develop, prior to construction, an Inadvertent Discovery of Human Remains and Archaeological Properties Monitoring Plan.

While NASA later withdrew the funding for the Outrigger Project, following legal challenges, the MOA (Appendix B) and the Burial Treatment Plan (Appendix C) included in the Final Environmental Impact Statement (FEIS) are important documents that could be used as models in the development of future construction monitoring plans and burial treatment plans.

PCSI began preparing a cultural resource management plan (CRMP) for all three of the UH management areas on Mauna Kea in 2007. A draft of the CRMP (McCoy et. al. 2008) has been reviewed by OMKM and its cultural advisory group, the Kahu K• Mauna Council. A series of public consultation meetings were held on the island of Hawai`i in 2008. The results of these meetings have been summarized in the draft plan.

4.0 THEORETICAL AND METHODOLOGICAL ISSUES

Little attention tends to be given to theoretical and methodological issues in CRM archaeology. One of the primary reasons, according to Patty Jo Watson, is that "CRM routine is not conducive to sustained concentration on theoretical issues" (Watson 1991:273). The "routine" she refers to is the business side of CRM in which there is a constant need to complete a project as quickly and efficiently as possible. This means that there is commonly little time for data analysis and reflection on the results of a project. So, in Watson's words "we have the quite undesirable paradox of those who actually do most of the archaeology being simultaneously the most distant from the theoretical pinnacles" (Watson 1991:273). As a result, many CRM projects amount to little more than data aggregation and, thus, do not meet the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation, which state in part that "Archaeological documentation is not completed with field work; analysis of the collected information is an integral part of the documentation activity and should be planned for in the research design." Even when field data are analyzed, the data are commonly under-interpreted.

One of the problems with archaeology in general is that there is no consensus on goals and methods. Another is the existence of competing and often conflicting theoretical paradigms. Because of this there are many archaeologists who argue that we should forget about theory and just "get on with the business of doing archaeology." For other archaeologists, including the senior author, this is unacceptable:

> Ignoring philosophical and theoretical concerns is no way out. Such an approach, urging us to simply press on with the study of data without worrying about the niceties of theory, presumably inviting us to respond directly to that data, assumes that the lack of any systematic approach or procedure is somehow a miraculous guarantee of objectivity. Such a common-sense approach systematically evades any confrontation with its own premises, safeguards any methodology which is currently available and, in this manner, produces the very opposite of objective problem-free research. Empirical research presented as the obvious stuff of common sense is never called upon to guarantee its consistency, silences, and contradictions and hence is entirely unsatisfactory (Shanks and Tilley 1987:33).

4.1 THEORETICAL ORIENTATION

This is a period of theoretical eclecticism in archaeology. The senior author does not believe that there is any one approach that can claim a monopoly on truth. He holds to the view that archaeology is an interpretive social science with both particularizing and generalizing goals, and that the "archaeological record" must be understood in both materialist (ecosystem) and idealist terms (the conviction that ideas, beliefs, values, motives, intentions, etc. are of paramount importance in human life). In the case of the Mauna Kea summit region, which has been characterized as a "ritual landscape" (McCoy 1999a), the assumption is that beliefs and intentions are manifested in the spatial patterning of sites and in specific site characteristics, such as the number, placement and shape of uprights (god-stones) on shrines.

More specifically, the senior author subscribes to the goals of contextual archaeology, with its emphasis on meaning. Henry Glassie has written that "To explain the object the analyst needs to know something of its meaning, and to know its meaning he needs some understanding of its context" (Glassie 1975:116). The aim of contextual archaeology (Hodder 1991) is to go beyond a simple understanding of empirical patterning in terms of behavior alone to an understanding based on behavioral and cultural factors, such as beliefs and organizational principles. It is the combination of behavioral and cultural factors, such as beliefs, ritual and organizational principles, that defines the contextual approach in which there is a primary emphasis on meaning.

4.2 METHODOLOGICAL ISSUES

Archaeological field methods, too, tend on the whole to be taken for granted. The unstated assumption is that the observations made in the field do not differ from one archaeologist to another and that "standard archaeological recording procedures" are universal and known to every archaeologist. The problems with doing archaeology without reflecting on field techniques and methods are highlighted in this insightful statement by Richard Bradley:

> The practice of archaeology is not as objective as fieldworkers would like to believe; nor is it as subjective as theorists often suppose. Its procedures employ a mixture of objectivity and subjectivity...The observations made in the field depend on a whole series of assumptions that are not discussed because they are taken for granted. It is only when those ideas are challenged that archaeologists can recognize their own vulnerability. All their primary observations are influenced by their knowledge and experience, but what they accept as knowledge, and what they think of as relevant experience, will change when the assumptions behind them are questioned. The methods used in the field constrain the interpretations formed at the time, and those techniques may not be the best ones for investigating different problems (Bradley 1998:3).

4.2.1 Archaeological Survey Data Requirements

The definition of what constitutes an adequate database to achieve the objectives of most archaeological projects, including site surveys, is never a simple, straightforward matter, although much of the time the issue is simply ignored. The assumption is that there is a consensus amongst archaeologists on what is important to record and what is not. Charles Redman has referred to the minimal information necessary to characterize a site as "baseline information," which in his view is different from the information necessary to address a research problem:

> ...much of the fieldwork we do is designed to collect a common body of information that characterizes the site. I will refer to this as *baseline* information. Baseline information is the minimal set of information that most archaeologists agree must be retrieved from an excavation or survey (Redman 1987:257-258).
>
> Realistically, there are two genres of minimal data requirements with which one must be concerned: those that provide adequate baseline information, and those that solve the specific problems one has chosen to investigate (Redman 1987:259).

What Redman and many other archaeologists fail to recognize is that "baseline information" is theory dependent:

> Now, as all archaeologists know, or should know, there are a multitude of possible competing descriptions of an artifact, an assemblage, or any set of remains encountered in the archaeological record. The choice involved in the description of these remains is related to the theories used to understand them (Shanks and Tilley 1987:109).

4.2.2 Site and Feature Definitions

No universally accepted definitions of site and feature exist in Hawaiian archaeology, and it is unlikely that any ever will because of the architectural complexities of the archaeological landscape in many areas of the Hawaiian Islands, and the different perspectives that archaeologists hold on how the archaeological landscape should be observed and recorded. Though it makes inter-site and regional comparisons difficult, it must be remembered that site classification is a tool rather than an end it itself:

> Classification and other conceptual and measurement devices do not constitute theory because definition is not explanation (cf. Scriven 1958; Levin 1973:391-2). They are, in Dunnell's (1986:152) words, "instrumentalities of the investigator without empirical import." As with all tools, they have to be judged by their utility, not their validity. The ultimate test is not whether they are true or false, but whether they work for any particular purpose (Adams and Adams 1991:312).

Additionally, archaeological classifications are not immutable. They may require revision.

In the senior author's earlier research in the Mauna Kea Adze Quarry (McCoy 1977), a portion of which is located in the Science Reserve, a site was defined as a topographically discrete constellation of what were presumed to be functionally integrated activity remains, such as habitation rockshelters, workshops, and shrines. Each class of activity remains, which are the result of groups of adze makers living and working in the quarry, was numbered sequentially within a site (e.g., Site 1, Rockshelter 1; Site 3, Shrine 2; Site 14, Workshop 15). Physically discrete portions of the larger, more complex activity remains were assigned feature designations (e.g., Site 14, Workshop 15, Feature 2). In the case of the workshops, many of the features correspond to what are often called "chipping stations," where one or perhaps two individuals were engaged in adze manufacture.

In contrast to the adze quarry, the vast majority of the known archaeological remains in the Science Reserve are single component activity remains, primarily single upright stones or arrangements of multiple uprights that are inferred to be shrines based on ethnographic data and comparison to similar remains in the adze quarry and elsewhere in Hawai'i and East Polynesia. In the 2005-2008 inventory survey of the Science Reserve each set of such remains, which are typically well separated from one another, was assigned an individual site number. In the few sites, where there is more than one set of uprights within 5-10 meters or so of each other, each set was assigned a feature number.

4.2.3 Site Form and Function

The convention in Hawaiian archaeology today, due largely to the requirements set forth in Chapter 13-276 of the Hawaii Administrative Rules on archaeological inventory surveys, is to distinguish between formal and functional "types." While sites

and features can be easily described in terms of formal attributes, there is in reality no dichotomy between form and function, since function is inferred from form, as argued below for artifacts, but which applies to sites and features as well:

> It must at the same time be recognized that function is an inferential variable... that is, it is an inference made by the archaeologist himself, mostly on the basis of the observable form of the artifact. Consequently, there is no real dichotomy between functional and formal classification ...functional classification merely involves the consideration of certain specific attributes of form and not others (Adams and Adams 1991:285).

4.2.4 Formal Site and Feature Types in the Astronomy Precinct

The following terms represent the most commonly found formal site and feature types found in the Astronomy Precinct in the summit region of Mauna Kea. These terms have been used before in earlier reports.

Terrace--A structure similar to a platform, except that one side is not free-standing, but rather abuts a slope or rock outcrop; like a platform, the fill can be made up of stone and/or soil.

Upright--An archaeological term for what are inferred to be god stones that the Hawaiians called *'eho* or *pohaku 'eho*; this same term was also used for stone boundary markers and bird cooking stones (cf. Pukui and Elbert 1971; Buck 1957; Emory 1938; McCoy 1991); many of those on Mauna Kea are angular/tabular slabs set on end ("upright").

4.2.5 Functional Site and Feature Types in the Astronomy Precinct

Definitions of the functional site and feature types found in the project area are presented below. Functional inferences are based on a number of factors, including morphology, construction style and materials, locational context and comparison with similar remains of known function. The confidence level in assigning functions to many of the sites and component features varies.

Shrine--In common usage a place of worship; the distinction, if one existed in the past, between shrines and temples (*heiau*) is not altogether clear and the present study follows Buck (1957:527-528), who defined a shrine as "a convenient term to designate a simple altar without a prepared court. They were made by individuals or small family groups who conducted a short ritual which required no priest."

Unknown Function---applies to remains where the function cannot be determined on available evidence.

5.0 SUMMARY OF FINDINGS

The historic properties identified for the inventory survey of the Astronomy Precinct include archaeological sites documented during previous archaeological reconnaissance surveys (McCoy 1982a, 1982b, 1984b, 1999a) as well as new sites found during the inventory survey fieldwork conducted in 2005 by Pacific Consulting Services, Inc. Background information for the previous reconnaissance surveys is presented below.

In 1982 the Bishop Museum conducted an archeological reconnaissance survey of ca. 1,000 acres of land on the summit and northern slope of the mountain, down to the 13,000-ft elevation. The survey area encompassed all of what was later to become the Astronomy Precinct (McCoy 1982a:Figs. 2.1, 2.2).

The 1982 survey was undertaken with the limited objective of determining the number, location, and formal/functional diversity of archaeological remains. Project area boundaries were set by the Hawaii Institute for Astronomy (IfA) to encompass the "maximum" areal extent of land judged to have the best viewing qualities for proposed and possible future telescopes. At IfA's request (Ginger Plasch, personal communication), the lower elevation limits of the survey area were extended to slightly below 13,000 ft. Few, if any, archaeological sites were predicted to occur within the boundaries of the project area, given the high altitude location and presumed absence of exploitable resources, including adze-quality stone, which on present evidence is restricted to the south slope of the mountain. The inherent biogeoclimatic constraints of the project area environment on human adaptation and exploitation are briefly described below.

The survey was carried out over a 51/2-day period between July 12 and 17, 1982, by Patrick C. McCoy (Field Director) and three assistants--Aki Sinoto, Ragnar Schousboe and Judy McCoy. Completion of fieldwork was delayed by rain, periodic snow flurries, and a thick, wet fog on July 16. Holly McEldowney volunteered her services on July 14 and 15. The size and topography of the project area (McCoy 1982a: Figs. 2.1, 2.2) combined with altitudinal constraints on work performance, were major factors in survey design and methodology. Thus, while there was ethnographic evidence to suggest the possible existence of human skeletal remains in buried contexts on the lower flanks of cinder cones, the massive size of these landforms and the instability of their steep-sided slopes effectively precluded the use of subsurface testing as a means of determining the presence or absence of burials or any other possible subsurface features. The survey was structured accordingly, with an emphasis on systematically examining those portions of the landscape most likely to reveal surface evidence of human exploitation and/or modification.

At the time of the 1982 survey much of the land surface above 13,000 ft was blanketed with snow. The snow limited vehicular access and caused additional fatigue, but its more important effect on the results of the survey, vis-a-vis the reduction in area coverage, is considered to be negligible. Snow patches of sufficiently large size and depth to constitute an "archaeological visibility problem" were primarily restricted to the steeper, north-facing slopes of the summit cones and deeper depressions between lava flow lobes (see McCoy 1982a: Figures 2. 7-2.9 and 2.13). Snow-free areas on these

same slopes and in topographically similar low-lying places were devoid of archaeological sites, and there is no reason to believe that any were concealed by the snow.

The glacially scoured and ' thus, relatively rubble-free tops of lava ridges and domes had little or no snow and provided the best means of traversing the landscape, in addition to serving as vantage points from which areas of lower relief in the immediate environs were easily scanned by eye or binoculars. Ridge tops were the focal point of the most intensive search for archaeological sites--and all of the sites recorded in this survey (see below) were, indeed, found in areas of high relief--the lateral flow margins and intervening areas of desert pavement and gelifluction features were examined in sufficient breadth to effectively minimize the sampling bias.

Site locations were established on the basis of altimeter readings (40-ft interval accuracy) and compass bearings, and plotted on the 7.5-minute U.S.G.S. Mauna Kea (1956) topographic map. A more recent (1978) orthophotoquad was also employed, but proved to be of little value. It should be noted that the 5-ft coutour map was not provided until after completion of fieldwork, thus seriously hampering our efforts to provide accurate locational data. A further constraint was the absence of staked project area boundaries. Site recording procedures included: (1) the preparation of tape and compass maps; (2) a description of topographic location, form, dimensions, construction materials and technique; and (3) photographic documentation. All of these field records are on file in the Department of Anthropology, Bernice P. Bishop Museum.

In 1995 the State Historic Preservation Division, with financial support from the Hawaii Institute for Astronomy, initiated a project designed to result in a historic preservation management plan for the Science Reserve. The first task, which was begun in 1995, involved the relocation and GPS locational mapping of the sites recorded in the 1982 and 1984 surveys. In the course of the fieldwork 18 new sites were found and recorded (McCoy 1999a). This number included one new shrine (Site 21447) and a small terrace of unknown function (21449) within the Astronomy Precinct. The latter site was excavated in 2008 (see Excavation Results).

The project summary that follows includes a discussion of field methods, limitations of the survey and findings. The findings include a description of all of the historic properties that were identified in the survey; artifacts collected during the fieldwork, and a summary of other cultural resources that were found and recorded. The latter encompasses parts of the built environment that are suspected of being less than 50 years old and thus do not qualify as historic properties under Chapter 6E and the National Historic Preservation Act of 1966.

5.1 Field Methods

This section presents details of survey and excavation methods used during the inventory survey for the Astronomy Precinct portion of the Mauna Kea Science Reserve.

5.1.1 Survey Methods

As noted in the summary of previous archaeological investigations, with the exception of the adze quarry research in 1975-76, all previous archaeological surveys in the Science Reserve have been reconnaissance surveys. In keeping with the definition

of reconnaissance surveys, the coverage was partial and selective, rather than intensive and complete. The emphasis was on systematically examining areas of the landscape most likely to reveal evidence of human activity. Based on the results of the earlier surveys, ridge tops and other areas of high relief were the focal points of the most intensive search for sites, since this is where the vast majority of sites have been found. Apart from this fact, the tops of lava ridges and lava domes also provide excellent vantage points from which to scan the terrain below with the eye or binoculars. It is important to note in this regard that "archaeological visibility" in the summit region, indeed on the whole top of the mountain above the tree line, is exceptionally good. Areas of low relief, such as the glacial outwash plains and moraines, can be scanned very quickly to determine the presence/absence of historic sites.

The 2005 survey employed the use of systematic transects, following either a set azimuth or more often, topographic features (ridge tops) to ensure that the coverage was as complete as possible. The spacing of individuals within transects varied and was determined by the kinds of landforms present in a given area. In open areas with no rock outcrops, individual crew members were more widely spaced, whereas areas of relief will require closer spacing.

The practice in all previous archaeological surveys in the Science Reserve has been to **not** test possible burial features to determine the presence/absence of human remains. This same practice was adhered to in this project. The result will be that all such features will continue to be classified as "possible burials."

Previously identified sites in the Astronomy Precinct were relocated using GPS locational data recorded by SHPD in 1995 and 1997. New GPS readings were taken at all sites in 2005. Field observations were recorded on a Site Recording Form created for this survey. Digital photographs were taken of all sites. The general location and direction of each photograph was marked on site maps to serve as photographic reference points. The purpose in establishing such points is to provide future land managers and researchers with a guide for taking new photographs from the same places on a site to assist in the monitoring of changes in site condition.

Though not included in the scope of work (SOW), the survey continued the practice, begun by former SHPD staff in a reconnaissance survey of selected areas of the Mauna Kea Science Reserve, in 1997, of recording cultural remains that are either obviously modern or cannot be classified with any level of confidence as historic properties because of their uncertain age and/or function (e.g., one stone or several stones on top of a boulder). The recording of these remains is part of a resource management strategy aimed at obtaining baseline data with which to evaluate long-term changes to the cultural landscape in the Mauna Kea Science Reserve.

5.1.2 Excavation Methods

A single 1.0 m by 1.0 m test excavation unit was placed adjacent to the interior face of the possible terrace facing at Site 21449. The unit was positioned to include a portion of the possible facing and the level area south of the facing in order to determine the absence or presence of subsurface cultural materials, features, and layers. Standard excavation procedures were used during testing and included screening all excavated material in a 1/8 inch-mesh screen. Excavations were conducted by natural stratigraphic layers and arbitrary 10 cm levels within each layer. All soils and sediments were

documented and described based on standard USDA soil descriptions; including soil color (Munsell 2000), texture, consistency, and plasticity (Schoenenberger et al. 1998). Color photographs were taken before, during, and after excavation.

5.1.3 Limitations of the Survey

In addition to the usual effects of high altitude on work performance, both mental and physical, day-time temperatures during the entire 6-day project commonly remained in the 30s and 40s (in degrees Fahrenheit). Almost constant winds made field conditions even more uncomfortable. While the weather was less than ideal and did not prevent the survey from being finished, it presented problems in terms of mapping and writing field notes and may have contributed to more than the usual amount of mental errors that are difficult to avoid at high elevations.

Though the whole project area was surveyed repeatedly (McCoy 1982a, 1982b, 1999a) at a very high level of intensity, it is impossible to claim, as is the common practice in Hawaiian archaeological inventory surveys, that all cultural remains were identified and recorded. The authors agree with George Cowgill that it is a mistake to think that an archaeological survey, surface collection or excavation is ever "total" or complete in terms of, for example, identifying or recovering every single artifact (Cowgill 1986; 1989).

5.1.4 Consultation

Ethnographic studies conducted for Mauna Kea by Maly and Maly (2005) mention the adze quarry and the summit region where the Astronomy Precinct is located, but no one interviewed by Maly and Maly remembered any information regarding the archaeological sites on Mauna Kea (e.g., shrines, rock shelters). Maly and Maly did talk to several individuals who worked on the construction of the summit road during the 1960s and these individuals did not recall seeing any burials or other cultural sites during road grading and excavation activities (Maly and Maly 2005). For the most part, people interviewed knew about the adze quarry and remembered the legend of Papa and Wakea associated with Mauna Kea. Information about archaeological sites and the activities that occurred on the summit, however, was not obtained during Maly and Maly's interviews, and it is believed that this information is no longer available.

Extensive consultation for the draft Cultural Resources Management Plan (CRMP- McCoy et al. 2009) was conducted between 2007 and 2009. No information regarding archaeological sites and historic activities on the summit was obtained during this consultation.

5.2 Survey Findings

Six archaeological sites are located within the boundaries of the Astronomy Precinct. These include previously recorded sites 16166, 16167, 16169, and 16172, and newly recorded sites 21447 and 21449. A group of four newly recorded shrines (Sites 21441, 21442, 21443, and 21444) are located just outside of the 2005 survey area boundaries, relatively close to the northwestern corner of the Astronomy Precinct (Figure 5.1; Table 5.1).

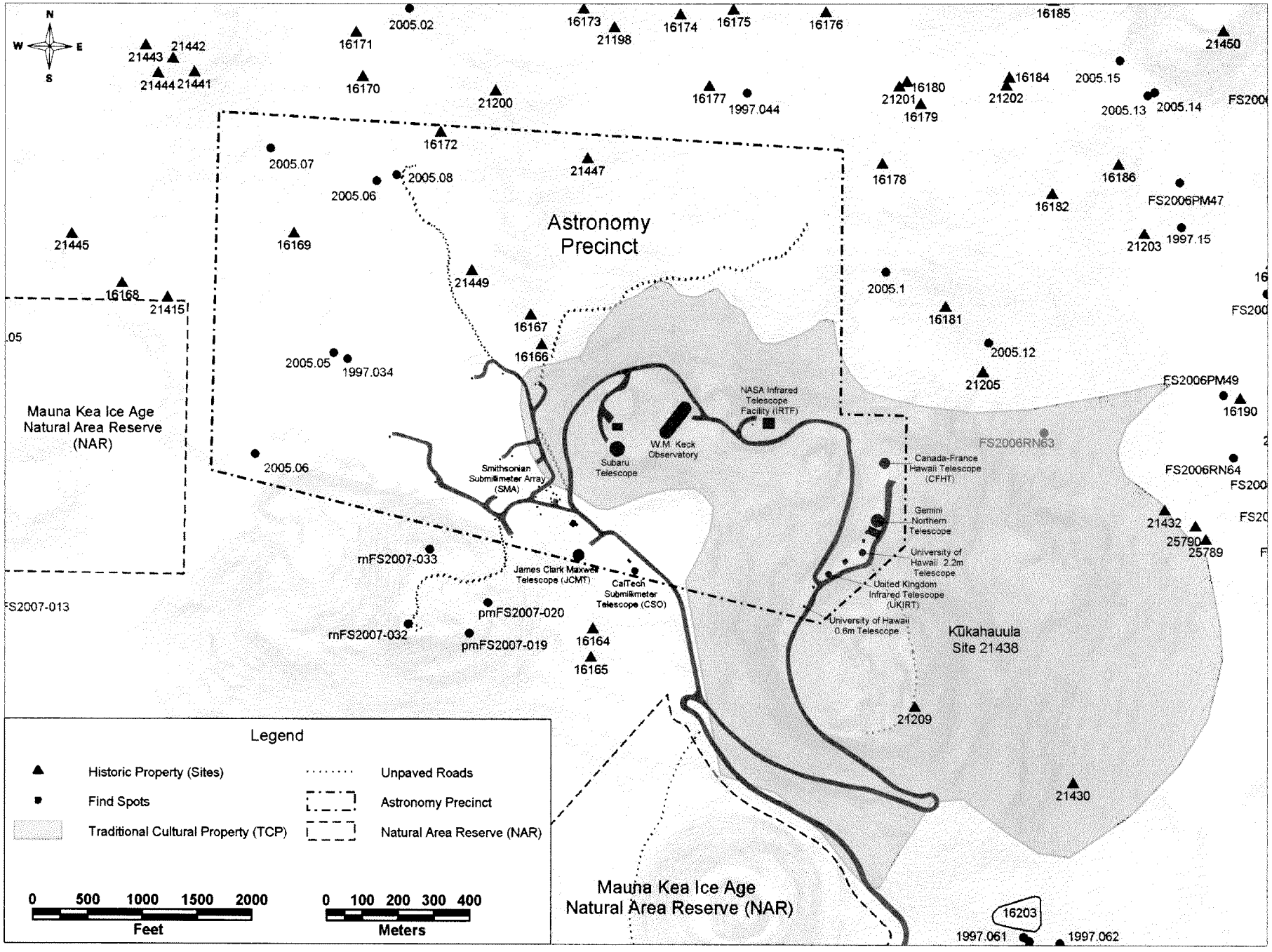


Figure 5.1. Location of Historic Properties and Find Spots in the Astronomy Precinct and Surrounding Areas.

Table 5.1. Previously and Newly Recorded Archaeological Sites in the Astronomy Precinct.

State Site No. 50-10-23-	Site Type	Site Function
Previously Recorded Archaeological Sites		
16166	2 rows of uprights, 8 to possibly 9 total	Shrine
16167	Single row of 2 uprights	Shrine
16169	Single row of 2 uprights	Shrine
16172	Single Upright	Shrine
Newly Recorded Archaeological Sites		
21447	Single Upright	Shrine
21449	Terrace	Unknown

Four previously identified sites and one previously identified find-spot were relocated in the survey area (see Figure 5.1 and Table 5.1). The previously identified sites, all of which were found during the 1982 reconnaissance survey (McCoy and McEldowney 1982), were evaluated in terms of the completeness and adequacy of the existing maps and descriptions. A number of the maps were either redrawn or annotated with new observations.

5.2.1 Historic Properties

This section presents descriptions of archaeological sites as well as traditional cultural properties, both of which are defined as historic properties.

5.2.1.1 Archaeological Sites

The archaeological site descriptions include both the previously recorded four sites and the two new sites found during the 2005 field season. Each site description includes a summary table of general site characteristics, such as topographic location and elevation, type and function, number of features, the date when the site was first recorded and subsequent updates. This is followed by a narrative description of each site and tables summarizing the attribute data for each upright on multi-upright shrines.

STATE SITE 50-10-23-16166

Additional Site Numbers: State: Site 50-10-23-5224 BPBM: 50-Ha-G28-42	
Site Function: Shrine	**Number of Features:** 2
Date First Recorded: 1982	**Subsequent Site Visits:** 1995; 1999; 2005
2005 GPS Data: Garmin Point 06	**Topographic Location:** Ridge flank (slope margin)
Site Dimensions: 9.0 m by 3.0 m	**Approximate Elevation:** 13,387 ft

	a.m.s.l.
Current Status: The basalt flake found during the 1982 survey has been moved upslope closer to Feature 2.	

Description

Site 16166 was first recorded in 1982 as a multi-feature shrine with a total of 8, possibly 9 uprights arranged in two groups (Table 5.2). The site is located in central portions of the Astronomy Precinct on top of a steep-sided ridge (lava flow margin) that partially mantles the western flank of Pu'u Hau Oki (see Figure 5.1). In the original site report (McCoy 1982a) the feature on the north was referred to as Feature 1 and the one to the south as Feature 2. In 1999, when the site was revisited, the feature designations were reversed and the uprights numbered sequentially for the whole site (Figure 5.2).

Feature 1 is a poorly defined, roughly 2.0 m long alignment with 3, possibly 4, uprights (#1-4) on the eastern edge of the ridge top (see Figure 5.2). Remnants of two foundations are noted by two small (adjacent) rubble piles (see Figure 5.2). When the site was revisited in 1999 it was noted that several of the uprights had been reset in a vertical position along the edge of the outcrop.

Table 5.2. Site 16166 Upright Data

Feature/	Upright		Upright Form			Upright Dimensions (cm)		
Upright #	Foundation	Material	Body	Treatment	Top	Ht	Wd	Th
1/1[E]	Bedrock Crack	T	S	-	Beveled	40	20	6
1/2[E]	Bedrock Crack	T	D	-	Pointed	34	20	12
1/3	Bedrock Crack	N	I	-	Pointed	53	20	15
¼	Bedrock Surface	N	P	-	Rounded	48	16	17
2/5	Bedrock Surface	T	P	-	Beveled	34	13	12
2/6[E]	Bedrock Crack	T	D	-	Pointed	23	25	10
2/7[E]	Bedrock Crack	T	P	3	Beveled	39	26	10
2/8	Bedrock Surface	T	P	-	Beveled	49	18	14
2/9	Bedrock Surface	T	P	-	Pointed	56	10	15

Feature/Upright # = Feature/Upright Number; [E] = Upright is erect; Material: T = tabular, N = non-tabular; Body Form: P = parallel, S = sub-parallel, D = divergent, C = convergent, I = irregular; Treatment: 1 = shouldered, 2 = unilateral flanged, 3 = corner notched, 4 = side notched, 5 = knobbed; **BOLD** = Possible Upright

Feature 2 is located approximately 3.0 m north of Feature 1 at the northern edge of the ridge top (see Figure 5.2). It consists of a natural depression filled to ground level with 0.1 to 0.3 m size chunks of scoriaceous lava to form a roughly square "pavement" measuring 2.3 m by 2.2 m. Four aligned and essentially *in situ* upright stones (#5-8), spaced 0.2 to 0.4 m apart, were found along the north edge of the "pavement"; a fifth displaced upright (#9) is located on the rubble slope immediately below the others

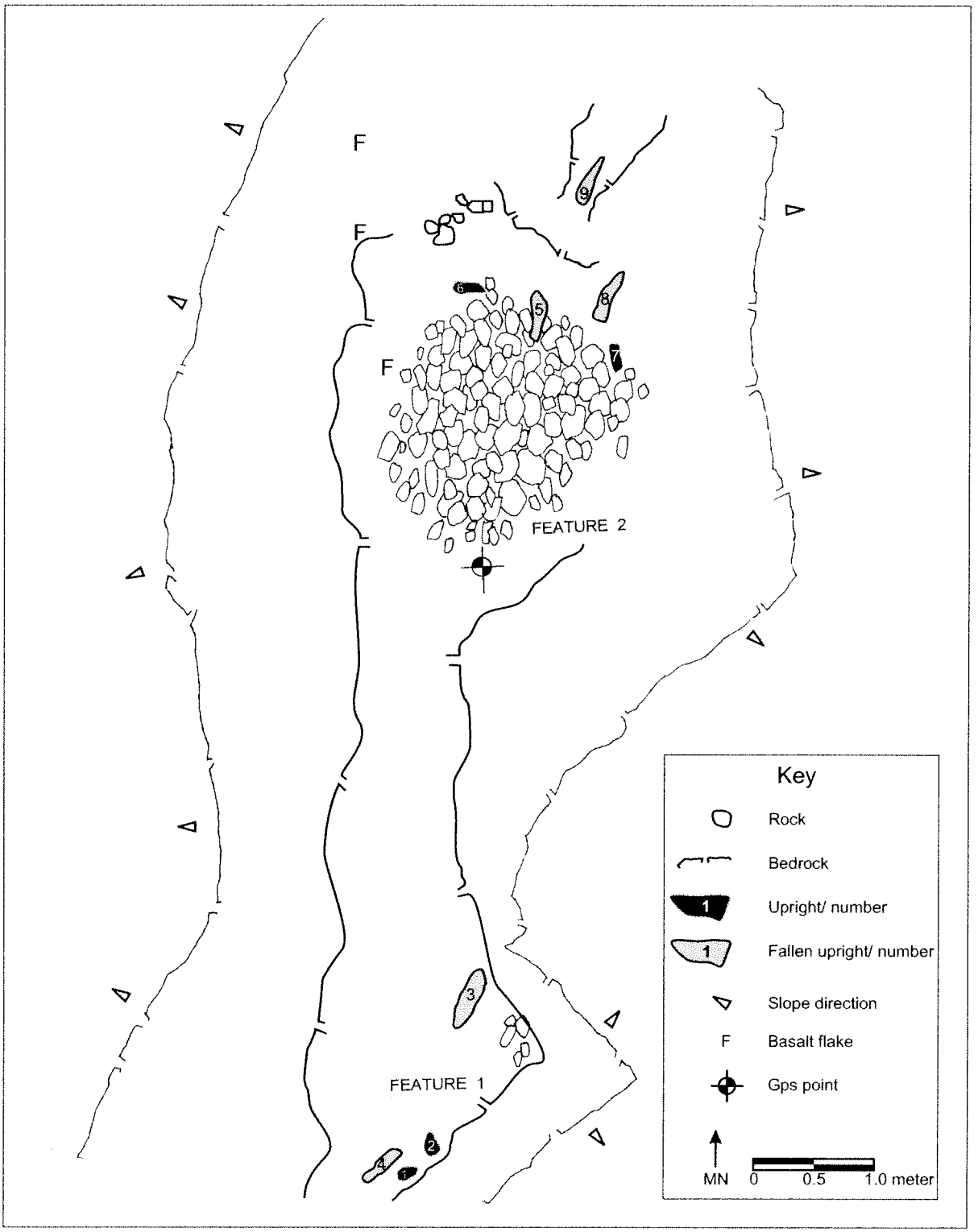


Figure 5.2. Site 16166, Features 1and 2, Plan View.

(Figure 5.2). Their location on the edge of the "pavement" (the "altar") indicates that the approach to this feature would have been from the south.

During the original survey (1982) a piece of flaked basalt measuring 15 cm by 10 cm was found approximately 2.0 m northwest of Upright #6. A second piece of worked basalt was found on the western edge of the "pavement" when the site was revisited in 1999. These are the only pieces of flaked stone found on a shrine in the Science Reserve, other than those associated with several adze manufacturing workshops on the eastern margins of the adze quarry (Sites 11079, 16163, 16203, 16204, and 21211). The material differs from that in the quarry and is probably from the local area.

STATE SITE 50-10-23-16167

Additional Site Numbers: State: Site 50-10-23-5225 BPBM: 50-Ha-G28-43	
Site Function: Shrine	**Number of Features:** 1
Date First Recorded: 1982	**Subsequent Site Visits:** 1995; 1999; 2005
2005 GPS Data: Trimble R082918a	**Topographic Location:** Ridge crest (toe)
Site Dimensions: 1.0 m by 1.0 m	**Approximate Elevation:** 13,354 ft a.m.s.l.
Current Status: Altered. The second upright has fallen since 1995.	

Description

Site 16167 was first recorded in 1982 as a shrine with one, possibly two, uprights placed in a bedrock crack (Figure 5.3). It is located approximately 100 m north and downslope of Site 16166 in central portions of the Astronomy Precinct (see Figure 5.1). In 1982, the one upright (# 1) was found in a vertical position, while the second, probable, upright was not (Table 5.3). In 1995 the site was revisited and both stones were found in a vertical position, thus indicating that someone had erected the probable second upright. Both uprights are non-tabular pieces of scoriaceous lava of the same general shape and nearly identical dimensions. The resurvey in 1995 concluded that the second stone should also be regarded as an upright. Approximately six cobbles, measuring 15 to 20 cm in size, form the base of the shrine, which measures 0.85 by 0.55 m.

Table 5.3. Site 16167 Upright Data

Feature/ Upright #	Upright		Upright Form			Upright Dimensions (cm)		
	Foundation	Material	Body	Top	Treatment	Ht	Wd	Th
1/1[E]	Bedrock Crack	N	S	-	Gabled	55	25	14
½	Bedrock Crack	N	I	-	Pointed	54	21	14

Feature/Upright # = Feature/Upright Number; [E] = Upright is erect; Material: T = tabular, N = non-tabular; Body Form: P = parallel, S = sub-parallel, D = divergent, C = convergent, I = irregular; Treatment: 1 = shouldered, 2 = unilateral flanged, 3 = corner notched, 4 = side notched, 5 = knobbed; **BOLD** = Possible Upright

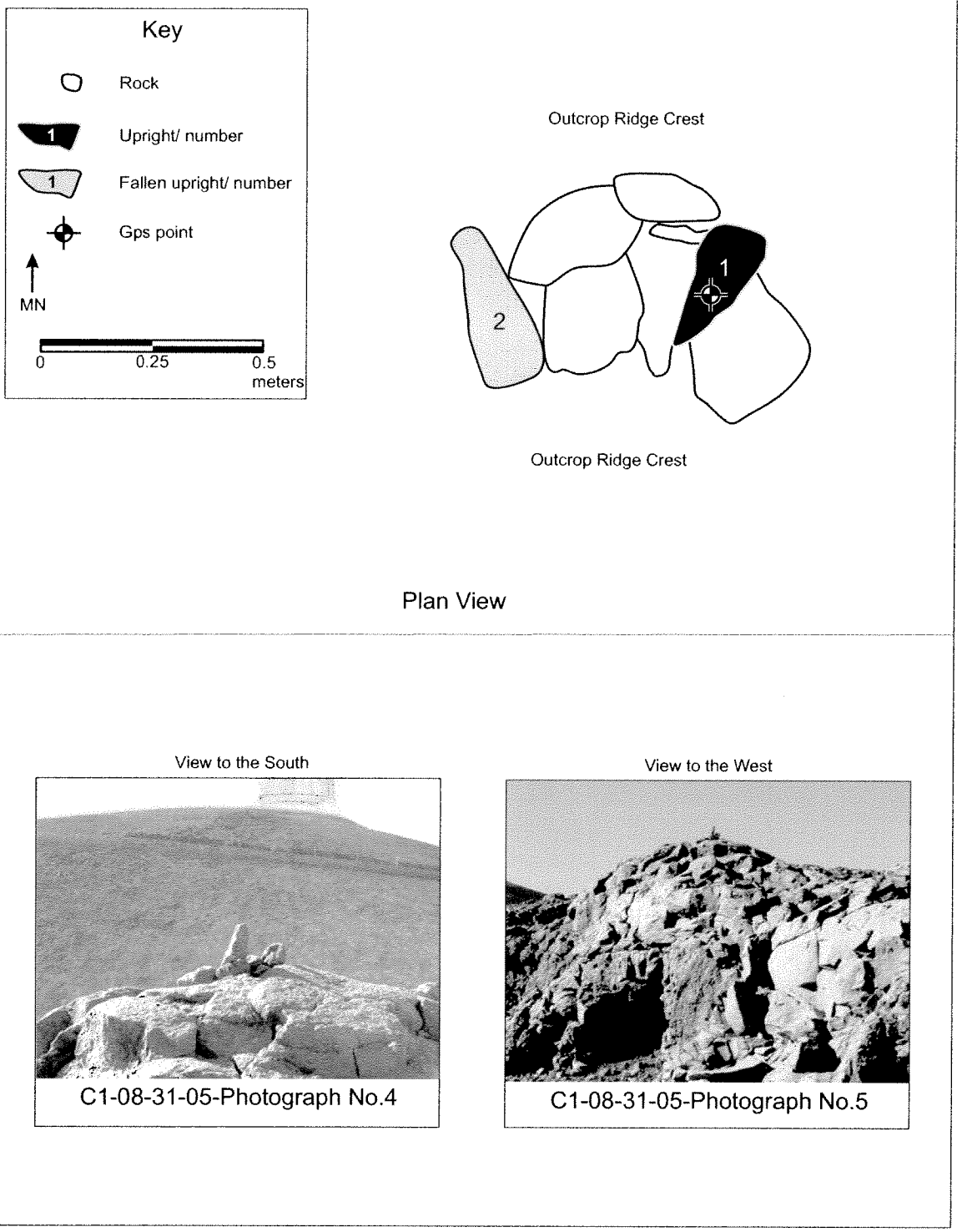


Figure 5.3. Site 16167, Plan View and Photographs.

STATE SITE 50-10-23-16169

Additional Site Numbers: State Site: 50-10-23-5227 BPBM: 50-Ha-G28-45	
Site Function: Shrine	**Number of Features:** 1
Date First Recorded: 1982	**Subsequent Site Visits:** 1995; 2005
2005 GPS Data: Garmin Point 016	**Topographic Location:** Ridge crest (summit)
Site Dimensions: 1.75 m by 1.0 m	**Approximate Elevation:** 13,202 ft a.m.s.l.
Current Status: Change in Upright #2 material type.	

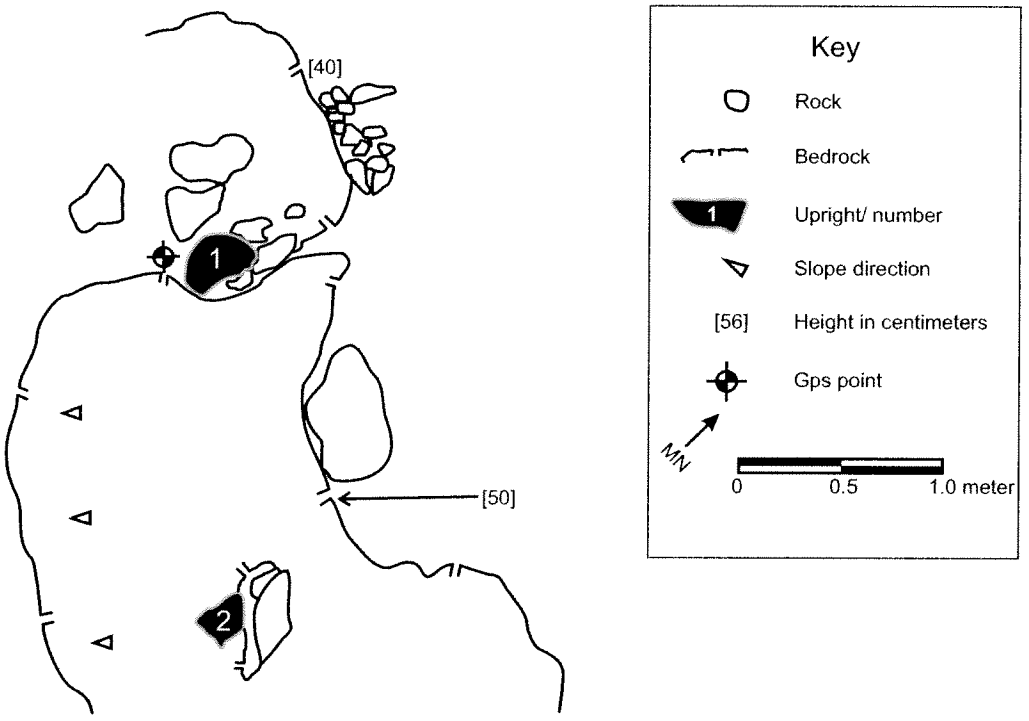
Description

Site 16169, first recorded in 1982, is located in the northwest quadrant of the Astronomy Precinct, on the top of a narrow (15.0 to 20.0 m wide) and relatively low (4.0 to 5.0 m high) ridge that trends northwest-southeast (see Figure 5.1). The site consists of two uprights set 1.66 m apart, and are similarly oriented (northwest-southeast) parallel to the direction of the lava flow (Figure 5.4). The northern upright (Upright 1 in Table 5.4) is located on the bedrock surface and braced by a few cobbles. Upright 2, on the south, is securely wedged into a crack in the bedrock.

Table 5.4. Site 16169 Upright Data

Feature/	Upright		Upright Form			Upright Dimensions (cm)		
Upright #	Foundation	Material	Body	Treatment	Top	Ht	Wd	Th
1/1[E]	Bedrock Surface	N	P	-	Beveled	71	30	21
1/2[E]	Bedrock Crack	T	D	4	Pointed	62	28	12

Feature/Upright # = Feature/Upright Number; [E] = Upright is erect; Material: T = tabular, N = non-tabular; Body Form: P = parallel, S = sub-parallel, D = divergent, C = convergent, I = irregular; Treatment: 1 = shouldered, 2 = unilateral flanged, 3 = corner notched, 4 = side notched, 5 = knobbed; **BOLD** = Possible Upright



Plan View

View to the Northwest



C4-08-31-05-Photograph No. 47

Figure 5.4. Site 16169, Plan View and Photograph.

STATE SITE 50-10-23-16172

Additional Site Numbers: State Site: 50-10-23-5230 BPBM: 50-Ha-G28-48	
Site Function: Shrine	**Number of Features:** 1
Date First Recorded: 1982	**Subsequent Site Visits:** 1995; 2005
2005 GPS Data: Garmin Point 07	**Topographic Location:** Ridge crest (summit)
Site Dimensions: 1.0 m by 1.0 m	**Approximate Elevation:** 13,240 ft a.m.s.l.
Current Status: No change.	

Description

Site 16172 was first recorded in 1982 as single upright with several support stones (Figure 5.5). Later in the same year Dr. Frank Howarth, Bishop Museum entomologist, reported seeing a crude C-shaped structure and other walls in this general area. None of these walls were observed during the 1995 or 2005 re-examination of the site.



Figure 5.5. Photograph of Site 16172, Shrine.

STATE SITE 50-10-23-21447

Additional Site Numbers: Temporary: 2005-07	
Site Function: Shrine	**Number of Features:** 1
Date First Recorded: 2005	**Subsequent Site Visits:**
2005 GPS Data: Garmin Point 024	**Topographic Location:** Ridge crest (toe)
Site Dimensions: 1.0 m by 1.0 m	**Approximate Elevation:** 13,136 ft a.m.s.l.
Current Status: New site.	

Description

Site 21447 is located on a ridge crest in north central portion of the Astronomy Precinct. It consists of a small upright [erect] placed in a crack with 2-3 support cobbles (Figure 5.6).

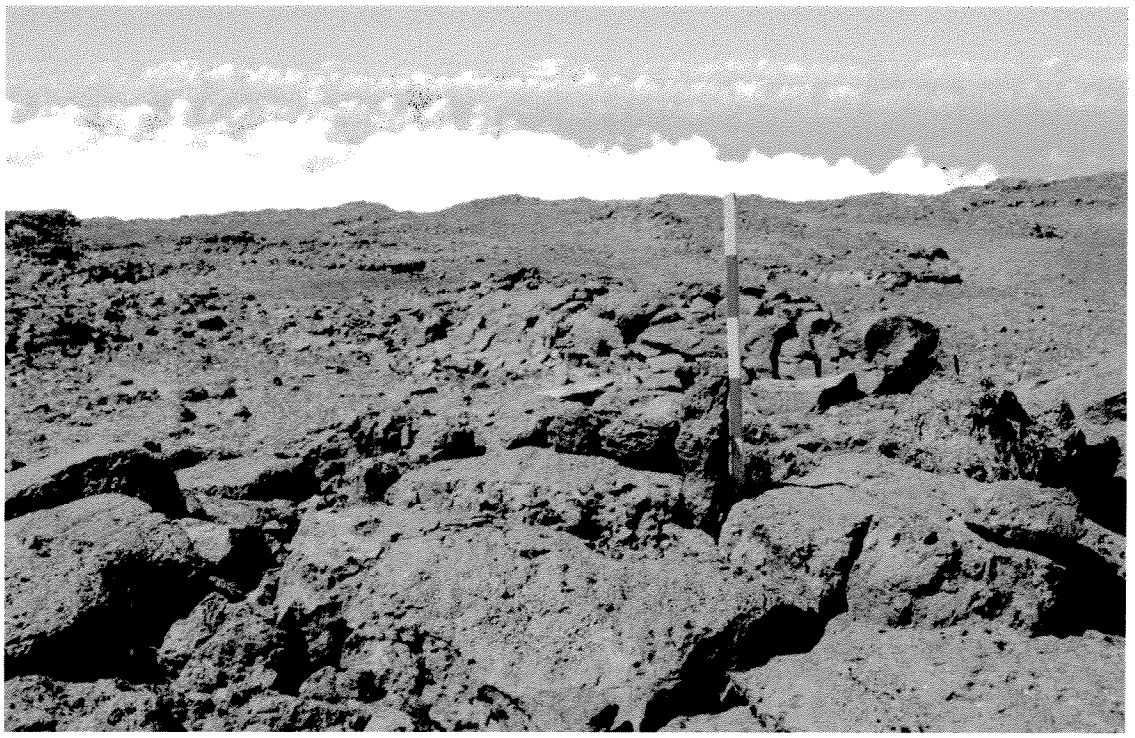


Figure 5.6. Photograph of Site 21447, Shrine.

STATE SITE 50-10-23-21449

Additional Site Numbers: Temporary: 2005-09	
Site Function: Terrace	**Number of Features:** 1
Date First Recorded: 2005	**Subsequent Site Visits:**
2005 GPS Data: Garmin Point 025	**Topographic Location:** Gelifluction terrace
Site Dimensions: 3.0 m by 1.5 m	**Approximate Elevation:** 13,029 ft a.m.s.l.
Current Status: New site.	

Description

Site 21449, a terrace, is located approximately 200 m northwest of Site 16167 in central portions of the Astronomy Precinct, and 50 m east of "13 North Road" (see Figure 5.1) The site is located on a small gelifluction terrace on the side of a ridge. The edge of the ridge forms the east and west sides of the terrace.

The terrace is constructed of stacked cobbles and small boulders (2-3 courses) and measures approximately 1.8 m long, 1.3 m wide and 0.5 m high (Figure 5.7). The lower end on the north is faced. The terrace surface consists of cobbles, small boulders, and thin flat slabs, which do not occur in the immediate area and must therefore have been introduced. Soil is present along the southeast edge of the terrace. The terrace and soil area together measure 2.5 m long by 1.3 m wide. No cultural material is present on the terrace or surrounding area. The function of this site is unknown.

5.2.1.2 Traditional Cultural Properties

In 1999 the State Historic Preservation Division designated K• kahau'ula (the traditional name of the summit), Pu'u L•l•noe and Pu`u Waiau (see Figure 5.1) traditional cultural properties based on legendary information and cultural practices. Each area was given a Statewide Inventory of Historic Places (SIHP) number: K• kahau'ula (50-10-23-21438); Pu'u L•l•noe (50-1-23-21439) and Pu`u Waiau (50-1-23-21440). K• kahau'ula and Pu`u L•l•noe are located in the Science Reserve, while Pu`u Waiau is located just outside of the Science Reserve in the Mauna Kea Ice Age Natural Area Reserve. A portion of K• kahau'ula falls within the boundaries of the Astronomy Precinct (see Figure 5.1).

Traditional cultural properties are a type of historic property that was formally defined for the first time in 1998 by Patricia Parker and Thomas King, in National Register Bulletin 38 (*Guidelines for Evaluating and Documenting Traditional Cultural Properties*). TCP's, to use the commonly used acronym, were defined by Parker and King defined as follows:

> A traditional cultural property, then, can be defined generally as one that is eligible for inclusion in the National Register because of its association

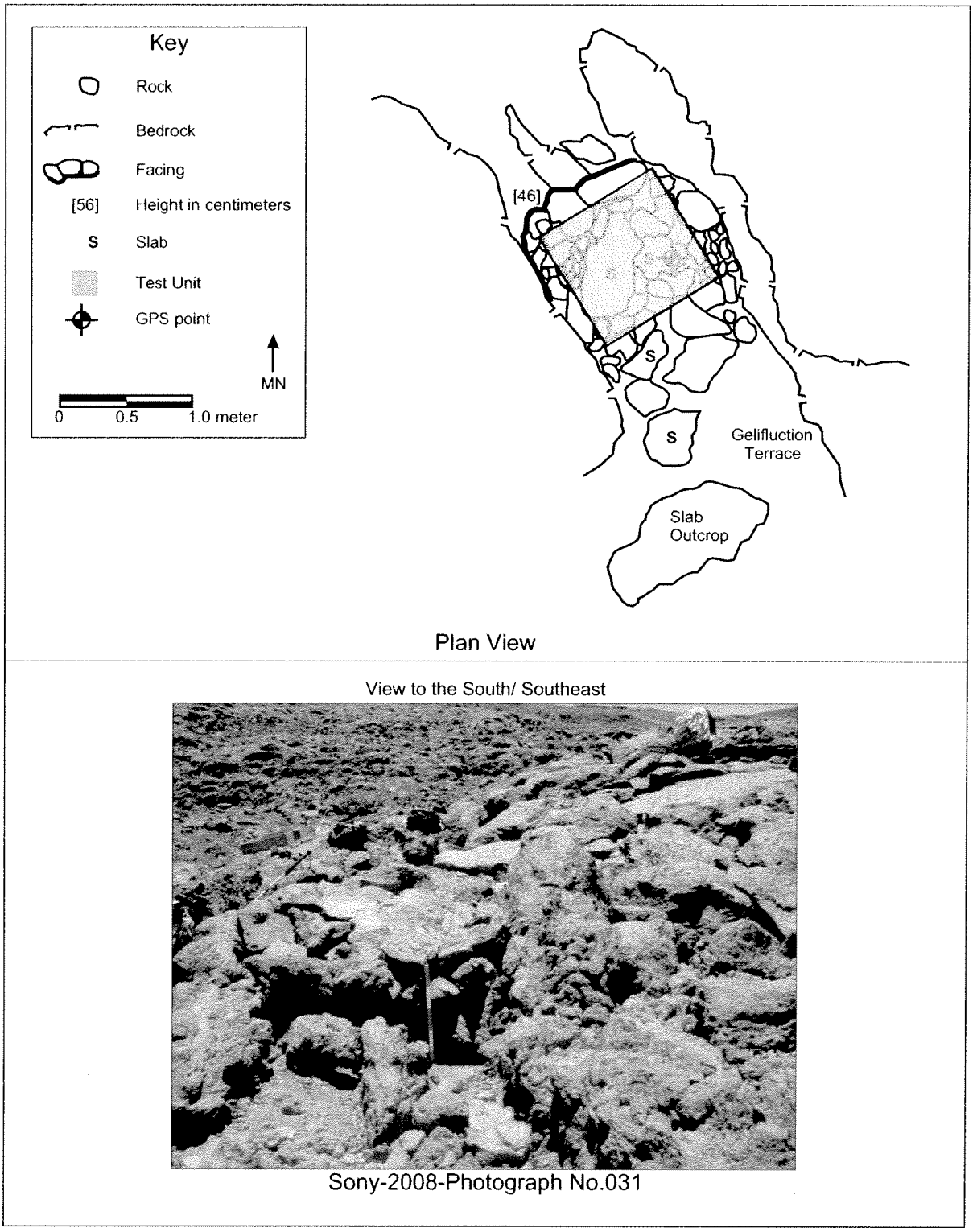


Figure 5.7. Site 21449, Plan View and Photograph.

with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King 1998:1).

Parker (1993) notes that an important difference between traditional cultural properties and other kinds of historic properties is that the significance of a TCP "cannot be determined solely by historians, ethnographers, ethnohistorians, ethnobotanists, and other professionals. The significance of traditional cultural properties must be determined by the community that values them" (Parker 1993:5). The Hawaiian oral traditions summarized in Section 2.2.3 testify to the importance of Mauna Kea and the summit in particular.

The cultural significance of Kukahau`ula was highlighted in a Chapter 6E-8 and Section 106 review of the proposed Keck Outrigger project by SHPD in 1999 (Hibbard 1999). Relevant portions of the review letter [which is included in the CRMP as Appendix B] are presented below, without the references that appeared in the formal letter:

> As you are aware, we are currently reviewing historical, ethnographic, archaeological information on Mauna Kea in the process of preparing an historic preservation plan for the Science Reserve which includes the summit region. During this process, we have come to believe that the cluster of cinder cones which merge and collectively form the summit of Mauna Kea is an historic property and that this single landscape feature probably bore the name Kukahau`ula. This single landscape feature is now called Pu`u Hau Oki, Pu`u Kea, and Pu`u Wekiu. Several lines of evidence lead us to the conclusion that the cluster of cones is an historic property. These will be discussed in more detail in documents being prepared for the preservation plan. The first line of evidence indicating the cultural and historical importance of the summit is that, at a minimum, some portion of the summit cluster bore the name Kukahau`ula who appears as a character in recorded Hawaiian traditions and as a figure in legends about Mauna Kea. As a character in traditional histories and genealogies, he is the husband of Lilinoe and is named as an *`aumakua* (family deity) of fishermen. A descendant, Pae, was known as an exceptional fisherman whose bones were coveted for fishhooks by the paramount chief Umi. In one legend, Kukahau`ula is cast in a more fanciful role as the suitor or husband of Poliahu, the deity of snow and, poetically, his name is said to allude to the pink hue that can be seen reflecting from the snow-covered summit. Lilinoe plays a similar role in the mountain's traditions in that she appears both as a traditional character and a mythical figure. She is, however, even more frequently associated with the summit region of Mauna Kea. In addition to being the wife of Kukahau`ula in some traditions, she is said to have been buried near the summit and is called the "woman of the mountain." One tradition has her being an ancestor of the illustrious Mahi family who served as warriors and attendants to the paramount *ali`i* of Hawaii Island. In legends, Lilinoe becomes the embodiment of fine mist, the literal meaning of her name, and as such is the companion or sister of Poliahu.

The names Kukahau`ula and Lilinoe are both attributed to cinder cones in the summit region: Kukahau`ula to the summit and Lilinoe to a cone immediately to the southeast of the summit cluster. These names, along with that of Waiau, appear on the earliest reliable maps in 1884 and are repeated in the next survey of the summit region in 1892. Kukahau`ula is given as the name of "the highest peak" even earlier in 1873 land boundary testimonies. Of all the place names in the summit region, these three are applied the earliest and most consistently to specific landmarks on the mountain. In compiling the 1892 map of Mauna Kea, W.D. Alexander refers to these as "genuine native names." The place name Poliahu appears in traditions and native testimonies as being applied to a trail, spring, pond, and cave, but it is not consistently applied to a single and identifiable landscape feature until 1892 when W.D. Alexander proposes attaching this name to "a nameless peak" in honor of the demigoddes, Poliahu, who appears in the tale of Laieikawai.

While the association between the summit and Kukahau`ula is sufficiently clear, it is not as clear which specific topographic features in the summit the name encompasses. The conclusions drawn here that Kukahau`ula, and thus its association with a significant individual and character, probably applied to the entire summit cluster relies on four major arguments. First, use of the name Pu`u o Kukahau`ula in the boundary testimonies and in subsequent notes of field surveys indicates that the name was applied, at a minimum, to the cinder cone (i.e., *pu`u*) as a whole and not just to the highest peak or what would generally be considered the summit in English usage. Second, on the early survey maps (i.e., 1884 to 1891 and 1891), the name Kukahau`ula is written to the east of the cluster of cones and is not immediately associated with a particular point. In contrast, the highest point on the mountain on these maps is labeled the "summit" and "summit cone" and the triangulation marker on the northeastern peak of the cluster is labeled "Mauna Kea."

The third argument is that place names attributed to the summit cluster are relatively modern because these cones were not differentiated by name until after the 1920s. The name Pu`u Kea, the northeasternmost cone of the three, first appears in 1937 when commemorative names, such as Macrae, Douglas and Goodrich, were given to other unnamed cones. The names Pu`u Wekiu for the southernmost cone in the cluster and Pu`u Hau Oki for the westernmost of the three, were recorded by Forester L.W. Bryan in the 1920s and were officially adopted by the Advisory Committee on Geographic Names in 1974. Another factor suggesting the relatively modern origin of these three names is that all are highly descriptive in nature, particularly in contrast to those older names which tend to be associated with traditional or legendary characters. Pu`u Hau`oki literally means "frosty peak," Pu`u Kea means "white peak," and Pu`u Wekiu means "summit peak." Finally, from most angles of approach, the three cones have the appearance of a single, although uneven and complex, landscape feature. It is only after a more thorough examination of this feature that one, if so inclined, would begin to differentiate particular cinder slopes with their associated crater

features. Most early historic accounts of visits to the summit essentially describe the summit as a single feature with some parts being higher than others. This is also reflected in the early survey maps which, through hatch marks, depict the cluster of cones as a single unit. At this time, it can not be known with certainly how Hawaiians during the early historic period and their predecessors would have viewed the cluster or what purposes they may have had to make and name particular distinctions within the cluster. Given the unified appearance of the cluster and the prominence of the name Kukahau`ula, however, it seems reasonable, if not probable, that this name applied to this entire landscape feature, including that which is now called Pu`u Hau Oki.

Another line of evidence indicating the summit cluster was of particular and singular significance can be drawn from the archaeological data. The distribution of know shrine locations essentially radiates, at various distances, outward from the base of the summit cluster. This suggests that the summit cluster could have been the central focus of ritual observances and that part of these observances was to avoid or stop short of this central feature. This is further supported by there being no records, with one possible exception (i.e., a 1935 photograph of a slab at the summit peak), of shrines on the summit cluster. This practice of avoiding or staying outside that area of greatest significance is common in many religious observances recorded throughout the world. Thus the summit cluster could have been a focal point of the presumably long journey to the summit region. An avoidance of the summit, or the summit region as a whole, for fear of the spiritual nature of this area may be one explanation for the number of times native Hawaiian guides refused or found excuses not to accompany early historic visitors to the summit. In discussing this tour of Hawaii Island in 1823, missionary William Ellis was told "numerous fabulous tales relative to its [Mauna Kea] being the abode of the gods, and none ever approach its summit..."

Traditional cultural properties, like all historic properties, must have boundaries. As Parker notes, however, "Many, if not most, traditional cultural properties, were and are simply not meant to have lines drawn around them marking where they begin and where they end. Trying to do so can lead to some fairly bizarre and artificial constructs" (Parker 1993:4). Parker goes on to give a hypothetical example of a Native American vision quest site on a mountain top in terms of how the boundaries can be narrowly defined from one point of view and encompass a vast area from the perspective of potential effects on the property. She writes, "The boundaries of a mountain top on which religious practitioners seek visions could be drawn around the toes of a person sitting on it, but the area of potential effect could include everything within that person's viewshed" (Parker 1993:4).

The boundaries of the three TCP's on Mauna Kea were drawn based on geological boundaries of the cinder cones (Wolfe et al. 1997: Plate 2) and in the case of the summit a series of overlapping, contiguous cinder cones which include Pu`u Wekiu, Pu`u Kea, Pu`u Hau Oki and at least one other unnamed cone (see Figures 3.6 and 3.7). In the case of Kukahau`ula, the boundaries are also based in part on the near total absence of archaeological sites on the summit. The summit thus stands out from the

rest of the cultural landscape which is dotted with shrines and other cultural remains as summarized above.

5.2.2 Other Cultural Resources (Find-Spots)

"Find spots" are cultural resources that are either obviously modern features (e.g., camp sites with tin cans, pieces of glass and other modern material culture items), or features that cannot be classified with any level of confidence as historic sites because of their uncertain age and function (e.g., a pile of stones on a boulder). Seven find-spots were identified in the Astronomy Precinct in 2005 (see Figure 5.1; Table 5.5), including a previously identified find-spot found during a 1997 survey (McCoy 1999a). This find-spot was relocated during the 2005 survey. The number of such finds, which

Table 5.5. Previously and Newly Recorded Find-Spots in the Astronomy Precinct.

Year. No.	Approximate Elevation (ft. asl)	Description	Function
Previously Recorded Find-Spots			
1997.07	13,308	Stacked (2) rocks on a boulder	Marker
Newly Recorded Find-Spots			
2005.03	13,271	Stacked (3) rocks	Marker
2005.05	13,220	Stacked rocks	Marker
2005.06	13,202	Possible upright	Unknown
2005.07	13,000	Possible uprights	Unknown
2005.08	13,140	Two uprights near weather station	Unknown
2005.09	13,016	Stacked rocks	Marker

the State Historic Preservation Division (SHPD) first started to record in 1997 as a way of tracking changes in the cultural landscape and distinguishing old from new cultural remains ("sites"), appears to be increasing, especially in areas close to existing roads.

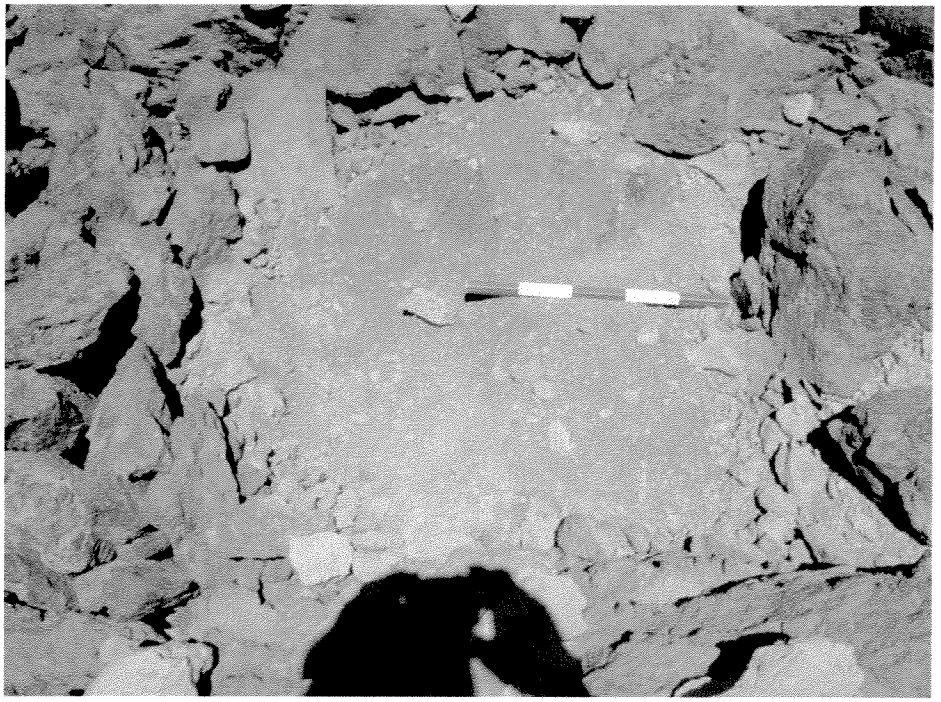
5.2.3 Excavation Results for Site 21449

This section presents the results of the archaeological excavation of Test Unit 1 (TU1) at Site 21449, a terrace. This site was tested to determine the presence/absence of cultural materials and to hopefully obtain information that would aid in determining the site's function. Test Unit 1 measured 1.0 by 1.0 m and was positioned to remove a portion of the possible facing and the level area behind (south of) the facing in order to determine the presence / absence of subsurface cultural materials and features. Surface slabs and cobbles of this feature, as well as underlying stratigraphic components, were documented.

Initially, the one to two courses of locally occurring angular basalt slabs and cobbles were removed. Two naturally occurring stratigraphic components were documented under the slabs and cobbles (Table 5.6; Figure 5.8). Layer I, yellowish brown silty sand, was found primarily in the southern portion of TU1. Layer II, brown to dark brown sandy silt, was encountered in the northern portion of TU1. Excavations were halted when basalt bedrock was encountered at approximately 25 centimeters below surface. A profile was not drawn due to the nature of the matrix, but Figure 5.6 presents photographs of TU1 after excavation.



Removing surface slabs and cobbles; view to North.



Base of TU1 Excavation at Bedrock; view to North.

Figure 5.8. Site 21449 Excavation Photographs.

No cultural materials or features were encountered during excavation, and no human burials or isolated human skeletal remains were present. The results of this excavation are discussed in the next section (Summary and Discussion).

Table 5.6. Site 21449 Stratigraphic Description from Test Unit 1.

Stratigraphic Layer	Munsell Color (moist)	Description	Interpretation
I	10YR 5/4	Yellowish brown, silty sand, slightly sticky	Natural: Buried A Horizon
II	10YR 4/3 – 3/2	Brown to dark brown, sandy silt, loose, friable	Natural: Buried B Horizon

6.0 SUMMARY AND DISCUSSION

The Astronomy Precinct, which was established in 2000 with the approval of the Mauna Kea Science Reserve Master Plan (Group 70 International, Inc.), has been surveyed three times in search of archaeological sites. The first survey, in 1982, identified four sites within the roughly 525-acre precinct (McCoy 1982a). In 1995, SHPD resurveyed a portion of the precinct in the process of relocating previously identified sites which for the first time were accurately located using GPS technology. The archaeological inventory survey of the precinct in 2005 found one new shrine (Site 21447) and a small terrace of unknown function (Site 21449; McCoy et al. 2005). Excavation of Site 21449 (a terrace) in 2008 did not recover any cultural remains and the terrace is now thought to be a natural gelifluction terrace.

The specific functions or uses of the 21 religious structures (shrines) recorded in the 1982 survey, including the four within the boundaries of the Astronomy Precinct, is unknown, in contrast to those in the adze quarry that are clearly occupational shrines based on ethnographic information (Handy 1927; Buck 1957), many of them complete with offerings of manufacturing by-products and tools (McCoy 1982a, 1999a). No readily discernible offerings were found on any of the 21 sites recorded in 1982, thus suggesting, on admittedly negative evidence, offerings of perishable materials such as leaves or food that may have been subsequently consumed on the spot (cf. Buck 1957:529). The ubiquitous absence of material objects is difficult to explain, unless one assumes that the offerings were nothing more than unmodified stones (Buck 1957:529). The remote geographical setting in a non-subsistence environment (McCoy 1990) favors the proposition, outlined in McEldowney's review of the ethnographic literature (1982), that these structures were erected by travelers, most probably in propitiation of mountain spirits.

The 1982 report contained a brief analysis of the site distribution pattern and discussion of the inferred socio-behavioral correlates of locational and formal (typological) dimensions of site variability. The site distribution map (McCoy 1982a: Figure 2.3) shows a broad but manifestly uneven site distribution pattern, with the largest concentration of sites on the north slope below the summit cones. The area of greatest interest is the north slope where all but two of the total 22 sites are located (McCoy 1982a: Fig. 2.3). Of particular interest is the fact that 13, or 65%, of the sites in McCoy's 1982 Survey Areas 2 and 3 (which include the Astronomy Precinct and surrounding areas) are located within a narrow 200-ft contour interval, between the 12,900- and 13,100-ft elevations, that coincides with a topographic change in slope gradient. The 13,000 +/-100-ft contour, between Pu`u Mahoe and Pu`u Pohaku, is the downslope margin of a gently sloping plateau (McCoy 1982a: Figs. 2.2 and 2.3). The edge of this small plateau, when viewed from either the base of the steep, inclined slope directly below, or from the base of the summit cones above, is a relatively flat horizon on which the shrine uprights are silhouetted and therefore visible from some distance. The possible significance of this horizon and, thus, at least a partial explanation for the clearly defined vertical zonation site pattern was discussed in the context of several multiple working "hypotheses" which are essentially untestable, however.

"Hypothesis" 1: The high density site area on the edge of the plateau is the lower, northern boundary of an upper mountain god/ spirit zone.

The posited relationship of shrines in the study area to mountain gods and spirits in, for example, the request for permission to ascend and pass over the summit, implies that the approach was from the northern, windward side of the island, a view wholly consistent with the inclusion of this land in the Hamakua District and generally accepted *ahupua`a* model of traditional Hawaiian land tenure. Apart from the knowledge that gods and spirits presided over different districts (Buck 1957:S29), the extent and physical boundaries of their domains in the Hawaiian land tenure system is unknown. The data obtained in the present survey suggest that the cluster of religious sites on the edge of the 13,000 + 100 ft plateau demarcates the lower boundary of an upper mountain god/spirit zone or domain, and that a sanction existed requiring the performance of ritual prior to entering this domain. Evidence in support of this zonal concept hypothesis would include the localized occurrence of religious sites at similar elevations elsewhere on the mountain.

It is tempting to relate some, if not a large number, of the shrines to the mythological snow goddess, Poliahu, and, thus, to the winter season of the year. While it would add a good measure of specificity to the above hypothesis, there is clearly no means of testing this proposition and the validity of the mythological data base on which it rests. It is difficult to imagine, however, that snow, a non-existent phenomenon in the ancestral Eastern Polynesian homeland, did not give rise to some associated rituals and pilgrimages in Hawaii. Though purely speculative, the broader site distribution pattern on the upper north flank of Mauna Kea might well reflect the construction of shrines at the lower margins of snow fields which, perhaps, normally extend down to the circa 13,000 ft elevation. Over a period of time, fluctuations in the snow line would be manifested archaeologically in a more variable site distribution pattern. This conjecture is offered in part to account for the greater altitudinal dispersion of sites than allowed by the above hypothesis, as formulated.

"Hypothesis" 2: Astronomical phenomena were integral factors in the topographic location, orientation, and function of the larger, more complex structures.

The Hawaiian ethnographic literature alludes to a class of people with a specialized knowledge of astronomical phenomena, and while there are no known Hawaiian archaeological sites with an unequivocally demonstrated astronomical orientation or function, it is reasonable to predict such sites on the higher elevation slopes of Mauna Kea. That some of the structures recorded in this survey might reflect some astronomical concept(s) is vaguely suggested by the north-south orientation of the two structures labeled *marae* and other multifeature shrines (see McCoy 1982a: Table 2.1). The isolated *marae* on the western edge of the 13,000-ft plateau (Site 16168; Figure 6.1) is especially noteworthy with regard to its orientation and possible function. The approach to this structure (i.e., the court) is on the east, looking down onto the Hamakua coast, Waimea plains, Kohala mountains and across to Haleakala on Maui. The placement of offerings and whatever other ritual took place here appear to have been intentionally directed away from Mauna Kea. The impression that many sites were purposefully situated with respect to the earlier described plateau horizon needs to be investigated. Further research is obviously required to test the multitudinous aspects of this hypothesis.

The degree to which it is presently feasible to comment on the temporal and social dimensions of ritualism is constrained by the absence of a chronology and by uncertainties regarding site function, which on current evidence favors a multivariate

interpretation. In terms of differential structural complexity and the inferred functional contrasts between simple shrines and *marae,* it is reasonable to suggest that the former were made by one or a few individuals and the latter by a larger kin group. On the basis of comparative ethnographic information on Eastern Polynesian religion, each structure would represent a separate social unit that had exclusive use-rights (Kenneth P. Emory, personal communication 1982).

To expand on and refine the earlier speculations, it now seems likely that the simple shrines were built and used by small family groups as originally thought, but that the larger, more complex structures were built and maintained by a priesthood. There are two initial reasons for thinking this may be the case. First, on the assumption that each upright stands for a separate god, the larger number of uprights on these sites points to a larger pantheon of gods (major and minor gods) that probably most Hawaiians would not have known.



Figure 6.1. Photograph of Shrine Site 16168 Located Adjacent to the West Boundary of the Astronomy Precinct; View to South-Southwest.

Second, many of the sites in this category are isolated from the main areas of worship (McCoy 1999a: Fig. 7). The separation has to have been deliberate. It implies, as physical separation often does, a meaningful social boundary and, in this case, status differences.

KŪKAHAU`ULA

As previously noted (McCoy 1999a), the most important observation to be made about the summit (K• kahau`ula) is the meager evidence of human activity prior to the historic period. Indeed, with the single exception of a cairn (Site 50-10-23-21209), there are no other known sites on the series of cinder cones that comprise the "summit" of Mauna Kea. While no archaeological surveys were conducted prior to the construction of the summit road in 1965, there is no indication that any archaeological sites on the "summit" were destroyed at that time, or at any time thereafter in the construction of the existing observatories.

The virtual absence of archaeological sites on the very top of the mountain may mean different things and is potentially open to a number of different interpretations. In the early to mid-19th century the opinion seems to have been that Hawaiians avoided the top of the mountain because of the cold environment and superstitious beliefs. The following accounts provide an indication of the thinking at that time:

> The natives have no passion for high mountains, or cold weather (Jarves 1844:222).

> Rev. Joseph Goodrich, who, on this occasion, was unfortunately laid up with mountain sickness, had on 26th August, 1823, reached the summit of Mauna Kea. This is the first recorded instance of the ascent of this mountain, although Mr. Goodrich mentions that on reaching the top of one of the terminal cones that encircle the main plateau of Mauna Kea, he discovered a heap of stones, probably erected by some former visitor. Who this former visitor was is unknown, but he was probably one of the white men that in the early years of the nineteenth century got a living by shooting wild bullocks that roved on the side of Maunt Kea. It is very unlikely that any native had reached the top of the terminal cones on the summit, owing to being unprovided with warm clothing to resist the great cold and also to the fact that the natives had a superstitious dread of the mountain spirits or gods. About six months after the date of the first ascent of Mauna Kea by Mr. Goodrich the peak was scaled by Dr. Abraham Blatchley and Mr. Samuel Ruggle, both connected with the American Mission (Macrae 1922:55).

> The snow on the summit of the mountain, in all probability, induced the natives to call it Mouna-Kea, (mountain white), or, as we should say, white mountain. They have numerous fabulous tales relative to its being the abode of the gods, and none ever approach the summit---as, they say, some who have gone there have been turned to stone. We do not know that any have been frozen to death; but neither Mr. Goodrich, nor Dr. Blatchely and his companion, could persuade the natives, whom they engaged as guides up the side of the mountain, to go near its summit (Ellis 1979:292).

The lack of warm clothing was clearly not a deterrent to reaching the top of the mountain, as the numerous shrines located only a few hundred feet below the summit demonstrate. The repeated references to the top of the mountain being the "abode of the gods" and to the fear of these mountain gods indicate why the early expeditions

could not persuade their Hawaiian guides to go all the way to the summit. The top of the mountain was clearly a sacred precinct that must, moreover, have been under a *kapu* and accessible to only the highest chiefs or priests. The virtual absence of sites on the summit cones suggests that the same belief system had been adhered to and strictly enforced in the more remote past.

Kukahau`ula is not the only "high place" in Hawai`i where the common people were prohibited from entering. Another example is a hill named Pu`upane at Keokea in the Kula District, Maui that was described by Moses Manu in the late 19th century:

> This was a hill decreed by the ruling chiefs of Maui to be sacred; no commoner ascended this hill; for it was a *heiau* for the high chiefs of Maui from ancient times until Kihapi`ilani's arrival on the hill of Pu`upane, and that was the reason that this kahuna lived at `A`apueo, to watch out for it (Manu 1884:4; quoted in Kolb 1991:109).

There is accumulating archaeological evidence that the summit region of Mauna Kea was not only the locus of a number of special purpose activities, including tool manufacture, burial and the worship of gods and spirits, but that there were also discrete places in this region (McCoy and Nees 2006). There is a suggestion in all of these activities of a direct link to the exercise of political power in the person of a ranking chief, and more particularly of what Sahlins has called the "general cultural practice of heroic history" (Sahlins 1985:34). Radiocarbon and 230 Th dates for the quarry suggest that each of these practices has considerable time depth and continuity (McCoy 1990; McCoy et al. 2009).

The appearance of more and more "find spots," which are being plotted on a map based on GPS readings, briefly described, and numbered sequentially in the year they are discovered (e.g., 1997.05; 2005.01), appears to be directly related to the increased use of the summit region by visitors and native Hawaiian practitioners, some of whom are either modifying existing sites or constructing new features to memorialize their visit to the top of the mountain or to perform ritual activities. The newly constructed features could in time become part of the archaeological record of the Science Reserve. One such area is the terminus of the "13 North Road," where two single uprights (Find-spots 2005-9 and 2005-9) were found in close proximity to the road and the recently installed test telescope and other equipment (see Figure 5.1). No archaeological sites have ever been found at this location in past surveys or during field inspections by SHPD staff archaeologists in 2004 as part of the compliance process for the installation of the new equipment. The appearance of find-spots 2005-8 and 2005-9 on the landscape between 2004 and 2005 presents a good reason why these new cultural features needs to be tracked and distinguished from the shrines and other features associated with Mauna Kea's ancient cultural landscape.

7.0 SIGNIFICANCE EVALUATIONS

In 1999, during the preparation of the Master Plan, SHPD proposed that the cultural landscape on the top of Mauna Kea be recognized as the Mauna Kea Summit Region Historic District. The historic district proposal was summarized in the cultural impact assessment for the Master Plan (PHRI 1999:30-32) and discussed in more depth in the early planning process for the proposed Keck Outrigger project (Hibbard 1999; NASA 2005). The IfA, NASA, and other parties agreed that the proposed district, which on current thinking would include all of the Science Reserve, the Natural Area Reserve, and additional areas at selected locations lower on the mountain, meets the eligibility criteria for inclusion on the National Register of Historic Places. The preliminary district boundaries are shown in Figures 3.6 and 3.7. The district is listed in the Statewide Inventory of Historic Places as Site 50-10-23-26869.

All of the sites in the Science Reserve are contained within the proposed boundaries of the historic district. They are what are called contributing properties in the National Register:

A **contributing** building, site, structure or object adds to the historic architectural qualities, historic associations, or archaeological values for which a property is significant because a) it was present during the period of significance, and possesses historic integrity reflecting its character at that time or is capable of yielding important information about the period, or b) it independently meets the National Register criteria (Parker 1985:45).

SHPD has begun working on the nomination of the Mauna Kea Summit Region Historic District to the National Register of Historic Places. The process will involve consulting with several agencies, including OMKM and DLNR-DOFAW since the district includes within its boundaries all of the Mauna Kea Ice Age Natural Area Reserve and state lands outside of both the Science Reserve and NAR. The district will include within its boundaries the three TCP's listed in the Statewide Inventory of Historic Places.

Evaluating the significance of sites or historic properties is a requirement for state projects under Chapter 6E-8 and its implementing regulation (Chapter §13-275-6). Site significance in American archaeology tends to be evaluated using standard criteria, such as those set out in the National Park Services National Register regulations at 36CFR 60.4. There are four National Register Criteria:

(a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
(b) That are associated with the lives of persons significant in our past; or
(c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or possess high artistic values, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
(d) That have yielded, or may be likely to yield, information important in prehistory or history.

One other criteria (e) has been added to the list in Hawai`i. Historic properties

evaluated as significant under Criterion "e":

> Have an important value to the native Hawaiian people or other another ethnic group with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity (Chapter §13-275-6).

Site significance tends to be viewed as fixed and unchanging, but in reality it is "both dynamic and relative" (Moratto and Kelly 1978:2). Bowdler (1977:2) and others have noted how archaeological significance is anything but static. Charles McGimsey and Hester Davis emphasize the importance of having a frame of reference in making significance evaluations and why they are always at the minimum relative:

The fact that archaeological sites and the information they contain are our only clues to much of human life in the past makes every site potentially significant. It is generally recognized, however, that defining significance implies some frame of reference, problem orientation, geographic, temporal or other context, against which an archaeological phenomenon is to be evaluated. A site is therefore more or less significant relative to some criterion or criteria (McGimsey and Davis 1977:31).

As previously noted, in 1999, during the preparation of the Master Plan, SHPD proposed that the cultural landscape on the top of Mauna Kea be recognized as the Mauna Kea Summit Region Historic District (Site 28689). The historic district proposal was summarized in the cultural impact assessment for the Master Plan (PHRI 1999:30-32) and discussed in more depth in the early planning process for the proposed Keck Outrigger project (Hibbard 1999; NASA 2005). The IfA, NASA, and other parties agreed that the proposed district, which on current thinking would include all of the Science Reserve, the Natural Area Reserve, and additional areas at selected locations lower on the mountain, meets the eligibility criteria for inclusion on the National Register of Historic Places.

With the recognition of the Mauna Kea Summit Region Historic District as eligible for the National Register there is now a single frame of reference that can be used in evaluating site significance for all of the historic properties on the top of Mauna Kea. As noted in the SHPD Plan, the site significance evaluation process differs for individual sites within and outside of the Historic District. Sites located outside of the proposed boundaries of the Historic District will be evaluated individually, in contrast to those located in the Historic District, as explained below:

> ...Within the historic district, the significance of properties is not evaluated individually because the summit region as a whole is considered eligible for inclusion in the National Register. Instead, the required assessments consider how each newly or previously recorded property potentially affected by a project contributes to the significance of the historic district as a whole. ...Determining that a property is significant and eligible for the Hawaii and National Registers does not necessarily mean the property will be placed on the Register, only that it possesses attributes and associations which would allow it to be considered eligible. Significance evaluation should conform with SHPD administrative rules or the National Register criteria (National Register Bulletin 15) if the project is federally funded or if the historic properties are located within the historic district (SHPD 2000:17, 20).

All of the sites in the Astronomy Precinct are contained within the proposed boundaries of the Historic District. They are considered to be contributing properties in the National Register.

The historic district is significant under all four National Register criteria and criterion "e" of the Hawaii Administrative Rules, Chapter §13-275-6. The district is significant under criterion "a" because of the presence of the Mauna Kea Adze Quarry Complex (a National Historic Landmark), which was used over a period of 500 years or more and the hundreds of shrines in and outside of the quarry. Both the quarry and the shrines are associated with broad patterns and events in Hawaiian prehistory. The district is significant under criterion "b" because of the association with several gods who may have been deified ancestors. These include K• kahau`ula, L•‹•noe and Waiau. The sites in the adze quarry and many of the shrines embody distinctive characteristics of traditional Hawaiian stone tool manufacture by craft specialists and a distinctive type of shrine construction found in only a few other places in the Hawaiian Islands. These make the district significant under criterion "c." Studies of the Mauna Kea Adze Quarry Complex and the on-going archaeological survey of the Mauna Kea Science Reserve have already made a significant contribution to our understanding of Hawaiian prehistory and history, and hold the potential to make even more contributions. The district is thus significant under criterion "d." Finally, the district is significant under criterion "e" because of the presence of numerous burials and the hundreds of shrines which have been interpreted as evidence of a previously unknown land use practice in the form of pilgrimages to the summit of Mauna Kea to worship the gods and goddesses. As noted earlier in **Section 5.2.1.1**, Pu`u K• kahalu`ula, Pu`u Waiau and Pu`u L•‹•noe were deemed Traditional Cultural Properties (TCPs) by SHPD in 1999 based on legendary information and continuity of cultural practices (Hibbard 1999; SHPD 2000). There are people, both Hawaiian and non-Hawaiian, who believe that more of the mountain, if not the entire mountain, is sacred and should be recognized as one large TCP.

8.0 RECOMMENDATIONS

Because the Astronomy Precinct is the only place in the Mauna Kea Science Reserve where construction of new observatories and telescopes is allowed, it is recommended that all future construction projects in the precinct proceed with caution and an increased awareness of the nature, location, and significance of historic properties in the Astronomy Precinct and the need to protect them. This inventory survey has updated the archaeological and cultural data, and as of September 2005 when inventory survey fieldwork was completed, seven historic properties (six archaeological sites and one TCP), as well as seven find-spots have been documented in the Astronomy Precinct. In addition, numerous archaeological sites and find-spots are present in areas of the Science Reserve immediately adjacent to the Astronomy Precinct (see Figure 5.1).

All historic properties within the Astronomy Precinct (and within the Mauna Kea Science Reserve) are scheduled for preservation. The historic properties within these areas will be addressed in the Cultural Resources Management Plan (CRMP: McCoy et al. 2009). It is recommended that OMKM implement the relevant portions of the CRMP as they pertain to future development in the Astronomy Precinct, as well as to other potential issues that will likely arise during future development in this precinct. A number of the potential archaeological and cultural issues in the Astronomy Precinct as well as relevant sections of the CRMP as they pertain to these issues are presented below. Brief summaries of the content of these sections are presented below.

Table 8.1. Relevant Archaeological and Cultural Issues in the Astronomy Precinct.

Archaeological/Cultural Issue	CRMP Section
Future development in the Astronomy Precinct	4.2.7; 4.2.7.1; 4.2.7.3
Inadvertent archaeological finds	4.2.7.2; 4.3.2
Consultation with Kahu Ku Mauna Council	4.0; 5.1 (Management Action 5)
Developing protocols for construction of new features	4.2.1.6; 4.2.1.8; 5.1 (Management Action 9)

CRMP Section 4.2.7: Future Land Uses. This section focuses on the historic preservation review process for planned developments, such as new observatories in the Astronomy Precinct. The approximately 525-acre Astronomy Precinct was established with a number of specific goals and objectives in mind, such as the recycling of older telescope facilities; clustering of new facilities in already developed areas, and construction of new observatories and infrastructure in or near disturbed areas to minimize the disturbance of previously unaltered areas. The boundaries of the Astronomy Precinct were established to avoid or minimize adverse impacts on historic sites. Each future construction project must identify its "area of potential affect" (APE).

CRMP Section 4.2.7.1: Determination of Effect. This section addresses the determination of effect for any construction projects. The 2000 Master Plan indicated that the location of any new facility would be set back at least 200 feet from a cluster of

shrines on the north slope of the mountain. While a 200 foot setback might be found acceptable, a buffer cannot be established until the Area of Potential Effect (APE) has been determined and approved by SHPD. The APE, a term used in environmental and cultural resource management studies, is commonly defined as the geographic area or areas within which an action may affect historic properties, if any such properties are present or thought to exist. The APE does not equate to the "footprint" of a building or road, for example, and must therefore take into consideration a larger geographic area. The definition of the APE is not limited, moreover, to the consideration of physical effects alone, but needs to also take into consideration the potential for visual and auditory effects and indirect impacts, such as erosion, especially in the case of culturally and spiritually significant places like Mauna Kea (King 2000:46-48).

Within the historic district, the effect of a project on the historic district as a whole needs to be assessed as well as the project's effect on individual historic properties located within or immediately adjacent to the project area. The effect of a project on the historic district must be addressed even if no individual historic properties are found within or immediately adjacent to the project area. Effects on the historic district would consider the visual impact of a facility on the surrounding landscape (i.e., the various land forms creating the setting and context of the multiple historic properties encompassed by the district) and on those individual historic properties which contribute to the significance of the district.

CRMP Section 4.2.7.2: Inadvertent Discoveries. If any historic properties should be found in the APE as defined above they will be classified as inadvertent discoveries per HAR 13-280 once the archaeological survey of the Science Reserve, including the Astronomy Precinct, has been completed. The CRMP outlines the process that will be followed if inadvertent discoveries are made during construction projects.

Because some Native Hawaiians believe that human remains were uncovered during the construction of at least one observatory on the summit cones and because burials are known to be present on other cinder cones in the summit region, any development or construction work requiring excavation near the rims of cinder cones will be subject to archeological testing prior to ground disturbance. Exceptions to this requirement are discussed in the CRMP. If burials are discovered, or if the area to be developed is relatively large and testing is not exhaustive, then any excavation undertaken during construction will be monitored by a qualified archaeologist.

CRMP Section 4.3.2: Burial Protection and Inadvertent Discovery Plan. In view of the documented existence of human burials in the Science Reserve there is a need to develop a burial treatment plan (BTP) to protect all known burial sites. Given the possibility that more human remains will be found inadvertently in the Science Reserve in the future there is also a need to develop an Inadvertent Discovery Plan. Guidelines for the preparation of both plans are presented in Table 4-22 and discussed below.

CRMP Section 4.2.7.3: Mitigation. Once the effects of a proposed development project are determined, treatment of the identified properties is proposed. Treatments, generally called mitigation measures, can include thoroughly documenting an historic property before it is destroyed or preparing a preservation plan to assure a property's protection during construction activities (i.e., monitoring, ample buffer zones) and during the long-term use of the constructed facilities or infrastructure. In all three areas leased

by UH, strong preference will be given to avoiding and preserving all individual historic properties whenever possible.

The protection of K• kahau`ula, arguably the most culturally significant place on the mountain, is important. If plans are developed in the future to construct new facilities, retrofit existing facilities or dismantle and remove an observatory within the area defined as K• kahau`ula, a part of which falls within the boundaries of the Astronomy Precinct, special attention will be given to minimizing adverse impacts using the guidelines established by SHPD for the Keck Outrigger project.

CRMP Section 4.0 and Management Action No. 3. At the beginning of Section 4.0 of the CRMP, it states that the Kahu K• Mauna Council will take the lead in making recommendations for policies regarding cultural practices. The Council will consult with representatives of the Mauna Kea Management Board (MKMB), Hawaiian Culture Committee, the Office of Hawaiian Affairs (OHA), the Hawaii Island Burial Council, and Hawaiian Civic Clubs prior to developing final policy recommendations.

Management Action No. 3 in Section 5 of the CRMP requires that OMKM develop a policy to assure that Kahu K• Mauna council is consulted on individual development projects. As the primary Native Hawaiian advisory group associated with Mauna Kea, the Kahu K• Mauna Council will be consulted on individual development projects, in a timely and appropriate manner. The consultation policy will include mechanisms for addressing any recommendations or concerns raised by the Council.

CRMP Section 4.2.1.6. Construction and Use of New Shrines. In addition to the modern use of ancient shrines, there are persons who are also constructing new shrines (k• ahu) and building less formal mounds (*ahu*) of stacked or piled rocks in the summit region. Though most of the *ahu*, at least those located near roads, were probably erected rather recently to commemorate or memorialize a person or family's visit to the summit region, it is also possible that some *ahu* were built based on a religious belief and might therefore be viewed as a new or different form of shrine, especially since one meaning of *ahu* is shrine or altar (Pukui and Elbert 1971:8).

The 1995 Revised Management Plan for Mauna Kea states that cultural activities are permitted if they do not involve physical impacts. While the construction of small shrines (for example, a single upright stone and a few supporting stones) may not seem to constitute a physical impact, it is a "land use" as defined HAR 13-5 (Hawaii Administrative Rules for Conservation Districts) if the structure is allowed to remain standing for more than 14 days. A "land use" in the case of shrines and other built structures means:

> The placement or erection of any solid material on land if that material remains on the land more than fourteen days, or which causes a permanent change in the land area on which it occurs (HAR 13-5-2).

CRMP Section 4.2.1.6. Piling and Stacking Rocks. Single rocks and mounds of piled or stacked rocks on boulders and outcrops dot the landscape in the summit area of Mauna Kea. The majority of the 336 "find spots" recorded in the archaeological survey of the Science Reserve as of 2007 are piled and stacked rocks. Such features, which are widespread in Hawai`i, represent a traditional cultural practice which undoubtedly has some time depth, but whose purpose and meaning have probably changed over time. At the same time, there is reason to believe that a large number of the single rock features and small concentrations of pile or stacked rocks on Mauna Kea are modern and that many were constructed by non-Hawaiian visitors in the last decade or so. The proliferation of such features is undoubtedly a result in part of what is popularly known as the "copy-cat effect."

Management Action No. 9 in Section 5 of the CRMP requires that OMKM develop a policy for the construction of new Hawaiian Cultural features and the long term management of these features. The AIS has documented many small stone features of presumably recent origin that may or may not be ceremonial or religious in nature. The policy will address the construction of additional new features, and include protocols (developed by the Kahu K• Mauna in consultation with other Native Hawaiian organizations) for how, where, and when such construction may occur.

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Appendix J. Mauna Kea Historic Preservation Plan

State Historic Preservation Division (SHPD), 2000. Mauna Kea Historic Preservation Plan, Management Components. Prepared for UH IfA. In the 2000 Master Plan, Appendix F. March 2000.

MAUNA KEA SCIENCE RESERVE
MASTER PLAN

APPENDIX F

Mauna Kea Historic Preservation Plan
Management Components

State of Hawaii
Department of Land and Natural Resources
Historic Preservation Division

March 2000

MARCH 2000

Mauna Kea Historic Preservation Plan

Management Components

Prepared by
State Historic Preservation Division
for the
Institute for Astronomy, University of Hawaii
March 2000

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Preface

The following outline defines and discusses the major management consideration of the historic preservation plan prepared jointly by the University of Hawaii (UH) and the State Historic Preservation Division (SHPD), Department of Land and Natural Resources (DLNR). Management commitments are made to a series of specified actions and procedures that are designed to protect the many significant historic properties located on state lands leased by the University of Hawaii on Mauna Kea and to insure their appropriate treatment over time. Currently, those uses that could adversely effect historic properties can be grouped broadly into two categories. The first focuses on those activities that are directly related to the development and use of astronomical observatories on Mauna Kea and to all the infrastructure, facilities, and maintenance work needed support the observatories. These activities are largely conducted by UH or individual parties operating the observatories. The effects of these activities are largely concentrated in already developed areas although, visually and indirectly, they have the potential to affect a much larger area. The second category looks more broadly at the long-term management of historic properties found in undeveloped and developed areas and at the potential effects caused by all user groups, including public and commercial users, on these properties. Particular consideration is given to establishing strategies to monitor the condition of historic properties over time, to compile a complete and detailed record of all historic properties in these areas, and to prevent or deter activities that will alter them. A number of commitments recognized the need to raise awareness of the mountain's cultural and historic past.

Throughout the plan, reference is made both to the numerous individual historic properties found in the defined management areas and to the Mauna Kea Summit Historical District. The State Historic Preservation Division is in the process of designating the summit region as a historic district that would be eligible for listing in the National Register of Historic Places (Fig. 1 and 2). This designation allows the significance of the many individual properties located within the district to be addressed collectively and within the context of the summit's natural landscape. It also allows the integrity of the district as a whole to be considered when the potential effects of particular activities or projects are evaluated.

While this plan defines the direction of management initiatives on Mauna Kea, it can not be finalized or implemented in detail until a number of steps are completed. First, the management structure proposed in the Master Plan, primarily the Office of Mauna Kea Management, needs to be established as it will be the primary entity responsible for

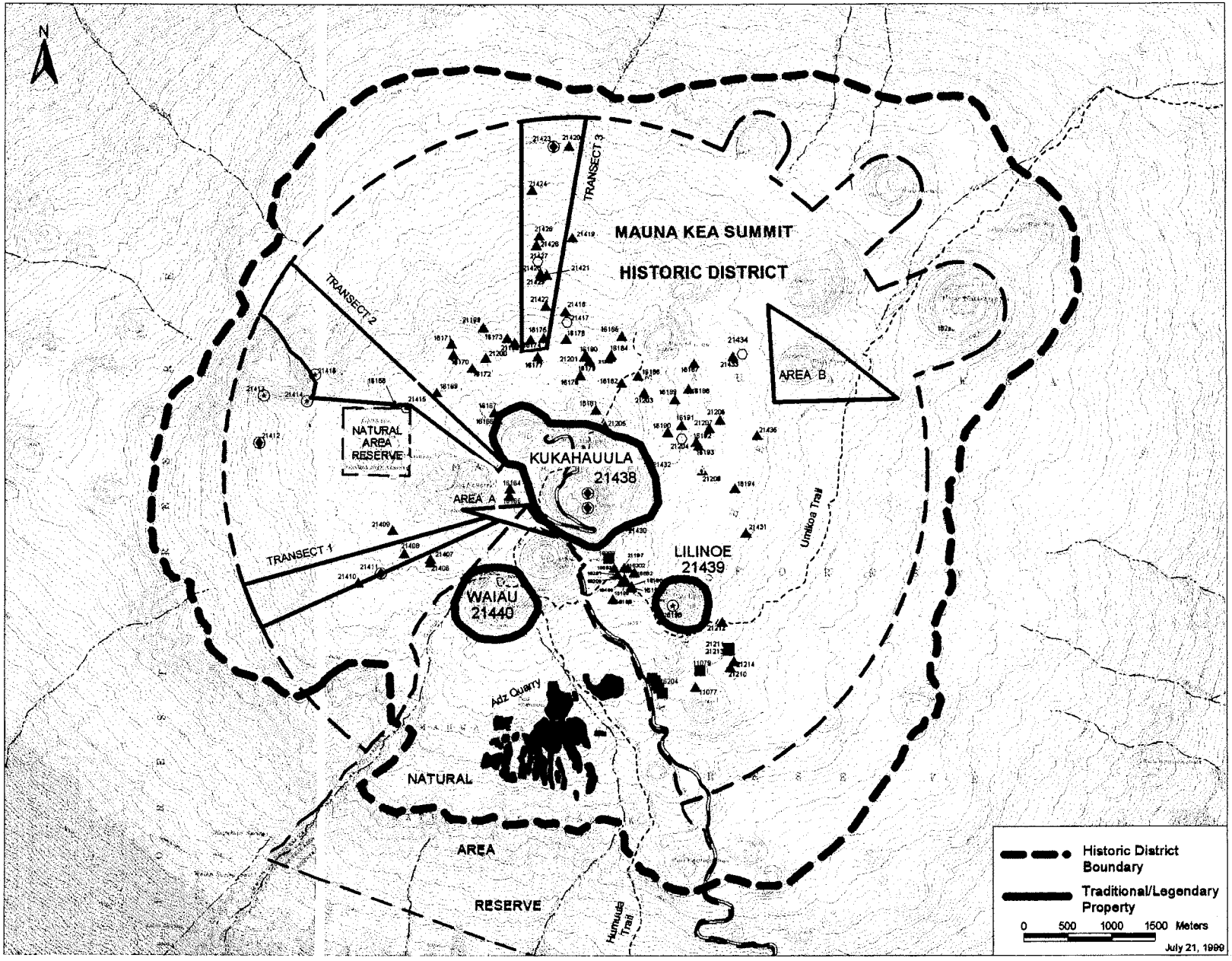


Figure 1 Mauna Kea Summit Historic District. Includes locations of the adze quarry, shrines, and traditional/legendary properties.

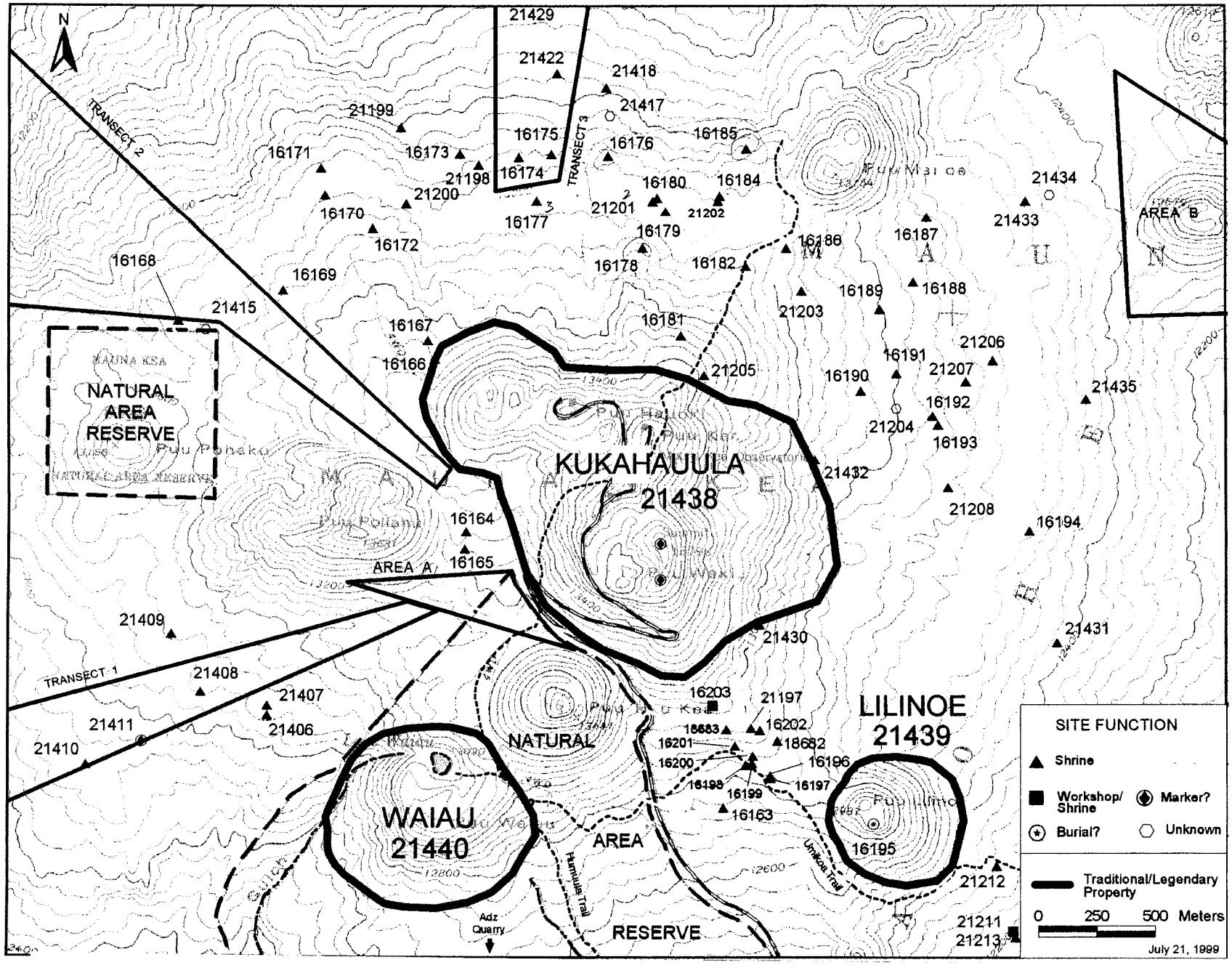


Figure 2 Distribution of shrines, adze workshops, and traditional/legendary properties at the summit.

implementing many of the plan's commitments. Its role and authority needs to be determined in more detail and in coordination with DLNR which now has primary management and regulatory authority over a number of activities occurring on Mauna Kea. Once these decisions are made, the plan can be revised to accurately reference the appropriate agency, rules, or agreements when discussing particular management actions. Second, the native Hawaiian community and other interested parties must be given the opportunity to review and comment on these major initiatives. This process will inevitably results in changes and refinements. Thirdly, the plan sometimes commits to the development and preparation of subsidiary plans, guidelines, or other document types to implement an initiative (See Appendix). These will be developed as the Office of Mauna Kea Management is being established and in coordination with these changes. In most cases, the absence of these secondary documents does not prevent the intent of the management initiative from being implemented.

Geographic Scope of the Plan

The plan addresses, in whole or in part, four major management areas. Three of them, the Mauna Kea Science Reserve, the summit road corridor, and a leased parcel at Hale Pohaku, currently fall under the joint jurisdiction of the University of Hawaii (UH) and the Department of Land and Natural Resources (DLNR). The first and largest of these areas is the Science Reserve which, as defined in a 1968 lease agreement (G.L S-4191, TMK: 4-4-15: 09), included all land falling within a 2.5 mile radius of the UH observatory (Fig. 3). Exceptions were three cinder cones to the north east of the Reserve which were included by extending the Reserve boundary around the outer bases of the cones (Pu`u Makanaka, Pu`u Hoaka, and an unnamed cone). The second area is a 19.3-acre parcel at Hale Pohaku (Fig. 4) which is the site of the Onizuka Center for International Astronomy, the Visitor Information Station (VIS), and the construction camp (TMK: 4-4-15: 12). Collectively this complex is commonly called Hale Pohaku or the mid-elevation facilities. The third area is the road leading from Hale Pohaku to the summit and a corridor extending 400 yards to either side of the road.

The fourth area considered by the plan are parts of the Mauna Kea Ice Age Natural Area Reserve which is administered by the Natural Areas Reserve System of DLNR. In 1981, two sections of the Mauna Kea Ice Age Natural Area Reserve were set aside from the 2.5 mile radius to form, at least in part, this NAR. One section became part of a 3,750 acre, pie-shaped parcel lying on the southern flank of the summit region and the other is a 149.5 acre rectangular area encompassing Pu`u Pohaku (Figs. 1 and 3). Where the 800 foot-

wide road corridor managed by the UH extends over the NAR's boundary, that portion of the corridor remains under the sole jurisdiction of the NARS.

These two sections of the NAR are included in the plan because the infrastructure developed and maintained by the UH to service the observatories has made historic properties located within the NAR much more vulnerable. The summit road in particular has created higher levels of public access and use than would have been feasible otherwise. The threat to historic properties located within the large, pie-shaped section of the NAR is, in fact, probably greater than that posed to many properties in the Science Reserve. This is primarily because of the nature of the historic properties found within the NAR and the location of the summit road along the eastern boundary of the NAR. The Mauna Kea Adze Quarry, a National Historic Landmark, is particularly vulnerable because it is within relatively easy walking distance of the summit road and artifacts can be easily carried away. Lake Waiau and historic properties associated with the lake are also at risk because the lake itself is a major visitor attraction. For these reasons, the plan proposes that all provisions addressing the long-term management of historic properties, particularly those designed to monitor and protect the integrity of historic properties, be implemented jointly for the NAR and the Science Reserve. This is also appropriate because the historic properties found within the NAR and the Science Reserve share a unique landscape and history, face similar threats, and fall under the jurisdiction of DLNR in some form. The plan encourages the development of a historic preservation plan for the Mauna Kea Ice Age Natural Area Reserve which complements that prepared for the Science Reserve.

Structure of the Plan

The plan is structured in five parts. Part I addresses those maintenance and construction activities related to observatory use and development that could have an effect on historic properties within the three areas under lease to UH (i.e., the Science Reserve, the summit road corridor, and the mid-elevation area at Hale Pohaku). For routine or periodic maintenance work, the plan calls for identifying those classes of on-going or anticipated activities which should be subject to historic preservation review and which should not. When review is needed, the plan sets out procedures to expedite or clarify this process. For the construction of new facilities or infrastructure, the plan discusses standard procedures used to comply with state and federal statutes and regulations (e.g., National Historic Preservation Act and Section 106 [36 CFR 800]; Chapter 6E-8, -42, -43 [HRS]).

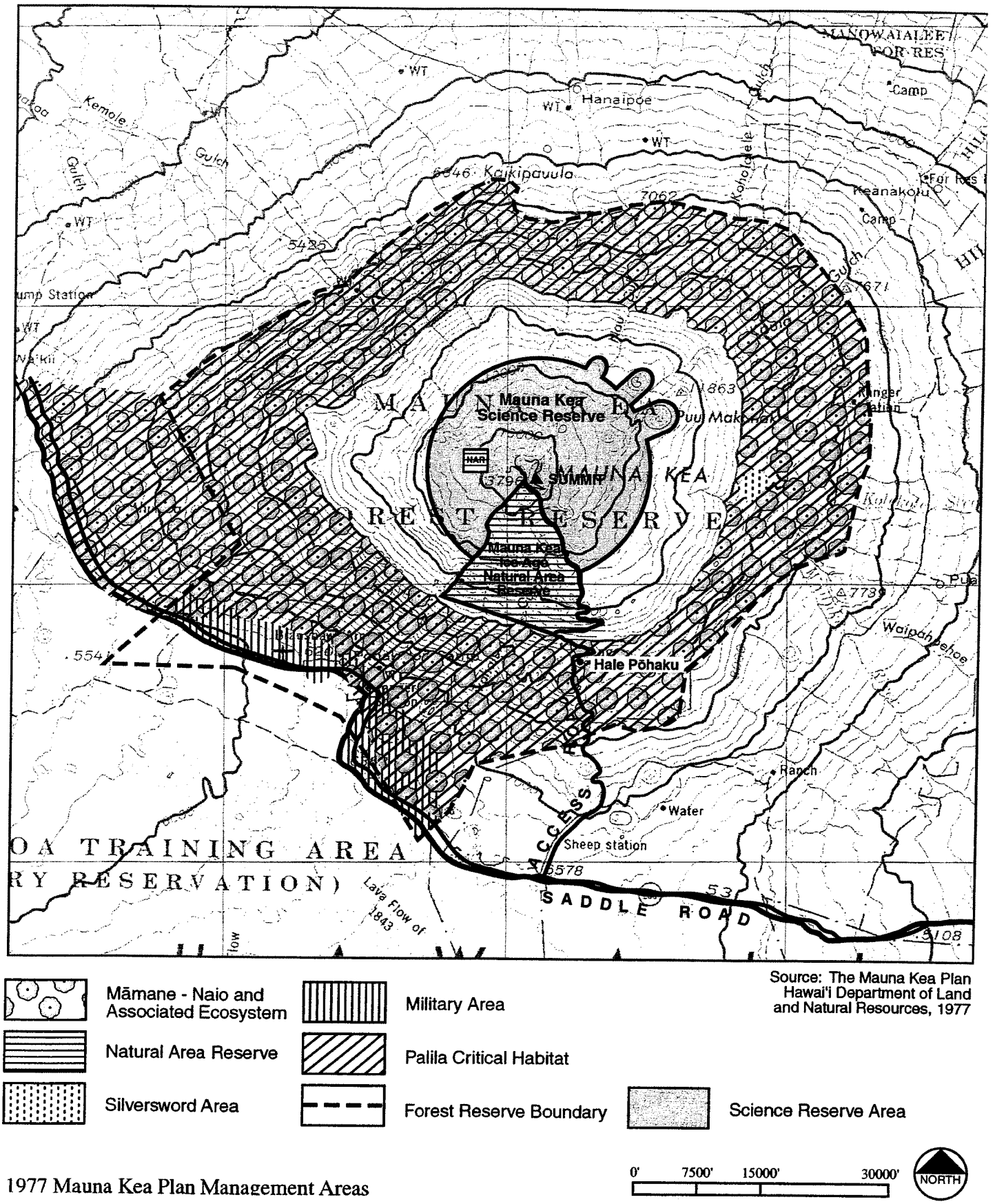
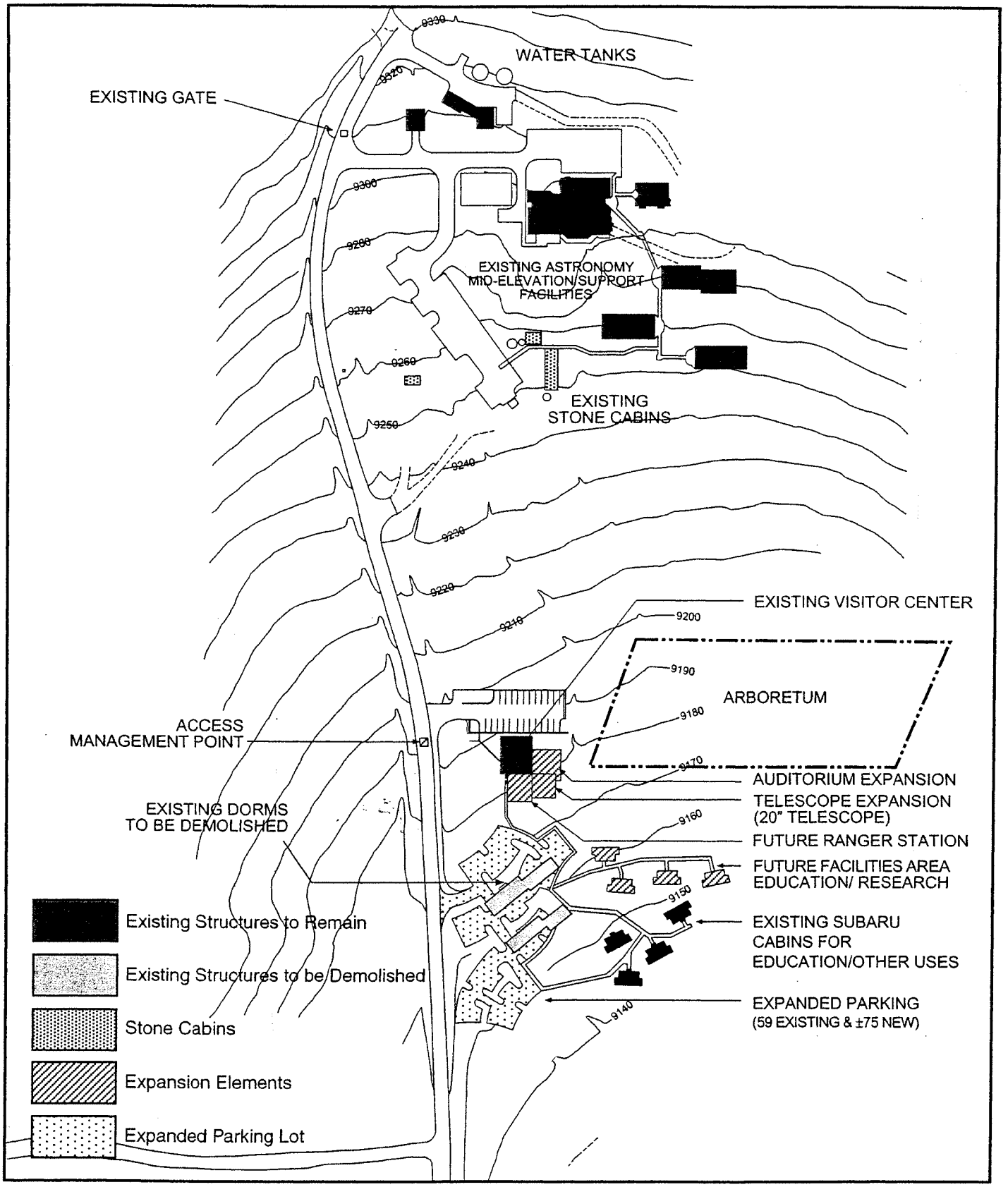


Figure 3 Location of the Mauna Kea Science Reserve, the Mauna Kea Ice Age Natural Areas Reserve, and Hale Pohaku



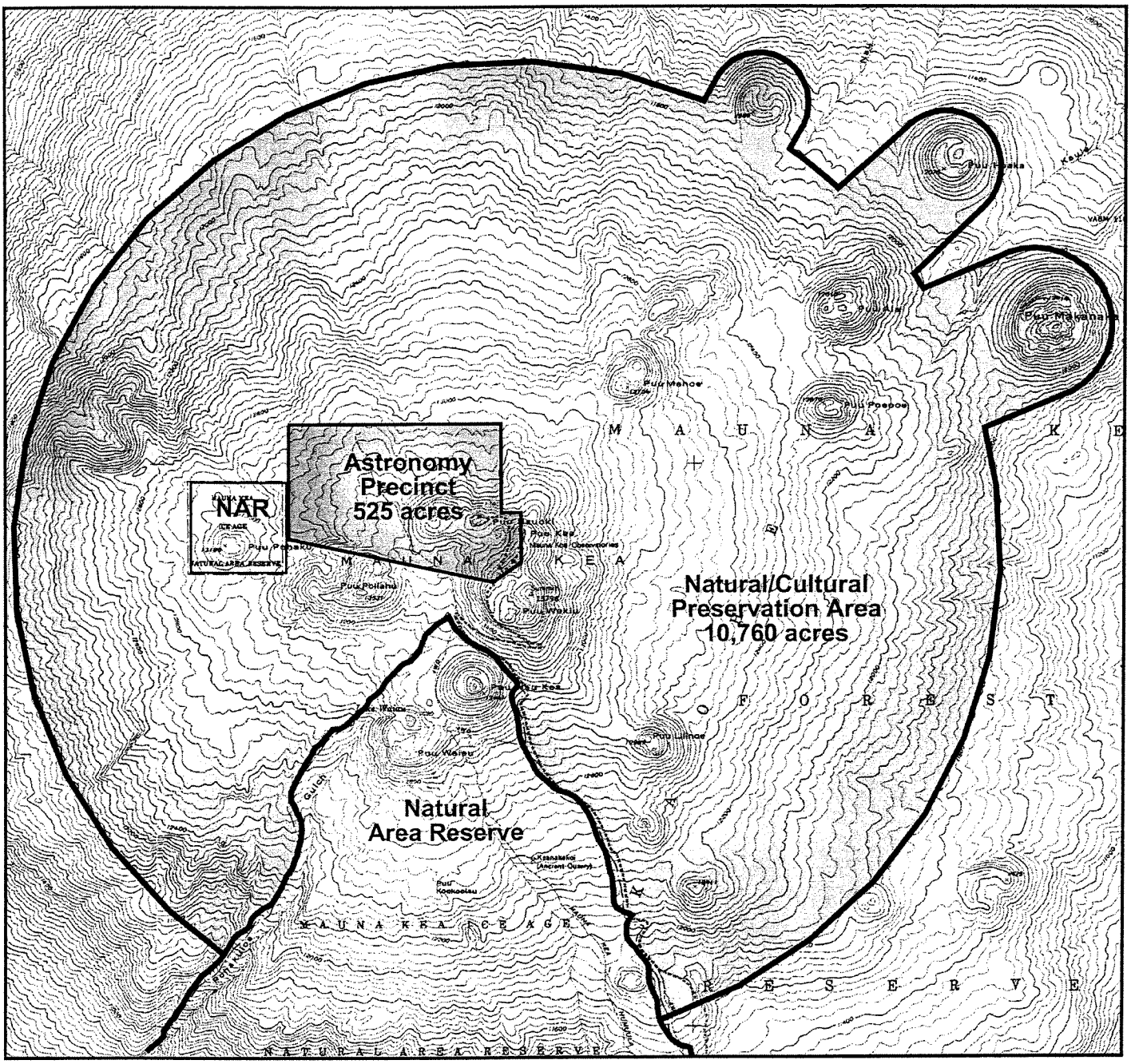
Hale Pōhaku Plan

Figure 4 University of Hawaii Facilities Located at Hale Pohaku.

Part II discusses the long-term strategies needed to protect and manage historic properties located within all the UH leased lands and the Natural Area Reserve. Many of these properties are unlikely to be affected by maintenance activities or construction projects because they are not locate in developed areas or within the Astronomy Precinct where future projects will take place (Fig. 5). Instead they are more likely to be affected by public and commercial uses. Within this part, the plan first describes several initiatives aimed at establishing an effect monitoring program so that managers can better understand which kinds of activities are adversely affecting historic properties and what preventative steps can be taken. This includes educational and interpretive efforts to focus visitor interest on selected properties and inform users of the need to protect historic properties and historic district. Several general management issues, control of debris, use of vehicles off-road, unrestricted public access, and enforcement, are also addressed. The remainder of Part II examines public and commercials uses occurring on Mauna Kea, the kinds of effects these uses can have on historic properties and the historic district, and how these effects can be mitigated. These uses include recreational activities such as skiing, hiking, hunting and stargazing and commercial activities such as weekly tours to the summit. Research and cultural practices are also discussed.

The last three parts address consultation with the native Hawaiian community, cooperative agreements that recognize the commitments made in the historic preservation plan, and the need for periodic review of the plan's effectiveness. Consultation with members of the native Hawaiian community and organization includes initiating consultation so that their views can be considered in completing the plan and sustaining consultation so that it becomes on-going process. Cooperative agreements insure that all entities operating observatories on Mauna Kea are equally aware of actions and procedures required by the plan and which they are also responsible for following. Periodic review of the plan provides an opportunity for all interested parties to recommend amendments or additions to the plan. This will be particularly important in plans formative years and if circumstances should change significantly at some point.

The structure of these management approaches is taken, to some extent, from that of programmatic agreements which are prepared to managing historic properties on federal lands in compliance with the National Historic Preservation Act. These agreements provide a mechanism by which interested parties can reach an understanding on which historic preservation review and compliance measures will be applied to particular classes of actions or activities within a single, generally large, land holding which is being actively



Astronomy Precinct

Figure 5 Astronomy Precinct and Natural/Cultural Preservation Area Proposed in Master Plan

used and managed by an agency. These agreements are most effective when the effects of certain kinds of activities on historic properties are likely to be similar or repetitive; when the distribution of historic properties is relatively well known in the areas being managed, and when similar types of routine maintenance activities could have an effect on historic properties. Programmatic agreements can also contain provisions to assure that management actions are taken in large areas that are not routinely used or in historic districts. In this context, the agreement sets out procedures to reconcile or integrate the need both to use and preserve historic properties; to continue the process of identifying and evaluating historic properties in previously unsurveyed areas; to refine predictions on the distribution of unidentified historic properties; and to structure consultation with concerned individuals and organizations. The intent of these programmatic agreements is to reduce the need for repetitive and standard historic preservation compliance reviews. This allows more attention to be paid to those planned activities which could have significant impacts on historic properties or to management areas where little is known about historic properties located within them.

I. CURRENT ACTIVITIES, CONSTRUCTION PROJECTS, AND PLANNED DEVELOPMENTS IN AREAS LEASED TO UH

A. Current Maintenance Programs and Routine Operations Performed by UH or Observatories.

1. Excluded Activities

Many of the daily operations and routine maintenance activities performed by the Mauna Kea Support Services and the individual observatories will not affect historic properties and need not be subject to specific historic preservation review or compliance. In order to reach a clear understanding of which activities fall within this category, a detailed list of all routine activities occurring within the summit region, along the summit road, and at Hale Pohaku will be compiled with the aid of the Mauna Kea Support Services. The list will characterize these activities and group those which will not, or are highly unlikely to, affect historic properties and those which could. Generally all classes of activities that do not entail ground disturbance of any kind would be exempted from specific historic preservation review and compliance as would those occurring in highly altered areas. These would include, for example, water delivery, waste removal, transportation of observatory personnel, routine road maintenance, and actual use of the observatories. A map will also be prepared to depict those areas which have been highly altered. Defining disturbed areas and the degree of disturbance will be based on information drawn from aerial photographs, ground inspections, permitted construction plans and descriptions, and potentially the recollections of individuals involved in these projects.

2. Activities Needing Prior Review and Potential Compliance Measures

Classes of routine or periodic maintenance activities which are listed and categorized as potentially having an adverse effect on historic properties will need to be reviewed by SHPD to determine if any compliance work is needed before the activity occurs. Any class of maintenance activity having the potential to alter previously undisturbed surfaces or subsurface areas will probably fall within this category and a surface survey or monitoring by a qualified archaeologist may be required. The classification of activities will also characterize nature of an activity's potential effect on historic properties and maps will be prepared to delineate those areas in which these classes of activities will be subject to SHPD review or specific restrictions.

Table 1

Historic Preservation Review and Compliance for On-Going and Maintenance Activities

Excluded Classes of Activities

General Characteristics	Examples	Review and Compliance	Plan Provisions
Entails no ground disturbance Entails ground disturbance in highly altered areas with no historic properties Does not alter the visual appearance of the historic district	Daily operations: Water delivery Waste removal Transporting observatory personnel Use of observatories Periodic or routine maintenance: Road maintenance Grading Snow plowing and removal Replace road markers Fix guard rails Repair electrical transmission lines Replace signs	None	Generate and update lists of excluded activities (compiled in consultation with UH) Prepare and update map of previously altered areas (includes degree of disturbance)

Table 2

Historic Preservation Review and Compliance for On-Going and Maintenance Activities

Classes of Activities Requiring Review and Potential Compliance

General Characteristics	Examples	Review and Compliance	Plan Provisions
Has potential to alter ground surfaces or affect historic properties and the historic district Activities are part of on-going or periodic maintenance program (not construction of new facilities or infrastructure) Occurs in previously unaltered ground surfaces or subsurfaces Any excavation of cinder cones forming the summit cluster	Replacement of buried transmission lines Improvements to drainage structures Creation or extension of push piles from road grading Removal of buried or partially buried structure Installation or replacement of guardrails or barriers along road	SHPD reviews proposed activity and asks for one or more of the following: No survey, consultation, or monitoring needed Consultation with native Hawaiian community should occur Inventory survey needed Monitoring of specified activities needed	Generate and update lists of activities requiring review (compiled in consultation with UH) Prepare and update map of areas potentially affected by activities requiring review Prepare and update map showing areas of high and low probably of historic properties within potentially affected areas (include areas in which activities are prohibited)

Examples of activities which could require compliance measures include any excavation occurring in previously undisturbed cinder cone deposits in the summit region, particularly when the activity is occurring within or along the rims of the cinder cones. These excavations should be monitored to ensure the immediate identification and, if necessary, recovery of any human remains or burials uncovered during excavation. This would include excavations needed to repair or replace existing underground utilities or infrastructure if there is a potential of affecting subsurface areas that were not previously altered during initial installation or construction. If, through time, no burials are uncovered during any of undertaking or planned development in the summit cones, this provision may need to be reassessed. Road maintenance is another example of an activity potentially requiring compliance measures. While most routine road maintenance activities, including snow plowing, are unlikely to affect individual historic properties, any activity that deviates from the current road alignment and shoulders (e.g., clearing soil or stones beyond the road alignment) or significantly changes drainage patterns, could have an effect on historic properties if any are present in these or adjacent areas and the integrity of the historic district.

To reduce the need for these activities to undergo SHPD review individually, systematic inventory surveys could be conducted of all areas in which these classes of activities are most likely to occur. Based on the results of this survey, a map could be prepared delineating those areas which are known to be free of historic properties and which require review of proposed activities and may need potential mitigation measures such as monitoring or the marking of restricted areas. This map would also depict the locations of known historic properties to ensure their avoidance and protection.

3. Emergency Activities

A number of emergency actions or rescues occurring in the summit region could directly and adversely affect historic properties or degrade the integrity of the historic district. To reduce this possibility, an emergency plan will be developed to set out contingency procedures to be followed when an emergency arises. Emergencies are considered those actions which would be difficult to predict specifically, which require a rapid remedy or response, and which involve health and safety issues. The plan will only address those emergency actions which involve ground-disturbing activities, take place on unaltered ground surfaces, or could affect undisturbed subsurfaces. Of particular concern are emergency actions that occur in unsurveyed areas. Examples could include the collapse of a road embankment or cinder cone face, the need to

Table 3

Historic Preservation Review and Compliance for On-Going and Maintenance Activities

Emergency Activities

General Characteristics	Examples	Review and Compliance	Plan Provisions
Activities could not be specifically and reasonably anticipated Rapid response or remedy needed Health and safety issues involved Activity involves ground disturbance activity Occurs in previously unaltered area or those not surveyed for historic properties	Rescue injured member of the public or employee (skiing accident, injured hiker, injured construction worker) Retrieve large objects Collapse of road embankment or cinder cone face Need to create detour road Chemical or fuel spill	Contact SHPD for verbal consultation when feasible and appropriate.	Prepare, update, and follow emergency plan that: Defines anticipated emergency scenarios Proposes contingency plans for each scenario to include: Map showing preferred routes or remedies for scenarios Defines measures to avoid historic properties and defacing the landscape: UH staff becomes well informed on the distribution and kinds of historic properties in areas potentially affected by emergency activities Staff will have ready access to maps with the locations and descriptions of historic properties

create a detour road, or having to retrieve large objects or vehicles that have, for whatever reason, become displaced from their normal locations. Another example is chemical or fuel spills which could require an extensive clean-up effort.

The emergency plan will set out a number of different scenarios which reflect those emergencies which have occurred in the past and those that can be realistically anticipated. Each scenarios would define one or more contingency procedures which, if followed, would avoid historic properties and minimize altering of the landscape. A map will also be prepared to show where the major kinds of emergencies are likely to occur and where they are possible. An important component of these contingency procedures to make sure that UH personnel responsible for overseeing emergency efforts have ready access to maps showing the distribution of known historic properties and are familiar with the kinds of historic properties known to exist in the Science Reserve and at Hale Pohaku. If time allows, SHPD should be notified verbally and have the opportunity to comment on any proposed remedy, particularly if the action deviates significantly from the anticipated scenarios.

B. Planned Development and Construction Projects

The following process shall be undertaken prior to the commencement of ground clearing or construction activities for any planned development or construction project. These procedures essentially follow those defined in the draft SHPD administrative rules which roughly parallel the process set out in the federal Section 106 (NHPA) review process. For the sake of discussion, some individual steps set out in rules or regulations have been grouped under five major headings. Discussions of the process also take into account the specific circumstances of each of the three areas under the direct jurisdiction of UH (i.e., the Science Reserve, the road corridor, and the mid-elevation facilities at Hale Pohaku). Historic preservation compliance for any project funded, in whole or part, by the federal government or requiring a federal permit or license, must be conducted in compliance with Section 106 of the National Historic Preservation Act. In these cases, compliance is technically the responsibility of the federal agency providing the funding or issuing the permit or license.

While this section is written primarily for the development of astronomy-related facilities and associated infrastructure, the process also applies to any project undertaken for non-astronomy purposes and by entities other than UH. An example would be parking areas

or facilities established for public use. The results of any archaeological work undertaken to fulfill the requirements of the historic preservation review process must be presented in a report or, where appropriate, in written plans that meet standards set forth in the SHPD draft administrative rules. These reports and plans must be submitted to SHPD for review and acceptance.

1. Inventory Survey of Historic Properties

   All project areas, which will be physically altered by the development of astronomical facilities and associated infrastructure, should undergo an historic property inventory survey to determine the presence or absence of historic properties in the project area. This survey should comply with the standards set by SHPD's administrative rules for inventory surveys and should systematically cover 100% of the area to be altered and that which could be potentially affected by the project. The extent to which adjacent areas should be included in the survey can be determined in consultation with the SHPD on a case by case basis. Such developments would include new observatories, expansion of existing observatories, and any permanent and temporary facilitates or infrastructure needed to support these developments. (At least one historic property will automatically be present for the expansion of any observatories or infrastructure on the cluster of summit cones [Pu`u Kukahau`ula] because these cones are collectively believed to be an historic property.)

   This inventory survey requirement could be accomplished in another way. The proposed Master Plan greatly reduces and clearly defines an 525-acre Astronomy Precinct to which future developments will be confined (Fig. 5). A systematic inventory survey could be conducted of this entire development area. This would preclude the need for individual inventory surveys for each development within the proposed precinct. An exception, and one that occurs rarely, is that a new kind of historic property could be discovered after the survey is completed and would, therefore, not have been recognized or documented during the initial survey.

2. Evaluation of Significance

   After the inventory survey is completed, the significance of identified historic property is evaluated using criteria established to determine a property's eligibility for inclusion in the Hawaii and National Register of Historic Places. This step primarily creates the rationale for determining and justifying why and how identified properties should be treated (e.g., recorded and destroyed, preserved with specific conditions, etc.).

Table 4

Historic Preservation Compliance for Planned Developments or Construction Projects

General Characteristics	Examples of Projects	Review and Compliance Process	Plan Provisions
Creation of a new facility Expansion of an existing facility Creation or improvement of infrastructure Project will alter undisturbed ground surfaces or subsurfaces Has potential to diminish the integrity of the cluster of cones forming the summit Has potential to visually impact the historic district Has potential to increase access to larger or more remote areas	Constructing a new observatory or building Constructing additions to existing observatories or enlarging buildings Reconstructing or renovating an existing observatory or building which alters its outward appearance Creating or realigning roads Rest room or support facilities for public users Constructing or formalizing parking lots Reinforcing cinder cone slopes Constructing or formalizing hiking trails Removing an existing facility or structure which entails altering undisturbed subsurfaces	Almost always requires Conservation District Use permit If funded or sponsored by UH or a state agency: Requires written concurrence of SHPD prior to commencement SHPD determines procedural steps needed to comply with state laws and regulations Compliance actions must conform with SHPD draft program and archaeology administrative rules and the Burial Sites Program administrative rule If federal funding or federal agency involved: Requires compliance with Section 106, National Historic Preservation Act Federal agency in consultation with SHPO and others determines procedural steps needed to comply with federal laws and regulations	Aid decision making process by: Preparing maps and descriptions of previously altered areas Preparing maps of areas having a high and low probability of historic properties Completing historic property inventory surveys of Astronomy Precinct and road corridor Expedite compliance procedures by: Preparing guidelines for historic property treatment plans suited to the three management areas: Interim and long-term preservation plans Monitoring plans Burial treatment plans Inadvertent burial treatment plan Establish reference collection of existing historic preservation laws and regulations Preparing guidelines for consulting with native Hawaiian organizations and interested members of the Hawaiian community Create roster of native Hawaiians wishing to be notified of all actions or actions in particular areas

Table 4a

Historic Preservation Compliance for Planned Developments or Construction Projects

Procedures

Initial Review by SHPD	Determination of Review	Historic Properties Identified during Survey in Project Area	Inadvertent Discovery of Historic Properties
Project description submitted to SHPD for review and comment (may be submitted concurrently with Conservation District Use application or Section 106 consultation) Initiate consultation with native Hawaiian organizations and interested individuals	SHPD determines: No inventory survey needed if: Areas previously surveyed and no historic properties present Ground surface and subsurfaces altered so no historic properties present Inventory survey required if: Area not previously surveyed with 100% coverage Ground surfaces within project area not previously altered Historic properties possible within or near project area Burials possible in subsurface deposits if: Project involves subsurface excavation in cinder deposits Project located on cluster of cinder cones forming the summit	Evaluate historic properties using criteria for determining eligibility for inclusion in the Hawaii and National Registers of Historic Places: If located in historic district, determine if property contributes to the significance and integrity of the district If located at Hale Pohaku or in the road corridor, evaluate significance and integrity of individual property Evaluate if project will have "no adverse effect" or an "adverse effect" on identified properties and the historic district Determine treatment of adversely affected historic properties or district by: Committing to mitigation measures in preservation plans: Interim preservation plan (protects properties during construction, sets buffer zones, may include monitoring) Long-term preservation plan (protects properties during use of facilities, reduces visual impacts) Burial treatment plan if burial present	Historic property or burial found unexpectedly during construction or after inventory survey and acceptance of inventory survey report If burial is found: Stop all work in immediate vicinity and secure area Notify SHPD and police department to determine jurisdiction If older than 50 years, SHPD determines disposition in consultation with Hawaii Island Burial Council Prepare and implement burial treatment plan If historic property found: Stop all work in immediate vicinity and secure area Notify SHPD Document, evaluate, and determine treatment of property found Consult with native Hawaiian community

The process of evaluating properties identified within the Mauna Kea Summit Historic District differs somewhat from that used to identify those found in the road corridor lying downslope of the historic district or at the mid-elevation facilities. Although different, two processes are essentially based on the same rationale and principles. Within the historic district, the significance of properties is not evaluated individually because the summit region as a whole is considered eligible for inclusion in the National Register. Instead, the required assessments consider how each newly or previously recorded property potentially affected by a project contributes to the significance of the historic district as a whole. Within those sections of the road corridor located outside the historic district and the lease areas at Hale Pohaku, the significance of potentially affected properties will be evaluated individually as is more commonly the case during the historic preservation review process. Determining that a property is significant and eligible for the Hawaii and National Registers does not necessarily mean the property will be placed on the Register, only that it possess attributes and associations which would allow it to be considered eligible. Significance evaluation should conform with SHPD administrative rules or the National Register criteria (National Register Bulletin 15) if the project is federally funded or if the historic properties are located within the historic district.

3. Evaluation of a Project's Effect on Historic Properties and Proposed Mitigation Measures

Evaluating the effects of a project on historic properties will also differ for developments planned within the historic district (i.e., summit region) and those planned within the two areas outside the historic district (i.e., a portion of the road corridor and the mid-elevation facilities). Within the historic district, the effect of a project on the historic district as a whole needs to be assessed as well as the project's effect on individual historic properties located within or immediately adjacent to the project area. The effect of a project on the historic district must be addressed even if no individual historic properties are found within or immediately adjacent to the project area.

Effects on a district would consider the visual impact of a facility on the surrounding landscape (i.e., the various land forms creating the setting and context of the multiple historic properties encompassed by the district) and on those individual historic properties which contribute to the significance of the district. Creating a network of roads would affect the historic district because, in addition to altering the landscape, it

creates easier access to more areas in the historic district and thus increases the possibility of historic properties being damaged by visitors. For projects located outside the historic district, the effect of a project would be assessed on individual historic properties identified within or adjacent to a project area. Effects on individual properties can include the complete destruction of a property or severe alteration of the terrain in which the property is located.

Once the project's effects are determined, treatment of the identified properties is proposed. Treatments, generally called mitigation measures, can include thoroughly documenting an historic property before it is destroyed or preparing a preservation plan to assure a property's protection during construction activities (i.e., monitoring, ample buffer zones) and during the long-term use of the constructed facilities or infrastructure. In all three areas leased by UH, strong preference should be given to avoiding and preserving all individual historic properties whenever possible. The proposed Master Plan commits to preserving all historic properties within the Astronomy precinct and establishing a 200 foot buffer around any properties found in or near a project area. For facilities located within the historic district, mitigation measures could be applied to the facilities themselves. These measures would attempt to minimize, for example, the visual or audible impacts of a facility on the historic district or any nearby properties.

All mitigation measures would be set out in mitigation plans such as a data recovery plan (i.e., if the historic property needs to be documented and studied before being destroyed); an interim preservation plan (i.e., if the property is at risk of damage during construction); and a long-term preservation plan (i.e., measures insuring a property's protection long-term). To help expedite the preparation of these individual plans, guidelines will be developed on preparing these different types of plans based on the historic properties known to be present in these areas. In general, guidelines for preparing interim and long-term mitigation plans should be the most useful given the proposed Master Plan's commitment to avoiding all historic properties.

4. Treatment of Known and Potential Burial Sites

Given that some native Hawaiians believe that human remains were uncovered during the construction of at least one observatory on the summit cones and burials are known to be present on other cinder cones in the summit region, any development or construction work requiring excavation near the rims of cinder cones will be subject to

archeological testing prior to ground disturbance. Exceptions would be circumstances in which it can be demonstrated that previous grading or extensive excavations of the proposed construction site effectively precludes the possibility of any burials being present. When archaeological testing is required in a relatively small area, testing alone may be sufficient to establish, with a high degree of certainty, that burials are either present or absent before construction begins. If burials are discovered or if the area is relatively large and testing is not exhaustive, then any excavation undertaken during construction should be monitored by an qualified archaeologist. If the Hawaiian community wishes, provisions can be made for a cultural monitor. These provisions can be reassessed if no burials are ever uncovered during numerous test excavations or monitoring efforts and it thus appears highly unlikely that any will be found in the future.

a. Identified Burials. If a burial is found during test excavations and it is determined to be a native Hawaiian burial site over 50 years old, it is considered a previously identified burial site and its disposition falls under the jurisdiction of the Hawaii Island Burial Council. The council will determine if the burial should be preserved in place or relocated. Whether it remains in place or is relocated, a burial treatment plan must be developed by either the entity undertaking the project or UH. SHPD will ask the burial councils to review the plan and will consider the council's recommendations. If the burial is to be preserved in place, the plan details measures that will ensure the stabilization and long-term protection of the burial site. If it is to be relocated, the plan will describe the proposed reburial site, reburial procedures, and measures to ensure the long-term protection of the reburial site. Although testing procedures are not recommended for areas beyond the cinder cones (i.e., the glaciated, stony terrain of the summit region), the same procedures would be followed should a burial be identified during the inventory survey for any project. The burial treatment plan must conform with §13-300-33 or, if the remains are believed to be non-Hawaiian, §13-300-34.

b. Inadvertent Burials. If human remains are uncovered when construction work is being monitored or anytime after construction commences, the procedures set out in Chapter 6E-43.6 (HRS) and administrative rule §13-300-40 must be followed. This includes notifying SHPD and the police department who will determine if the remains are native Hawaiian and if the burial site is over 50 years old. If the burial site appears to be over 50 years old, SHPD has jurisdiction over the disposition of

the remains but will seek the advice of the Hawaii Island Burial Council or the appropriate council members. A burial treatment plan will be prepared specifying how the burial will be protected in place or relocated and any appropriate procedures needed to carry out these actions. These procedures would apply to burials found inadvertently either in the cinder cones, stony terrain or along the rocky ridges.

c. Burial Treatment Plan Format. To help expedite preparation of burial treatment plans, should one be needed, the historic preservation plan will provide guidance on the general outline and contents of such plans and suggest some options for consideration. Many stipulations and procedures contained in these plans are relatively standard while others should consider the specific circumstances of the burial. These recommendations should be reviewed by the Hawaii Island Burial Council and other concerned members of the native Hawaiian community. Some options might include the designation of reburial areas to help assure the long-term protection of the remains or identifying those individuals or groups wanting to take responsibility for the care of these burial sites. This part of the historic preservation plan, as with the plan as a whole, should be reviewed periodically and revised when appropriate.

5. Inadvertent Discovery of Historic Properties.

Despite a thorough inventory survey, historic properties can unexpectedly be discovered in a project area after construction begins. If this occurs, the plan will follow the SHPD draft or finalized administrative rule which deals with the inadvertent discovery of historic properties. This includes stopping all construction within the immediate vicinity of the property, notifying SHPD, having the significance of the property assessed, and proposing appropriate mitigation measures. If the property can not be avoided due to construction or design constraints, it should be thoroughly documented before being destroyed. If it can be saved, appropriate measures are needed to protect the historic property during the remainder of the construction phase and when the facility is in use. Interested members of the native Hawaiian community should be consulted for properties believed to be associated with native Hawaiians.

6. Consultation with Native Hawaiian Organizations.

Both federal regulations and SHPD draft administrative rules, call for consultation with the native Hawaiian community in the process of identifying, evaluating, and treating

historic properties. Procedures by which the native Hawaiian community may be consulted in these decisions will be developed in accordance with advice received from the community. These procedures would need periodic review as more is learned about the nature and distribution of historic properties on Mauna Kea and as the concerns and perceptions of the native Hawaiian community may change accordingly.

II. Long-Term Management of Historic Properties in UH Leased Areas and within the Mauna Kea Ice Age Natural Area Reserve

As explained in the introduction, discussion of long-term management issues in this plan encompasses both those areas leased by UH and those adjacent lands administered by DLNR which are vulnerable to disturbance because of the infrastructure created to support UH facilities and those of the participating observatories. The DLNR areas covered by these management proposals include those portions of the Mauna Kea Ice Age NAR which fall within the historic district (i.e., Pu`u Pohaku and the larger, pie-shaped parcel) and a management area extending to the west and south of the parcel leased to UH for mid-level facilities at Hale Pohaku. Although we expect UH to assume responsibility for the proposed management tasks on these non-UH leased lands, we do not necessarily expect them to perform all of the proposed management tasks with the same frequency or degree of intensity as they would for UH holdings. At this point, the plan can only identify those management tasks and obligations which we feel should be undertaken or considered. How these tasks will be implemented, by whom, and at what funding levels, can not be settled until agreement is reached on the structure and role of the proposed Office of Mauna Kea Management. Some responsibilities may remain with DLNR while other could be held jointly with UH. All actions and plans generated by this plan which involve or affect the NAR should be prepared in conjunction with NAR staff and should be reviewed by the NARS Commission when appropriate.

A. Management Actions and Plans

1. Monitoring Plan

A monitoring plan will be prepared to determine strategies to systematically monitor the condition of identified historic properties located within the different management areas and the historic district. The primary purpose of monitoring is to determine what uses, if any, are affecting historic properties, the degree and frequency of these effects, and ways to prevent or minimize their occurrence. In addition to providing information on the current conditions of historic properties, monitoring also creates baseline information that can be used to track changes in these conditions through time. For individual properties, the strategy would focus on the periodic inspection of selected properties (i.e., shrines, known or suspected burial sites, significant cinder cones). Inspections would include qualitative descriptions of the condition of each property and

Table 5

Management Actions and Plans

Monitoring Long-Term Condition of Historic Properties and the Historic District

Action	Purpose	Strategy
Systematically monitor the condition of all historic properties and the historic district	Determine which activities are affecting historic properties Determine the degree and frequency of these effects Propose ways to prevent or minimize these effects Provide baseline information to track changes in potential effects through time	Periodic inspection of selected properties (shrines, possible burials, cinder cones) Routine inspection of vulnerable properties (close to roads, visible from a distance, evidence of past disturbance, representative types) Rotational inspection of all properties over five-year period (located far from roads, no evidence of past disturbance) Inspections note existing condition of properties (comparison with photographs, maps) Inspections note and document any signs of disturbance, visitation, or deterioration by natural causes

notes on the presence or absence of any signs of disturbance or visitation. Comparisons would be based on existing photographs and maps of a property and new photographs would be taken to systematically document any changes.

Several criteria would be used to select properties for routine inspection. The most important would be a property's vulnerability given its relative proximity to roads, visibility from a distance, or past history of visitation or disturbance. Another criterion could be shrines or other properties that are good representative examples of a type or are somehow unique. Attempts should also be made to visit all known properties on a rotational basis over a five-year period. The properties visited and the strategy used should be reassessed and changed as needed, particularly if changes in the kind or intensity of use in the summit region changes. For the historic district, observations would note, for example, the distribution of debris, changes in any off-road vehicle use, scarring of cinder cones, and unexpected visual intrusion by constructed facilities.

Given the number of known shrines, the potential burial features, the cinder cones, and the significant areas within the Mauna Kea Adze Quarry, such an annual monitoring program would probably take no more than of total of three weeks (i.e., 15 working days with a crew of at least two). The monitoring strategy for historic properties in the vicinity of Hale Pohaku could include more frequent inspections given their accessibility and the higher use of the area by the public.

In general, this is consistent with the NARS 1997 management policies which direct staff, potentially with the assistance of researchers and the community, to monitor the status of resources in all reserves using Division of Forestry and Wildlife (DOFAW) monitoring protocol. The intent of this monitoring is similar to that being called for in the historic preservation plan in that it tracks the overall status of resources and provides a means of measuring changes overtime. The DOFAW monitoring protocol, however, probably focuses on natural resources more than historic properties. Integrating the two monitoring strategies would probably could help broaden the monitoring mandate of the NAR which includes some of the most significant historic properties on the mountain.

2. Complete Inventory and Documentation of Historic Properties within Management Areas

The inventory of historic properties within the Science Reserve, the historic district, and the management area at Hale Pohaku should be completed as some large areas have never been surveyed or surveyed systematically. A general strategy and plan will be developed for completing these surveys incrementally over a five year period. This could be done in conjunction with the monitoring program if feasible. The primary focus of these surveys in the summit region is to complete the record of shrines and their distribution throughout the Science Reserve and to assess the distribution of potential burial sites on cinder cones located in the historic district. A complete inventory is needed not only to adequately manage all the historic properties in the Science Reserve, but it greatly enhances our ability to interpret how the summit region was used in the past, to discuss the possible functions of the shrines, and to assess their significance within this context. This in turn contributes to any on-going educational programs conducted on Mauna Kea.

Methods used to document and locate these historic properties should, at a minimum, conform with that used for the 1995 and 1997 surveys and the resulting records should be added to the catalogue of historic properties being prepared and submitted with this historic preservation plan. A survey report should be written after each increment which clearly describes and locates the areas covered. In the case of properties found within the summit region, the report should also address how any new findings contribute to the description and significance of the historic district. It should also assess any potential impacts observed in the areas surveyed.

In addition to recording newly identified properties, an effort should be made to upgrade and standardize the descriptions and photographic record of previously recorded properties where needed and to verify their locations. This would be particularly important for some properties which were recorded over the last 30 years but have not been documented recently. This includes many of the properties and workshop areas located in the Natural Area Reserve. Even the descriptions of some shrines recorded since 1982 could be improved if they were initially recorded under weather or time constraints. Upgrading descriptions of recently identified properties could be done during the monitoring effort, but documenting and locating those identified many years ago or only briefly should be scheduled with the incremental inventory of previously unsurveyed lands. In general, priority should be given to

Table 6

Management Actions and Plans

Complete Inventory and Documentation of Historic Properties

Action	Purpose	Strategy
Complete survey and inventory of all historic properties within the historic district and other management areas	Complete and more accurate records allow for better informed and effective management decisions Information contributes to interpretation and educational efforts	Develop plan to systematically and incrementally survey areas not previously surveyed Verify locations and standardize documentation of previously described properties when necessary Prepare report after each survey increment Document and evaluate newly identified properties to current standards Add newly documented properties to historic properties catalogue Upgrade descriptions of previously record historic properties in the catalogue when necessary

identifying new properties because knowing the distribution of historic properties is more crucial when dealing with many management issues.

3. Interpretation and Education

The interpretation and educational initiatives described here will be implemented by an interpretation plan that includes four major components. The first component designates those historic properties which may be suited for public access and discusses ways in which visitation can be informative while diminishing the integrity of the properties as little as possible. The second deals with preparation of brochures for distribution at the Visitor Center at Hale Pohaku which provides information on the historic properties found throughout the summit region and in the area surrounding Hale Pohaku. The third component discusses the preparation of displays at the Visitor Center. As plans to renovate or expand the current center have not been finalized, the plan can only discuss appropriate interpretive themes for the displays and display options. Once these decisions are made, displays can be designed to conform with the size or general lay-out of the rest of the Visitor Center. The fourth component consists of summaries or extracts of information on the prehistory and history of Mauna Kea to help staff stationed at the Visitor Center or in the field give informed presentations and to answer many of the routine questions asked by the public.

a. Interpretation of Historic Properties. Subject to consultation and review, three approaches to interpreting and providing access to historic properties in the summit region are being proposed. These interpretive efforts will not include historic properties in the NAR until specific proposals can be coordinated with the NARS Commission and can be implemented within the context of a management plan for the NAR. The levels of interpretation and access proposed include self-guided tours with optional stops at designated properties and vantage points; guided tours to multiple properties and vantage points; and providing only limited and general guidance to those wishing to hike independently in the summit region. In all cases, any signage, literature, or presentations would emphasize appropriate ways of visiting historic properties and warn against altering or damaging historic properties.

Self-Guided Tours. The plan will consider the development of three areas with shrines and four vantage points to accommodate those members of the public wishing to visit historic properties in the Science Reserve. The shrines that appear to be the most appropriate for visitation and interpretive development are in the

complex located just East of the summit road between 12,200 and 12,260 ft. in elevation (Site No. 16204). Access to the five shrines in this complex is relatively easy because of their proximity to roads and their being at a lower elevation. A limited parking area could be developed to the side of the existing road to the VLBA where parked vehicles and pedestrians would not interfere with use of the summit road. A trail could be developed from this parking area to the lowest shrine where interpretive signs could lead visitors to the upper shrines in the complex. Their location on a solid, stone ridge is also an advantage because this surface would withstand pedestrian traffic better than areas with loose stones, glacial till, or cinders. Reconstruction of the shrines, mostly returning fallen shrine slabs to their apparent up-right positions, should also be considered in the plan. The plan will include provisions for the detailed recording of the shrines in their present state, surface collection of vulnerable artifacts, and possible test excavations before any reconstruction or site development is undertaken.

Two other areas with shrines may be amenable to this kind of interpretive development although priority should be given to Site No. 16204. A self-guided route could be established to visit five shrines located east of the VLBA observatory (Site No 11077, 11079, 21210, 21211, 21213, 21214). Two of these shrines have flaked material from the adze manufacturing process. This area has the advantage of being near an established access road that could accommodate limited parking and of being at a lower elevation (i.e., 12,200 ft. in elevation) where walking would be slightly easier for those not acclimated to high elevations. If this area is developed, adze material should be recorded and recovered prior to initiating public visitation. Trails to these scattered shrines and signage would also be established. The other shrines potentially amenable to self-guided tours are two (Site No. 16166 and 16167) located on the western slope between the Caltech Submillimeter Observatory and the construction staging area and parking lot. Both are relatively near parking areas which could be improved without expanding already disturbed ground. Disadvantages to developing these properties for visitors is the higher altitude of their location (13,240 ft. in elevation), the uneven terrain that would need to be crossed to reach them, and the relative simplicity of the shrines themselves.

Establishing interpretive signs will also be recommended at four vantage points to give the public information on those landscape features which are historic properties because of their association with traditional and legendary characters and, possibly,

an overview of the distribution of known shrines and adze workshops. Two interpretive points would be established on already existing parking lots. Although the positions of these parking lots is not ideal for viewing some of these historic properties, the judicious use of both is preferable to constructing additional parking or pull-off areas and the effect this would have on the historic district. The lower parking area (i.e., at 11,880 ft. in elevation), could be used to point out that portion of the adze quarry which is visible from this lot if the NARS Commission agrees. Some of the geological features, such as the terminal moraine, are well illustrated from this lot and would be an appropriate topic for interpretation as well. Signs at the upper parking lot (i.e., at approximately 12,800 ft. in elevation) would focus on the traditions of Lilinoe and Kukahau`ula as the lot is located between the two cinder cones bearing these names. Some discussion could also be devoted to the diverse and complex cluster of shrines located between the two cinder cones.

The other two vantage points should be on the crest of the summit cones; one interpreting the view of the summit plateau to the east of the summit and the other the plateau to the west. Exact placement of these interpretive signs would be decided in conjunction with UH and the adjacent observatories so that limited parking would be available without obstructing traffic or road maintenance. Interpretive themes could include the known distribution of shrines, suspected routes to the summit region, and the landscape features which contribute to the unique historic district. In preparing the text for these interpretive signs, Hawaii residents should be considered the primary audience. The availability of four-wheel drive vehicles in the local community and the relatively high expense of renting them, makes it likely that Hawaii residents would make up a high percentage of visitors to the summit. Out-of-state visitors may be more likely to arrive with commercial tours.

A seventh historic property, Pu`u Waiau and its lake, is also a good candidate for self-guided tours because of its uniqueness, its significance, and the relatively high number of individuals already visiting the lake. Any consideration of formalizing access to Lake Waiau and providing interpretive signs at the lake would need to be done in conjunction with the NARS Commission and due consideration needs to be given to their primary mandates. Signage would also be useful in making visitors aware of the cultural significance of the lake itself and its waters.

Table 7

Management Actions and Plans

Interpretation and Education

Action	Purpose	Strategy
Prepare interpretive and educational materials for the public about historic properties on Mauna Kea	Educate the public and other users about the prehistory and history of Mauna Kea Encourage the preservation of historic properties on Mauna Kea and their environmental context Inform the public about the restrictions and precautions of visiting the summit region and other management areas	Designate historic properties suitable for public visitation and minimize impact of visitation: Self guided tours Guided tours Independent Hikers Prepare brochures on Mauna Kea's past including with visitor precautions: Develop themes for brochure Develop text, select photographs, and prepare graphics for two brochures Develop conceptual components of display panels, text, and illustrations for expanded or renovated Visitors Center at Hale Pohaku to include: Contents focus on five major topics: Develop context for the presentation of the major topics Objects or replicas in display Compile archaeological and historical background materials to aid staff presentations or interactions with public Outline major themes in more detail Answers to commonly asked questions

Table 7a

Management Actions and Plans

Interpretation and Education: Strategy Details

Public Visitation of Historic Properties	Brochures on Mauna Kea's Past	Conceptual Components of Display
Self guided tours: Proposes three potential areas with shrines for visitation Proposes four vantage points for interpretive signs Guided tours: Proposes three potential tours to areas with shrines Proposes potential tours to Mauna Kea Adze Quarry Independent Hikers: Provide appropriate information to independent hikers to remote areas	Develop themes for brochure: Prehistoric uses (adze manufacture, religious practices, access routes, burial practices, bird catching, travel, resource gathering) Legends and traditions associated with Mauna Kea Chronology of historic-period events and uses of Mauna Kea (early visitors and explorers, cattle hunting, ranching, forest and wildlife management, scientific research) Penalties for disturbing historic properties General precautions to protect the historic district (control debris, prohibit off-road vehicle use) Develop text, select photographs, and prepare graphics for two brochures Simple brochure for casual visitors with moderate interest in the topics (used during visit, single sheet, black and white, easily reproduced) More elaborate brochure for visitors with long-term interest in the topics (kept for future reference or souvenir, larger format, color, higher quality paper)	Display contents focus on five major topics: Adze manufacture at the Mauna Kea Adze Quarry Religious observances demonstrated by shrines Burial practices in remote areas Traditions and legends associated with Mauna Kea Chronology of historic periods and uses Develop context for the presentation of the five major topics: Historic district which integrates the types, distribution, and significance of historic properties Environmental zones, geology and topography of Mauna Kea's upper slopes Objects or replicas in display: Artifacts and stone previous removed from the quarry Artifacts and stone removed from octopus manufacturing area during data recovery Replica of a shrine found in summit region

Guided Tours. Guided tours to some of the more remote shrine complexes may be appropriate if the Office of Mauna Kea Management hires staff who will act as rangers or management specialists. One of their responsibilities could be escorting small to moderate sized groups to three areas which are relatively accessible but not appropriate for interpretive development or high levels of visitation. The level of effort devoted to these tours would be similar to the star-gazing events sponsored by UH at the Visitor Center and the periodic facilities tours conducted by the individual observatories. These guided tours would not cater to companies having commercial use permits to transport visitors to the summit, but to community or school groups requesting tours and to individuals who would be welcome to participate in tours scheduled at specified intervals (e.g., once a month). These tours would also provide the rangers an opportunity to periodically monitor the condition of the shrines and the surrounding landscape.

The most accessible of the three potential areas is the cluster of 11 shrines located between Pu`u Lilinoe and the summit cones (Pu`u Kukahau`ula). In terms of shrine attributes (i.e., number and position of uprights, structural foundations, ground plan or layout), this grouping includes the most diverse examples of complex shrines within a relatively concentrated area. The location of this cluster between the two cinder cones also provides an opportunity to discuss traditions associated with the legendary characters Lilinoe and Kukahau`ula whose names are born by these cinder cones. Visiting this cluster is relatively convenient given its proximity to the summit road and the existing parking lot at 12,800 ft. in elevation which could be used as a tour staging point. Depending on the number of shrines visited in the cluster, the tour could take between two and three hours. Proximity to the summit road is also advantageous for health and safety concerns, including the weather turning bad, visitor straying and becoming disoriented, or those who are overcome by the effects of altitude.

The second tour could visit a single shrine, Site No. 16168, which is an excellent example of a complex shrine and one of the most architecturally elaborate shrines found thus far in the summit region. Located on a flat promontory at the edge of a substantial flow margin, the shrine is composed of the three, discontinuous alignments with a total of 25 standing and fallen slabs. The configuration of these alignments and modifications to the base outcrop create the distinct impression of a court. In some respects it is the shrine that most closely resembles those recorded

on Necker Island. An added attraction of this particular shrine is the commanding and aesthetically pleasing view from the shrine on a clear day. This expansive vista can include the Hamakua Coast, the Waimea Plains, the Kohala Mountains, and Haleakala on Maui. The shrine can be accessed from the road leading to the lowest observatory platform of the Smithsonian Submillimeter Array. Tours would have to be coordinated with staff of the Submillimeter Array to make sure that parking or the timing of the tour did not interfere with their operations. The tour could take one and half to two hours. Prospective participants should be warned that the walk is moderately arduous and all above 13,000 feet in elevation.

The third tour, the most arduous and remote of the tours, would encompass the scattered shines located to the west of Pu`u Mahoe. Many of the shrines within this relatively small area are good representative examples of the various shrine forms and display the range of shrine attributes found within the summit region. This includes the simplest shrine form which consists of a single upright propped by several stones; a relatively common form created by an alignment of three upright slabs, and a much more complex arrangement in which multiple alignments of uprights form a semi-enclosed, court-like area. Flexibility is one of the advantages of this tour as the number of shrines visited and the distances covered could be tailored to the particular wishes or abilities of the participants. A convenient grouping of shrines for the tour would include Sites 16176, 16178, 16179, 16180, 16184, 16185, 21201, and 21202. Another advantage of this more remote tour is that it allows, to a greater degree, visitors to experience the isolation, quit, and natural setting of the shrines. All participants should be warned that the hike, particularly the return to access road, can be fatiguing as these shrines all lie between 12,400 and 13, 000 feet in elevation. Access would be from the jeep road that runs along the northern base of the summit cones at approximately 13,200 feet in elevation. The tour could take about four hours.

Consideration should also be given to conducting tours to the Mauna Kea Adze Quarry because supervised visits to this impressive and highly significant historic property would be preferable to self-guided tours or individuals wandering independently through the site. Of particular concern is the removal of artifacts from the quarry workshops or disturbance to the mounds of flaked material and rockshelter deposits. Before such tours are planned or recommended in the preservation plan, the NARS Commission and staff would need to be consulted. If

conducted, these tours would preferably conform with an historic preservation plan prepared for the NAR.

Independent Hikers. Given that the Science Reserve and the Natural Area Reserve are public lands, individuals who want to hike or independently explore the open, undeveloped areas of the summit region often feel they have a right to do so. The level of guidance provided these individuals should, however, be seriously considered. Providing individuals with some level of information on the nature and distribution of shrines within the Science Reserve could either put the shrines at greater risk or reduce this risk. This information could serve as an incentive for individuals to intentionally visit a greater number of shrines or to search out those in the more remote areas of the Science Reserve. Increased visitation could, in turn, increase the vulnerability of the shrines to disturbance. If properly presented, however, this same information could make hikers aware of the shrines which they might not have recognized otherwise and could have damaged in ignorance. Particular consideration should be given to aiding native Hawaiians requesting information for independent hikes.

b. Brochure. The exact content of the brochure will not be prepared until the synthesis of archaeological and historical information gathered for the preservation plan has been completed. The main topics addressed in the text of the brochure will include the major prehistoric and historic activities known to have occurred on the mountain; legends and traditions associated with the Mauna Kea; and a chronology of what brought people to the mountain during the historic period (i.e., 1823 to present). For the prehistoric period, focus will be on adze manufacture, religious practices as represented by the shrines, access routes, and burial practices. The Hawaii Island Burial Council and other concerned native Hawaiians would be asked to review the discussion on burials. The collective significance of the historic properties representing these uses, as expressed in the designation of the summit as an historic district, would be noted. Also mentioned would be known uses of the mid-elevation slopes where Hale Pohaku is located. These include bird catching, travel from one side of the island to the other, and the use of resources needed to carry out these activities (water sources, bird distributions, wood). Some of the historic properties located near the mid-elevation facilities could illustrate activities that occurred at these elevations. For legends and traditions, the text would discuss the major characters Poliahu, Lilinoe and Kukahau`ula and traditions alluding to

Lake Waiau. The chronology of historic periods uses would begin with the ascent of the mountain by early visitors and explorers; use of the lower slopes for cattle hunting and later sheep and cattle ranching; efforts to manage the mountain's forests and wildlife; and scientific research.

The number and distribution of graphics or photographs appearing in the brochure will depend largely on the size, lay-out, and printing specifications chosen for the brochure. In general at least one photograph or drawing of the adze quarry, a shrine, the lake, and a cinder cone associated with a traditional character should illustrate these significant historic properties. A map of the summit region best conveys the high number and wide-spread distribution of shrines throughout the summit region without providing sufficient detail to allow visitors to walk directly to the shrines. This or another map could depict the historic district and other historic properties which contribute to the significance of the district. The location of known and suspected burial sites would not be shown. If the proposed historic properties and vantage points have been developed for self-guided tours by the time the brochure is produced, a map should be included to guide visitors to these interpretive sites.

Given that so much of what can be included in a brochure in terms of topics and illustrations will depend on the size and format of the brochure, the quality of paper used, and printing specifications (number color separations, etc.), consideration should probably be given to producing two brochures. One brochure could be produced quickly and cheaply in black and white and another, more expensive brochure could be printed in color, on higher quality paper, and in a larger format to accommodate more text. The cheaper brochure would be for visitors who have only a causal interest in the mountain's past and will probably throw it away once it serves its purpose as a guide. The other, more expensive brochure, would be for those who are more interested in the information presented and are more inclined to keep the brochure for future reference or as a souvenir.

Portions of the brochure would warn visitors against damaging or altering historic properties and removing artifacts. The penalties for disturbing historic properties on state land will be cited (Chapter 6E-11, a $10,000 fine for each offense). The public would be cautioned about the need to control and remove any debris created during visits and reminded that use of vehicles off of established roads is prohibited. The

effects of altitude and the dangers of unpredictable weather (i.e., high winds, snow, or thick mists) would be mentioned briefly as this topic is generally covered in more detail by UH in other informational materials prepared for the public.

c. Displays. As noted earlier, the Master Plan proposes expanding and renovating the Visitor Center so only the conceptual components of the displays, general interpretive themes, and display options can be addressed until these expansion plans are finalized. If expansion occurs, then the selection of specific text, illustrations and objects for the displays on the prehistory and history of Mauna Kea should be coordinated with the other displays panned and the lay-out of exhibit space. If these plans do not materialize, then the lay-out and content of the display should be adapted to the existing space.

Most of the themes and illustrations proposed for the brochure would form the core presentation of the display. Panels and text could focus on four major themes of Mauna Kea's cultural past: adze manufacturing at the Mauna Kea Adze Quarry (i.e., extraction of basalt, reduction of material, etc.); religious observances as illustrated by the distribution of the shrines throughout the historic district; use of inland, remote regions for burial; and traditions and legends associated with Mauna Kea. At least two panels should be devoted to creating a context for these activities. The first would describe the historic district as a means of integrating all the significant properties found in the summit region and should include a map showing the distribution of these properties within the context of the landscape. The second would portray and describe the different environmental and topographic zones of the mountain's upper slopes that provide a context for discussing the resources that drew native Hawaiians to the mountain's slopes or sustained them while they were there. Some of the historic properties found in the vicinity of Hale Pohaku could be addressed within this context. A chronology of historic-period landuse and notable events could also draw on this environmental and topographic context. As with the brochure, historic-period themes would include ascents of the mountain by visitors and explorers; cattle hunting or ranching and sheep rearing, efforts to manage the mountain's forests and wildlife; and scientific research.

Although the displays would primarily be composed of text, photographs, maps, and other illustrations, two displays which include materials should be considered. In discussing adze manufacturing, artifacts and stone already removed from the quarry

for various reasons could be displayed to illustrate the different implements and steps needed to take the fine-grained basalt extracted from the quarry and reduce it to the various forms of roughed-out adzes. A similar display could address the manufacture of octopus lure sinkers in the vicinity of Hale Pohaku and their use in fishing. For the use of shrines, a replica of a shrine could be constructed outside the Visitor Center for those who are unable to visit a real shrine, for lack of a four-wheel drive vehicle or health concerns.

d. Informational Material. As part of the preservation plan, informational materials will be compiled to aid those giving presentations at the Visitor Center or guided tours of the Science Reserve and/or NAR. These materials will primarily outline information about the history and prehistory of Mauna Kea in more detail than would be available in the brochures or in displays. Also emphasized would be answers to some of the questions most commonly asked during site visits. The format of these materials should allow guides or rangers sufficient flexibility to adapt the information to different kinds of presentations and assist them in becoming better informed in general. The themes developed in the outline would include both archaeological topics as well as historic-period uses of Mauna Kea and would essentially expand on topics raised in the brochure or display. These materials could also be used by those giving tours of the individual observatories should they want to augment their presentation with information about past uses of the mountain.

4. Burial Protection and Inadvertent Discovery Plan

A burial protection plan will be prepared for known or suspected burial sites located in areas that are not being developed or actively used [See Section I-B(4) for burial plans related to project planning and construction work]. The plan will be developed in consultation with the Hawaii Island Burial Council and other interested native Hawaiians. At present, taking specific actions to protect these sites (i.e., constructed barriers, markers, signs) could be counter-productive. Such measures tend to call attention to features that would otherwise be overlooked. There is currently no indication that known or potential burial sites are being actively disturbed or that any particular activities are causing such disturbances, but this could only be established with greater certainly through routine monitoring. An exception would be the possible burials on the rim of Pu`u Waiau as the lake is visited by hikers more than any other area in the summit region. Despite this high rate of visitation, the potential burial mounds show no sign of on-going disturbance and anonymity may be the be best form

Table 8

Management Actions and Plans

Burial Protection and Inadvertent Discovery Plan

Action	Purpose	Strategy
Adopt measures to protect burial sites in all management areas (within a non-development context) in consultation with Hawaii Island Burial Council	Protect known or possible burial sites from disturbance and degradation Determine appropriate treatment for inadvertently exposed human remains (non-development context)	Prepare plan to protect known burial sites: Anonymity strong protection Use of barriers, markers, or warnings only if needed Monitor burial sites and adjacent areas for signs of visitation or disturbance Prepare plan for inadvertently exposed human remains (e.g., by natural processes): Comply with administrative rule §13-300-40 Provide guidance on potential burial treatment plan scenarios: Stabilize exposed human remains Relocate if stabilization is not feasible Consider temporary repository in summit region until consultation or reburial is completed Designate protected reburial areas if appropriate Document inadvertent burial sites and reburial sites for inclusion in historic property catalogue to ensure long-term protection and monitoring Establish policies on confidentiality for burial site information

of protection. An important protective measure would be ensuring that enforcement or management personnel working in the Science Reserve pay particular attention to any signs that people may be visiting known or suspected burial areas.

Given the known presence of burials in the summit region and at lower elevations, it is possible that human remains could become exposed by natural processes (e.g., erosion). The historic preservation plan will include provisions for dealing with inadvertent burials found in these circumstances in accordance with §13-300-40 and will provide guidance on the preparation of an inadvertent burial treatment plan for these situations. As with other burial matters, the plan should be reviewed by the Hawaii Island Burial Council and members of the native Hawaiian community. The plan will emphasize the stabilization of exposed burial sites so that they can remain in place and be protected from further disturbance. If stabilization is not feasible, the burial would be relocated in accordance with a burial treatment plan prepared in consultation with the Hawaii Island Burial Council and other native Hawaiians requesting to be consulted in these matters. For all inadvertent discoveries that need to be removed for their protection before reburial occurs, the plan may propose finding a temporary repository in the summit region so that the remains need not be removed from the mountain while waiting for reburial. The plan could also consider designating reburial areas that would be more feasible to monitor and protect over time and identifying those individuals or groups wanting to take responsibility for the care of these remains.

All inadvertent burial sites and reburial sites should be recorded and their exact location plotted so they can be included in the on-going monitoring program and protected. This information should be added to the catalogue of known historic properties within lands administered by UH or DLNR and maps showing these additional locations should be updated for use by land managers or enforcement personnel. Policies on confidentiality established for all burial site records would apply to these documents. Records of human remains exposed where there are no surface indications of a burial (i.e., mounds, platforms, in-filled cracks) are particularly important because they would indicate the presence of burials in areas that were not previously known. These areas or type of areas could then be afforded greater attention in monitoring efforts. Some remains in the more remote areas may have been exposed for many years before being discovered as is indicated by surveyors' accounts which mention seeing eroding burials in cinder cones.

Guidelines should be established to address the issue of confidentiality. A balance needs to be found between restricting information on the precise location of burial sites and having this information readily available for those with management responsibilities.

5. General Management Issues

Several long-term management issues are addressed here individually because they are not associated with any one user group or specific type of historic properties. Instead, they are created by or can influence all the major uses (i.e., public uses, commercial operations, use of the observatories, etc.) of the summit region, the summit road, or the areas surrounding Hale Pohaku. These include approaches to control the distribution of debris, prohibitions on the use of off-road vehicles, the monitoring of public access, and enforcing the various restrictions or regulations that exist or may become adopted.

a. Debris Removal, Monitoring and Prevention. The wide-spread distribution of debris over the summit region has been recognized as a problem for a long time. During the archaeological surveys conducted for this preservation plan, it was clear that some areas within the summit region are more vulnerable to debris accumulations than others and that debris is generated by the full range of activities taking place on the mountain. Construction work, routine activities by observatory personnel, and uses by the public, particularly snow-related ones, all appear to contribute to the wide-spread and sometimes concentrated distribution of debris.

Debris can potentially affect historic properties in three ways. First, it could physically damage or deface individual properties such as shrines or burials. During the 1995 and 1997 surveys of the summit region, no instances were noted of such damage to individual properties other than debris lying on the slopes of the summit cinder cones. Second, debris can affect the visual integrity of the historic district and individual landscape features within the district. This potential effect is particularly high given the open and exposed landscape of the summit region. Third, systematic efforts to remove debris could, if not done appropriately, affect historic properties. Most vulnerable would be the shrines and the slopes of the summit cones. Individuals participating in the clean-up could inadvertently damage or alter a shrine if they were unaware of its significance or if collection points for the

temporary stock-piling and removal of debris are placed too close to shrines or shrine complexes.

A debris removal, monitoring and prevention plan will be developed to define steps that can be taken to avoid or reduce the initial creation and spread of debris and to remove debris that will inevitably escape and accumulate despite the best intentions. Some of the steps needed to minimize the chance of materials being carried away by high winds may already be practiced by UH, the individual observatories, and contractors. These or other appropriate measures will be included in the plan in order to recognize their importance in terms of historic preservation and as a means to ensure their inclusion in future agreements or in permits. For the public, the plan will address educational efforts to raise awareness of the problem and recommend that unobtrusive trash receptacles be placed where visitors are most likely to congregate. To avoid potential adverse effects on historic properties during debris clean-up efforts, all those participating should be briefed sufficiently to recognize shrines and instructed to exercise caution when collecting debris near them. Preferably the locations of all collection points will be selected prior to the effort and will be placed at sufficient distances from any shrines. This would ensure the avoidance of shrines and the effective spacing of collection points. Efforts to remove debris from the slopes of the summit *pu`u* should be designed to avoid permanent or temporary scarring of the slopes. Hopefully the need for large-scale clean-ups will decrease as preventative efforts increase and much of the debris which has accumulated over many years is removed.

b. Off-Road Vehicle Use. Historic properties and the district as a whole can be affected directly and indirectly by the use of vehicles off of established roads. Direct damage can be caused by vehicles running over or into historic properties. Most vulnerable to this kind of damage are relatively obscure flake scatters produced by adze manufacturing and cinder cones which can be scarred by vehicle tracks. Shrines are less vulnerable to these direct impacts given their frequent location on stone outcrops or outcrop ridges which are often inaccessible to vehicles or are avoided in cross-country travel. Vehicle tracks can also scar the landscape within the historic district as well as the cinders cones. While some scars may be obscured by natural forces through time, others could remain visible for long periods, particularly if repeated use occurs, and could be enhanced by erosional processes. More importantly, visible tracks tend to encourage others to follow the same route if

Table 9

Management Actions and Plans

General Management Issues

Action	Purpose	Strategy
Adopt measures that address issues affecting all major user groups on Mauna Kea and historic properties in all management areas	Minimize and mitigate the effects of debris on historic properties and the landscape	Prepare guidelines to remove debris and reduce its initial distribution
	Prevent or deter the use of vehicles off of established roads	Continue to prohibit the use of vehicles off of established roads and strengthen measures to deter off-road use
	Minimize the impact of unrestricted public access on historic properties along the summit road and the summit region	Institute measures to minimize the potential effects of unrestricted public access on historic properties and the historic district through registering visitors, distributing information on the protection of historic properties, and monitoring public uses
	Improve enforcement of laws, regulations, and restrictions that protect historic properties and deter violations	Institute measures to increase the effectiveness of enforcing and deterring infractions by maintaining a sufficient staff presence and compiling all laws, regulations, and policies needing enforcement

Table 9a

Management Actions and Plans

General Management Policies: Strategy Details

Guidelines to remove debris and reduce its distribution	Take steps to minimize debris escaping from observatories, during maintenance work, and from construction sites Inform public and commercial users of the impact of debris Install and maintain unobtrusive trash receptacles where users congregate Monitor the distribution of debris Conduct systematic clean-ups to remove debris without disturbing historic properties by: Informing clean-up participants of historic properties and restrictions Designating debris collection and pick points which avoid historic properties
Prohibit and deter use of vehicles off-road	Retain and enforce current prohibitions Adopt language used in NARS administrative rules in rules or management controls Establish measures to prevent or deter vehicles from leaving established roads and designated parking areas Maintain current guardrails and boulder barriers Avoid or minimize visual intrusions on landscape if new guardrails or barriers are installed Designate parking areas by unobtrusive signs, temporary signs when needed, or on maps distributed to public users Inform public and commercial users and UH staff of these restrictions Devise mitigation measures to obscure off-road tracks created by unauthorized or authorized vehicles
Measures to minimize effects of unrestricted public access	Monitor public use through a registration process Provide public users with information on historic properties and restrictions that protect historic properties and the historic district Monitor the effects of public use on historic properties so that controls or restrictions can be revised when necessary Maintain an adequate level of staff presence to deter violations and encourage adherence to restrictions Direct users to historic properties or vantage points designed to accommodate visitation or to guided tours
Measures to effectively enforce or deter infractions	Hire sufficient staff with enforcement or management authority to patrol the three management areas and portions of the NARS Train staff to document the intentional alteration of historic properties to federal standards Maintain and update the catalogue of historic properties and their current condition for comparative purposes Monitor the condition of historic properties to identify patterns in the alteration of historic properties Integrate all regulations, restrictions, and polices in a single document to aid management staff

only out of curiosity. Off-road vehicles have an indirect affect on historic properties because they allow individuals to visit a greater number of historic properties and more distant parts of the Science Reserve with greater ease during a single outing. This increase in accessibility to otherwise relatively remote properties can, in theory, raise the probability that historic properties or parts of the historic district could be altered or damaged.

The 1995 Revised Management Plan prohibits the use of off-road vehicles by the general public and commercial operators. The types of off-road vehicles specified as being subject to this prohibition include motorcycles, dune buggies, snowmobiles, and 4-wheel drive passenger vehicles, van, and trucks. Exceptions are allowed for emergency rescue and medical reasons. The administrative rule for the Natural Area Reserve prohibits the operation of all motorized and unmotorized land vehicles within a NAR except on roads or trails specifically designated for this purpose. It also prohibits the use of "air conveyance of any shape or form" in the NAR. The NARS Commission can issue special use permits to allow otherwise prohibited activities for purposes such as research, education, and management. For historic preservation purposes, we would prefer that the stronger of the two conditions be applied to the entire Science Reserve in addition to the NAR and that similar provisions be included to deal with exceptions such as emergencies or special requests that would then be subject to review by the appropriate agencies. The terminology used for off-road vehicles in the NARS Commission rule is also preferable because it is broad enough not only to include the range of vehicle types in use today, but also those that have not been developed yet or have yet to become popular. In addition to keeping vehicles on designated roads or trails, the historic preservation plan will also address measures to restrict vehicles to designated parking areas such as those that are formalized and paved or those that are unpaved but marked for this purpose. The latter could include previously disturbed turning areas or stretches of road shoulders that have been previously disturbed and could accommodate parking safely. In all cases, these restriction would apply to public and commercial activities.

The plan will consider mitigation measures to prevent or deter off-road vehicle use and to obscure tracks or damage caused by authorized and unauthorized vehicles. Currently restrictions against off-road vehicle use are encouraged or enforced by signage and guardrails or boulder alignments that keep vehicles from departing the

main road where exits are possible or have been used in the past. The proposed Master Plan recommends that guardrails be installed in potentially hazardous stretches of the summit road after a road safety study assesses where they are needed. We would prefer that physical barriers, including guardrails or boulder alignments, be used sparingly as they are a visual intrusion on the landscape although safety is still a primary consideration. Boulder barriers could be installed in areas that are identified as problematic only after monitoring suggests a need for them in particular places. Even these should be installed in a way that minimizes their visibility. Signs should also be used with constraint and be designed to certain specifications so that they do not distract from the landscape. Low markers, instead of tall or reflecting signs, could be used to delineate unpaved parking areas or stretches along the road where parking is permitted. Preferably, all areas in which vehicle use or parking is restricted or allowed should be well illustrated in information distributed to all visitors and commercial operators. If presented effectively, this information could help reduce the need for distracting signs and markers. To restore areas that have been marred by vehicle tracks, experiments may be needed to determine which methods will best obscure the scars in differing slopes and substrate types. Those areas in which this has been attempted should be reexamined to see how effective these efforts were.

c. Public Access. From the narrow perspective of preserving historic properties, the more access to the summit region is controlled and restricted, the less likely it is that historic properties will be damaged or destroyed. Preservation alone, however, is not the overriding or exclusive mandate of the historic preservation plan which must also consider native Hawaiian access and public education as major objectives. When all three objectives are considered, options that emphasize the monitoring of access instead of restricting it are preferred. This does not include the exceptions of restricting access for snow clearance, for health and safety reasons, during heavy visitor usage periods, or for night-time observatory use (i.e., access restricted to one half hour before sunrise and after sunset). The proposed Mater Plan commits to establishing guidelines for registering visitors to the summit region and providing an orientation for visitors.

Many of the potential affects of uncontrolled access on historic properties can be reduced or minimized by providing users with information on historic properties; monitoring the condition of historic properties; having some level of staff or ranger

presence in the area as a deterrent; enforcing the laws or regulations when needed; directing visitors to historic properties suitable for visitation; or informing them of the guided tours. Asking that all visitors register before going beyond Hale Pohaku would provide the opportunity to supply the public with the appropriate guidance and warnings.

d. Enforcement. In terms of enforcing of historic preservation laws and protecting historic properties, the importance of having a greater staff presence in the summit region, either in the role of enforcers or managers, can not be over emphasized. While it may be preferable to have individuals with full enforcement powers available, the presence of rangers or management specialists alone can significantly deter actions that disturb historic properties or alter the landscape. Rangers or management specialist who are not official enforcement personnel should be trained in standard procedures for documenting potential violations. In particular, they should receive training in recording damage to historic properties such as that given National Park rangers who need to document damage or vandalism to standards required when enforcing the Archaeological Resources Protection Act on federal lands.

Three documents or programs generated by the preservation plan should make enforcement efforts more effective. The first is a catalogue of all known historic properties and their locations in the Science Reserve which can serve as baseline documentation against which any suspected alteration or damage can be compared. Second, the monitoring plan will routinely up-date this comparative documentation and identify patterns of disturbance and those particular areas or properties that are most vulnerable to intentional disturbance. Enforcement efforts can then be focused in these areas. Third, an outline of the applicable laws and regulations will be compiled for ready use by management staff. Adopting administrative rules specific to the Science Reserve, as recommended in the Legislative Auditor's report, could help simplify the overall enforcement effort in that all the required procedures, prohibitions, and penalties applicable to all resources and uses on the mountain would be available in one document.

B. Management of Public Use

In addressing the affects of public uses on historic properties within the UH leased areas and the NAR, the historic preservation plan will follow the general categories of use discussed in the 1995 Revised Management Plan adopted by the Board of Land and Natural Resources and UH. This includes a fundamental distinction between public uses which are generally considered recreational in nature and commercial uses which encompass any organized activity conducted on a fee-for-service basis. Public uses are largely unrestricted although the 1995 Revised Management Plan specifies a number of controls which can be enforced to manage these public uses. These controls are in addition to restrictions or procedures mandated by state laws and regulations. Commercial users must obtain permits for their operations and abide by a number of permit conditions which control and restrict certain types of activities during commercial operations.

Under the 1995 Revised Management Plan, DLNR assumed primary responsibility for managing and enforcing both commercial and public uses of the Science Reserve and other lands leased by UH (i.e., excluding facilities or areas under sub-lease agreements). Specifically, the Land Division of DLNR is charged with issuing and monitoring commercial permits while the Division of Conservation and Resources Enforcement (DOCARE) of DLNR is responsible for enforcing permit conditions or other violations. UH is charged only with assisting in these management and enforcement efforts, primarily through monitoring uses and reporting infractions. The proposed Master Plan suggests having UH assume responsibly for all commercial and non-commercial public uses of the Science Reserve. Public activities occurring within the NAR remain under the jurisdiction of the Natural Area Reserve Commission which also calls upon DOCARE if enforcement action is needed. Commercial uses within the NAR are prohibited without a NARS Special Use Permit and specific kinds of non-commercial activities also require Special Use Permits. Permits issued include general restrictions as well as specific conditions to prevent or minimize potential impacts by a proposed activity.

The following discussion addresses only those public and commercial activities known to occur on UH controlled lands and in the NAR which have the potential to affect historic properties. The general approach adopted to deal with the potential affects of these on-going uses is similar to that adopted for on-going or routine maintenance

activities in that it involves identifying those areas in which public and commercial activities are most likely to occur; determining the presence or likelihood of historic properties in these areas; assessing the potential of these activities to affect historic properties in these areas; and proposing measures to prevent or mitigate any of these potential adverse affects. Essential to the effectiveness of this part of the plan is a program to systematically monitor these uses, to effectively inform users of any controls or restrictions imposed to protect historic properties, and to enforce restrictions when necessary. Monitoring would allow the potentially affected areas to be identified more realistically in the future and the defined areas to be revised if patterns of use change through time.

1. Recreational Use by the Public

The treatment of public, non-commercial uses focuses on four major kinds of activities, most of which can be undertaken by individuals or groups. The first is snow-related activities which occur intermittently, usually seasonally, when sufficient snow falls on the mountain. The second kind encompasses activities associated with visitors who are primarily interested in seeing and experiencing the mountain region and summit. This includes activities associated with learning about the natural and cultural history of the mountain, enjoying vistas possible from higher elevations, or seeing the telescopes independently of tours sponsored by the Mauna Kea Support Services or individual observatories. The third is hunting which is allowed under 1995 Revised Management Plan if coordinated with UH and in the NAR only as part of a coordinated plan to reduce and control animal numbers. The fourth is non-commercial tours organized by Mauna Kea Support Services or individual observatories in which the primary objective is to tour facilities or view the stars through optical telescopes.

a. Snow-Related Activities. Snow-related activities occurring in the summit region range from the simplest form of merely experiencing snow to the more technical sports such as down-hill skiing on preferred slopes. These activities can include snow-play, snow-boarding, sledding, and cross-country skiing. The frequency, intensity, and distribution of these activities will always depend on the depth of snow accumulations, how long the snow cover lasts, and how far down the mountain slope the cover extends. These conditions can draw large numbers of people for relatively short periods (i.e., one or two days, a weekend, etc.) or cause only moderate increases in the routine number of visitors to the summit region. Despite this variability, most of these activities probably take place in relatively predictable

Table 10

Long-Term Management of Historic Properties - Public Uses

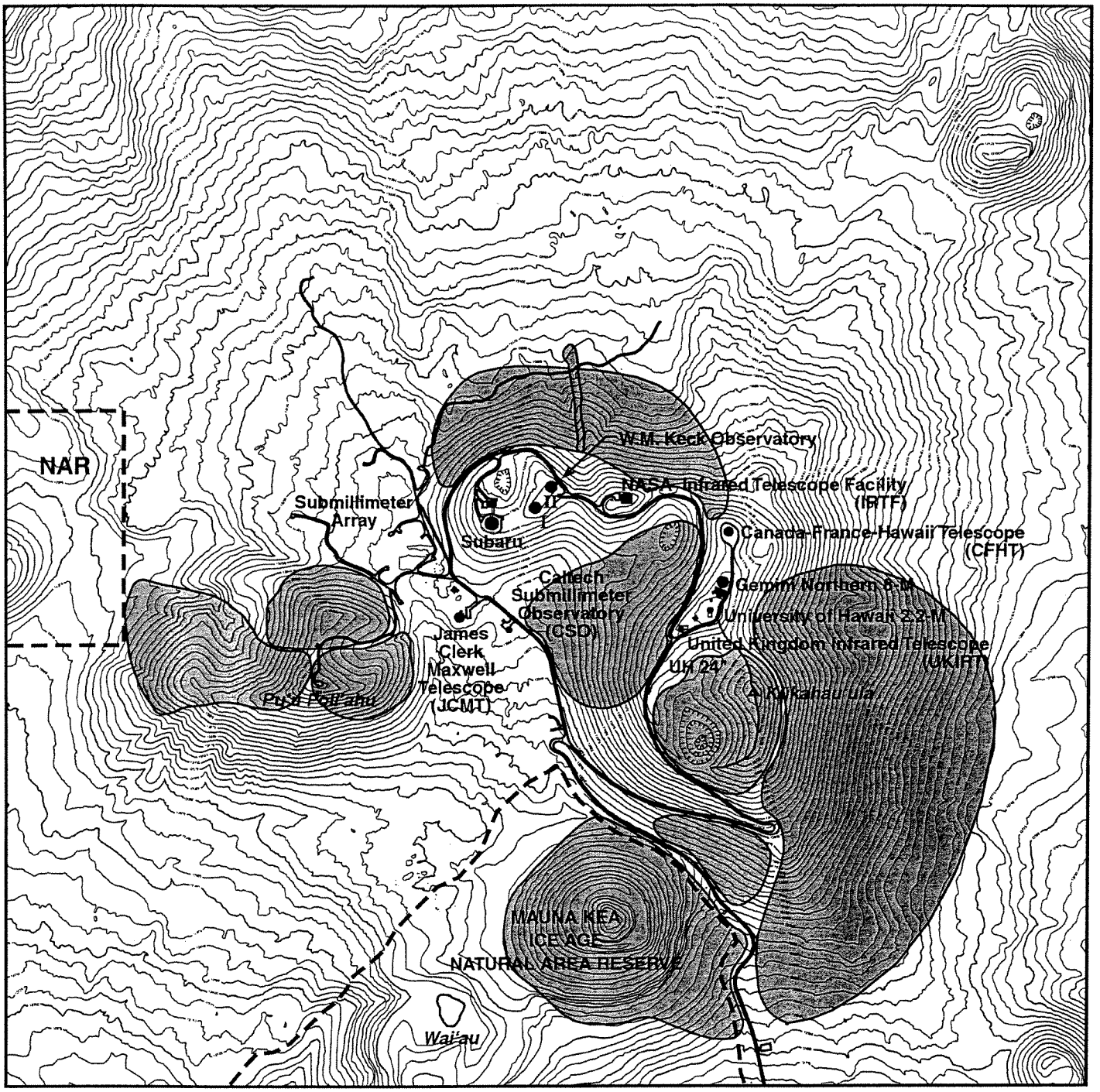
Snow Related Activities

General Characteristics	Examples of Activities	Potential Effects on Historic Properties and District	Mitigation Measures
Use is intermittent, usually seasonal, when sufficient snow falls Occurs where: Snow accumulates to sufficient depths Terrain and slopes are amenable to winter sports Areas are accessible by road or near parking Intensity of use: Large number of user for short periods Moderate increase in routine visitor numbers for short periods	Experiencing snow and winter conditions Snow play Snow-boarding Sledding Down-hill skiing Cross-country skiing	Scaring or eroding cinder cones during skiing, sledding or snow-boarding Inadvertent damage to shrines or flake scatters during cross-country skiing, snow-play, or snow-boarding Inadvertent damage to cinder cones, shrines, or flake scatters during emergency rescues Creating debris (clothing, beverage containers, Styrofoam board fragment, cardboard) Need for rest room facilities Use of vehicles off-roads (caused by limited parking, wanting to reach snow banks or covered slopes)	Confine down-hill skiing and sledding to cinder slopes with a protective layer of snow Monitor long-term effects of snow-related activities on cinder cones Designate areas where specific snow-related activities can occur Inform users of designated areas through maps, temporary signs, or directions given by rangers Inform users of rest room facilities and permanent trash receptacle locations Increase ranger presence during high intensity use periods Limit number of visitors or duration of visits during high intensity use periods Install temporary trash receptacles in areas of high usage Perform debris clean-up sweeps in high use areas at end of winter season Inform users of designated parking areas (also with temporary signs if needed UH staff reviews emergency plans when winter season begins

areas (Fig. 6). For down-hill skiing, the favored runs are well known to be particular slopes on Pu`u Poliahu, Pu`u Hau Kea, and the summit cones where established roads also allow a degree of vehicle access at the beginning and end of the runs. For other types of snow-related activities, factors such as proximity to access roads, convenient parking areas, and appropriate slopes for snow-boarding and sledding will influence where these activities are most likely to occur.

Most of the snow-related activities have the potential to directly affect historic properties. As we believe the cluster of summit cones (i.e., Pu`u Kukahau`ula) is an historic property, skiing on the slopes of this *pu`u* could adversely affect this historic property. For example, visibly scarring of the *pu`u* could occur if skiing-related actions take place on portions of the cinder cone which are not covered with a sufficient depth of snow to protect the cinder cone. If this is the case, skiers could be asked to confine their activities (i.e., walking, skiing) to slopes that are covered with a protective layer of snow. Long-term monitoring of the cinder cone slopes should be able to identify the magnitude of these or any other affects. Although we do not consider all cinder cones to be historic properties, similar constraints should be applied to them as they are encompassed by the historic district and contribute to the setting and integrity of the district as a whole. UH staff and other frequent users of the mountain will be asked to help identify areas most likely to be affected by the other types of snow-related activities. With this information, the plan can designate areas in which specific kinds of snow-related activities can and can not occur based, at least in part, on the known presence or absence of historic properties. Individuals could be shown which areas are appropriate and inappropriate in brochures, by rangers patrolling these areas during times of heavy snow cover, and possibly by temporary signs.

In general, the indirect effects of snow-related activities on the historic district are similar to those resulting from other recreational uses except that their occasional intensity can dramatically increase their effect. These activities all increase the amounts of debris generated, the need for rest room facilities, potential off-road vehicle use, and the likelihood of emergency rescues. In general, those mitigation measures recommended under General Management Issues and Policies [Section II-B(5)] apply although some additional steps may be needed to accommodate the intensity of use. During periods of heavy usage, the presence of rangers or resource managers patrolling areas should be increased and consideration given to controlling



Source: 1983 Mauna Kea Science Reserve Complex Development Plan, Dr. Jerry Johnson, 1998

Existing Ski Areas

Figure 6 Commonly Used Ski Areas

the number of visitors allowed access to the summit region at a given time. The length of the visits could also be limited to allow access to more individuals within these constraints.

Snow-related activities create the same kinds of debris as other public uses (hats, food and beverage containers, pieces of plastic, etc.) with some notable exceptions. They appear to be primarily responsible for the fragments of Styrofoam or fiberglass boards and cardboard sheets that are scattered over parts of the Science Reserve. Efforts to control debris, such as informing users of the problem and providing trash receptacles, should be intensified during periods of heavy snow. Temporary trash receptacles could be placed in areas where snow conditions are particularly favorable or use is high. This would be in addition to permanently installed receptacles. Once the snow cover has melted or when the winter season appears over, specific clean-up sweeps could be conducted in high use areas. The proposal in the draft Master Plan to construct permanent rest room facilities in a previously disturbed, level area between the summit cones and Pu`u Poliahu, would be particularly helpful in reducing the affects snow-related activities on the historic district. The presence of this facility and its location should be made clear to all users.

Several factors increase the probability of off-road vehicle use, including parking, during periods of heavy snow. Some individuals may be enticed to reach more remote areas where snow cover or slopes are amenable to snow-boarding. Greater competition for limited parking areas could also compel users to venture off of established roads or parking areas. These problems could be reduced if patrols by rangers were increased during these periods and if information distributed to the public makes it clear that off-road use is prohibited. If off-road parking becomes problematic in specific areas, temporary warning signs could be installed.

The frequency of emergency rescues clearly increases during periods of heavy snow given the potential danger inherent in snow-related activities and the high number of users. Accidents and the need for rescues might be reduced if users are better informed, areas appropriate for snow-related activities are specifically designated, and rangers or management staff direct users to areas where the snow is thickest and sledding or snow boarding are the least dangerous (e.g., relatively free of exposed rocks). More importantly, procedures recommended in this plan [Section I-A(3)] to

avoid damaging historic properties during emergency actions should be followed and the necessary materials made readily available when heavy snow falls in case they are needed by rescue crews.

Neither the NARS regulations nor its 1997 management policies specifically address snow related activities. The slopes of Pu`u Hau Kea are defined in the Master Plan as one of the preferred skiing and snow play areas and, depending of the extent and depth of particular snowfalls, other areas could be used as well. Skiing and snow play are not specifically mentioned as a permitted use (§13-209-3) and could be considered a prohibited use if they result in the damage or disturbance of geological features such as the cinder cones. If it were seen that skiing and snow play are disturbing these areas, the 1997 management policies state that public access may be "controlled, regulated, or prohibited in order to manage the impacts of public use of sensitive resources" (1997:5). A more specific policy on these uses should be developed with the NARS staff so that the monitoring, management and control of these uses during periods of heavy snow fall can be integrated with that of the Science Reserve.

b. Sightseeing, Hiking, and Educational Pursuits. General sightseeing and hiking, whether for experiencing the summit region or educational purposes, could have a greater effect on historic properties than other kinds of public uses because individuals or groups tend to have the time, mobility, and inclination to wander from established roads and trails and to encounter historic properties intentionally or inadvertently. In reality, however, relatively few visitors seem to wander far from established roads and trails or even from their private, four-wheel drive vehicles given the effects of altitude, cold temperatures, or windy conditions. Once at the summit, visitors generally stop at various vantage points for the view. Some will drive to the summit of Pu`u Poliahu on the rough, existing dirt road. Those inclined to hike tend to follow the well-worn path to the actual summit peak, the former dirt road to Lake Waiau, or the Humu`ula trail which cuts through the NAR from Hale Pohaku to Lake Waiau. Some wanting to see the Mauna Kea Adze Quarry and knowing its location will hike cross-county from the summit road to one or two of the workshop areas that are closest to the road.

The most likely, direct effects sightseers or hikers could have on historic properties would be the alteration of shrines, the removal of artifacts or materials from the

Table 11

Long-Term Management of Historic Properties - Public Uses

Sightseeing, Hiking and Educational Pursuits

General Characteristics	Examples of Activities	Potential Effects on Historic Properties and District	Mitigation Measures
Use occurs all year but higher during summer months or when weather is good Users generally stay near vehicles and on established roads and trails Low numbers of individuals or groups leave established roads or trails to climb cinder cones or visit areas of interest Occasional and unpredictable use of more remote areas	Non-Hawaii residents sightseeing in rented vehicles Sightseeing by Hawaii residents Day-hikers Excursions by school groups Individuals or groups interested in natural history	Scaring or eroding cinder cones by walking or running down slopes Inadvertent alteration of shrines, adze quarry features, or burial sites by visitors Inadvertent damage to cinder cones, shrines or adze quarry features during emergency rescues Removal of artifacts from the Mauna Kea Adze Quarry Contamination of Lake Waiau by visitors Intentional vandalism of historic properties Defacing landscape features	Control visits to historic properties by developing interpretive vantage points and self-guided and guided tours Inform visitors to avoid disturbing historic properties and of penalties in brochures or orientations Register all visitors to summit region to so that information on historic properties can be distributed Limit size of groups visiting off-road or remote areas through permitting process Enforce Special Use Permits issued for groups visiting the NAR Propose areas and routes for self-guided or guided natural history tours Establish new trails or formalize existing trails only if needed Inform visitors of need to control debris and personal belongings in high winds Inform users of locations of trash receptacles, rest rooms, and parking areas Control the number of visitors or the duration of visits if needed

Mauna Kea Adze Quarry, the disturbance of burial sites, or the scarring of cinder cone slopes. Those properties closest to access routes or visible from a distance are the most likely to be visited and are thus the most vulnerable. Creating self-guided tours and regular guided tours will hopefully reduce these potential impacts by focusing visitation on particular properties which can accommodate visitors or by having a guide present to monitor visitor actions. This would also reduce the frequency of visitors wandering independently and thus decreases the chance of historic properties being damaged inadvertently. As damage to historic properties by visitors is primarily done inadvertently or in ignorance, providing visitors with adequate information on how to recognize historic properties and on their appropriate treatment should also reduce these effects. This could be accomplished through brochures and orientations coupled with requirements that all entering the summit region must register. Registration provides the opportunity to distribute this information to all visitors and increases the likelihood of adherence to warnings and instructions.

A requirement that groups greater than a specified size obtain a permit or special permission to visit off-road areas of the Science Reserve should be considered because it allows conditions to be placed on group visits that are tailored to the particular areas being visited or the size of the group. This would be important for groups visiting for educational purposes because they are more likely to seek historic properties. A similar policy can already be implemented for the NAR. The NARS 1997 management polices state that all organized educational trips require a Special Use Permit which allows specific restrictions to be placed on the group's size and what areas will be visited. Currently, groups with more than 15 members are required to obtain a permit to visit the Mauna Kea Ice Age NAR.

For groups wanting to view multiple aspects of the mountains natural history, suggested tour routes could be developed to accommodate groups of various sizes, interests and abilities. This allows greater control over where groups go, particularly in remote or potentially sensitive areas, and what they do without diminishing their educational experience or a need for flexibility. If the routes of natural history tours are standardized to some degree, then it would be easier to provide group leaders with information on how to recognize and avoid historic properties located along or near those specific routes. Some group visits could become guided tours led by rangers or management staff which would further help

reduce potential effects on historic properties. This is consistent with the 1997 NARS management policies which direct Reserve Management Plans to identify areas appropriate for educational activities and field trips.

For recreational hiking, the 1995 Management Plan for the Science Reserve restricts hikers to existing roads and tails although this restriction does not appear to have been enforced or well publicized. The proposed Master Plan does not address this restriction, but proposes to eventually establish hiking trails though sections of the Science Reserve, particularly along routes that were traveled during the historic period. Hiking is permitted in the NAR although the 1997 management policies allow public assess, which presumably includes hiking, to be controlled or prohibit such if it could impact sensitive resources. This issue needs to be reconsidered and some consensus reached after all potentially interested parties have been consulted and the legality of enforcing any restrictions are addressed. Although extensive, independent hiking should be discouraged for those not prepared for the dangers of hiking at high elevations, it could be difficult to prohibit realistically. As part of the interpretive effort, we have proposed that those wishing to hike independently to visit shrines, particularly native Hawaiians, be provided sufficient information to visit these historic properties and to treat them appropriately. We prefer this alternative to establishing a network of hiking trails because trails themselves, no matter how well designed and constructed, are a visual intrusion on the landscape and thus affect the integrity of the historic district. We would, however, favor the creation of formalized trails if the monitoring program determines that multiple paths or tracks are being created because of repeated visitation to specific areas and that formalizing these routes would help reduce the overall impact of hiking on the historic district. The affects of heavy foot traffic are already evident in the worn paths leading to the summit peak and to Lake Waiau and on the road leading to the top of Pu`u Poliahu. Consideration should be given to formalizing these access routes for hikers and providing appropriate interpretative information about these landscape features. The creation of any new, formalized trails or substantial alteration of an existing route would be subject to review by the Historic Preservation Division.

The indirect effects of sight-seers and hikers are essentially the same as snow-related users in that they can generate debris, create a need for rest room facilities, could be tempted to drive vehicles off of existing roads, and could require emergency rescues. Although less intense than snow-related activities, effects caused by hikers

and sightseers could be more widespread and less predictable as some hikers could reach infrequently visited areas farther from existing roads. These effects would, in general, be reduced if mitigation measures discussed in the section on General Management Issues and Policies are implemented. Specifically, information given to sightseers or hikers should note areas where parking is permitted and trash receptacles and rest rooms are located. Some arrangements for parking should be formalized near the head of any formalized or well established trails such as those leading to the summit, Lake Waiau, and Pu`u Poliahu. In general, restricting the total number of visitors allowed in the summit region at a given time and visitation to specified hours would also, indirectly, reduce access to historic properties and thus the probability of them being altered. Currently, access to the summit region is primarily restricted to daylight hours and visitor numbers can be controlled should demand for access be exceptionally high.

c. Extreme Sports. Management proposals for the summit region and the summit access road must now consider the potential effects of what are loosely defined as extreme sports. Their recent rise in prominence can be attributed to the growing popularity of such sports and to technological advances in sporting equipment which have made these sports possible and affordable. Their potential impacts are addressed in the draft Master Plan, but not the 1995 Management Plan. The Master Plan defines extreme sports "as recreational activities that seek dangerous and unusual thrills" and gives down-hill cycling and hang gliding as examples of extreme sports that have occurred in the summit region. The unique settings and extreme conditions of summit regions such as Mauna Kea provide the kinds of conditions that can attract thrill-seekers. The status of this use is summarized in the draft Master Plan as not being categorically prohibited. The draft plan recommends that each extreme sport be evaluated on a case by case basis and that some may be prohibited or require permits.

Not all activities considered extreme sports are likely to have a direct effect on historic properties. Those which are confined to existing roads, such as down-high cycling, are highly unlikely to damage historic properties. Any activities, however, involving the use of motorized or unmotorized vehicles off of existing roads should be explicitly prohibited. This could include mountain bikes, all terrain vehicles, or motor cycles when used in an extreme manner. As with all off-road vehicle use, these vehicles can scar and damage the landscape which is an integral part of historic

Table 12

Long-Term Management of Historic Properties - Public Uses

Extreme Sports

General Characteristics	Examples of Activities	Potential Effects on Historic Properties and District	Mitigation Measures
Recreational activities by those seeking dangerous or unusual thrills Can occur on established roads or in remote areas Can increase need for emergency rescues Does not occur frequently Most are prohibited in the NAR	Down-hill cycling Hang gliding	Scaring and eroding cinder cones Scaring or damaging the landscape Inadvertent damage to shrines or adze flake scatters during activity Inadvertent damage to shrines or adze flake scatters during emergency rescues Creating debris	Establish permitting process to include these conditions: Clean-up any debris created by activity Specific measures to protect historic properties Submit an emergency plan prior to event which avoids damage to historic properties and the district SHPD reviews all permit applications Prohibit activities involving motorized and unmotorized vehicles off-road Prohibit activities in the remote parts of the Science Reserve Enforce NARS regulations when activity is a prohibited use Inform visitors of that permits requirements and prohibitions apply to extreme sports before they enter the summit region

district. Any activity that takes participants in the more remote areas of the Science Reserve should also be prohibited and is inconsistent with the concept of the Natural/Cultural Preservation Area proposed by the Master Plan. These sports could include hang gliding and the extreme use of other vehicle types. Not only can these activities damage historic properties, but they raise the probability of emergency rescues given their inherent danger. The emergency rescues themselves can mar the landscape or inadvertently damage historic properties given the speed and haste with which they must take place.

The preservation plan supports the recommendation that extreme sports be subject to a permit and review process. With the exception of those confined to existing roads, all applications should be reviewed by the Historic Preservation Division. The permitting process would provide a mechanism by which potential impacts on historic properties can be assessed and avoided. All applications should clearly define the area in which the activities will take place so that the potential to effects on historic properties in this area can be assessed. Permit conditions should also address some of the indirect effects of this recreational use. For example, permit conditions can stipulate that applicants are responsible for cleaning up any debris generated by the sports activity, particularly if this debris includes pieces of their equipment. Applicants could be required to submit an emergency rescue plan before the activity takes place to ensure that historic properties are avoided. The requirement to obtain a permit for these sports should be made clear to all those visiting the summit region. Information given in hand-outs or during orientations should give examples of activities that are considered extreme sports to reduce the chance of any misunderstandings.

d. Hunting. According to the 1995 Management Plan, hunting is currently allowed within the Science Reserve during daylight hours although it must be coordinated with the UH and is still subject to DLNR rules, regulations and policies related to hunting. Requests are apparently infrequent as there are few game animals or birds at the higher elevations. As a policy objective of the NARS commission is to reduce non-native animals to their lowest possible levels, public hunting is only used as a measure to control the number of animals in a reserve when practical. The 1997 NARS management policies list public hunting as only one of the ways to control non-native animals in the reserve. A summary of areas that have been or are most likely to be used for hunting will be compiled for the final plan and when completed,

Table 13

Long-Term Management of Historic Properties - Public Uses

Hunting

General Characteristics	Examples of Activities	Potential Effects on Historic Properties and District	Mitigation Measures
Allowed during daytime hours in the Science Reserve Occurs rarely as most game located at lower elevations Subject to applicable DLNR rules and regulations governing hunting Coordination with UH required if in the Science Reserve Prohibited in the NAR unless part of a sanctioned effort to reduce animal numbers	Rifle hunting for game birds, pigs, goats, and mouflon sheep Archery hunting for goats and mouflon sheep	Inadvertent alteration of shrines, flake scatters, or burial sites Ammunition striking shrines Off-road vehicle use to access game Debris left in areas hunted	Prepare description and map of most likely hunting areas and assess potential effects on historic properties Provide hunters with information on historic properties and the need to avoid them Inform hunters of designated parking areas and prohibitions against off-road vehicle use Ask hunters to remove all debris created while hunting Monitor long-term effects of hunting on historic properties and the district

the potential of hunting activities affecting historic properties can be better assessed. In several respects, the potential effects of hunting on individual historic properties are similar to those of hikers in that damage would probably be inadvertent because individuals do not recognize features as historic properties. Particular to hunting, however, is the possibility that historic properties could be damaged by ammunition that misses its mark or is deflected. Hunters may also be tempted to use off-road vehicles to reach hunting areas that are at a distance from human activity and thus more likely to have unsuspecting game.

The potential effects of hunting can probably be reduced or prevented in two ways. First, those granted permission to hunt in the Science Reserve should be provided an information sheet that describes the kinds of historic properties they might encounter in particular areas; warns against disturbing these properties; notes restrictions against driving off established roads, designates areas in which hunters can park; and asks that debris be controlled. Second, if long-term monitoring indicates that hunters are adversely affecting historic properties in particular areas, then additional steps can be taken to prevent this damage. One solution may be to designate the areas immediately surrounding these historic properties as being off-limits to hunters. This is more likely to occur, if at all, in areas with higher concentrations of historic properties.

e. Astronomical Observatories. Currently the public has several, non-commercial opportunities to tour astronomical facilities on Mauna Kea or to participate in star-gazing activities independently or in organized groups. The 1995 Management Plan permits individuals to use the grounds of the Visitor Information Station at Hale Pohaku for independent star-gazing and, if permission is granted by UH, they may also use areas within the summit region for this purpose. UH and the individual observatories operating on the summit are permitted to conduct tours of the astronomical facilities and to hold star-gazing, groups sessions at Hale Pohaku. They are also permitted to convene other educational meetings at Hale Pohaku. The Keck Observatory has a visitors gallery open to the public during day-light hours. Recently UH has been conducting tours to the summit observatories twice a week and star-gazing sessions at Hale Pohaku four times a week.

None of these activities is likely to affect historic properties directly given that they take place in existing facilities and on previously disturbed ground surfaces at the

Table 14

Long-Term Management of Historic Properties - Public Uses

Astronomical Observations

General Characteristics	Examples of Activities	Potential Effects on Historic Properties and District	Mitigation Measures
Public tours of astronomy facilities conducted by UH and individual observatories Nighttime stargazing at the Visitor Center or near summit observatories Educational events at the Visitor Center Activities almost always occur in previously disturbed or developed areas Number of visitors can be high for special events (meteor showers, eclipses) Existing facilities provide rest rooms and trash receptacles	Daytime public tours of the Keck Observatory School field trips to Hale Pohaku or observatories UH sponsored stargazing programs at Hale Pohaku four times a week Amateur astronomers independently observe from Hale Pohaku grounds	Low potential effects because activities confined to previously altered areas Parking off of previously disturbed surfaces could alter landscape or historic properties near Hale Pohaku when user numbers are high Debris escaping from users could have a visual effect on the historic district Increase usage of Mauna Kea by introducing public to the mountain	Confine all activities to previously disturbed areas Restrict parking to designate parking areas that have been previously altered Warn participants to secure clothing, beverage containers and other personal items in high winds and point out trash receptacle locations Include overview of visitor policies and allowed uses in presentations for potential return visitors

summit and at Hale Pohaku. As with all other on-going activities, amateur astronomers and UH sponsored tours should be confined to previously disturbed ground surfaces as delineated in the historic preservation plan. This includes not only the tour or star-gazing activities themselves, but all parking for these activities should be accommodated on previously disturbed surfaces. This is particularly important when specific events (e.g., meter showers, eclipses, etc.) can attract large numbers of participants. Activities taking place on the summit cones, which we consider to be a historic property, should be conducted in a manner that does not further alter the current condition and integrity of the summit cones.

The indirect effects of these public uses are already reduced by the presence of rubbish receptacles and rest room facilities at Hale Pohaku and the summit observatories. Participants should be warned to keep litter or pieces of clothing from being carried away by high winds. When conducting group tours and stargazing sessions, presentations should include a brief overview of visitor policies and allowed activities in the summit region for those who may return to visit the mountain independently. In many cases, these tours may be the first introduction many have to Mauna Kea and some may want to return.

2. Permitted Commercial Uses

The 1995 Revised Management Plan returned to DLNR administrative responsibility for all commercial activities that were not directly related to astronomy facilities. UH retained, as exceptions, the right to operate concessions and to contract shuttle services to the summit from Hale Pohaku. The DLNR mandate to manage and enforce commercial uses includes issuing permits; setting and collecting of fees; limiting the number of permits issued or operators receiving permits as needed, and enforcing permit conditions. Commercial uses were defined as any organized activity operated on a fee-for-service basis such as tours conducted for snow-related activities, hiking, sight-seeing, or daytime visits to observatories. Organized events, such as snow-related sports meets, also require a permit even if no fee is charged for participation in the event. A maximum of 14 commercial tour operators can be issued revocable, year-to-year permits to conduct tours on Mauna Kea. Permits for other commercial activities or organized events are to be issued on a case-by-case basis. The draft Master Plan recommends that these permitting and enforcement responsibilities be administrated by the a newly-created management authority instead of DLNR.

Table 15

Long-Term Management of Historic Properties - Public Uses

Permitted Commercial Uses

General Characteristics	Examples of Activities	Potential Effects on Historic Properties and District	Mitigation Measures
Organized activities operated on a fee-for-service basis Currently administered by DLNR Operators must obtain permit, are subject to fees, and must abide by permit conditions Number of commercial operator permits is limited Frequency of tours and number of participants are limited Case-by-Case permits issued for commercial activities or events not run by commercial operators Permit conditions include provisions addressing historic preservation concerns UH can operate concessions and contract shuttle service to the summit from Hale Pohaku	Commercial Operators: Sightseeing tours to Hale Pohaku and the summit with paid guide Skiing, snow-boarding, or cross-country skiing tours Stargazing tour to Hale Pohaku Commercial Events Ski or snow-boarding meets Viewing special astronomical events at Hale Pohaku	Scaring or eroding of cinder cones by walking, running, skiing, or snow-boarding down cinder slopes Altering of shrines, lithic scatters, or burial sites by hikers leaving established roads or trails Altering of shrines or lithic scatters by cross-country skiers or snow-boarders leaving frequented areas Damage to cinder cones, shrines or flake scatters during emergency rescues Visual impact of debris on the historic district Need for rest room facilities Landscape scared by vehicles when transporting skiers	Retain commercial permitting process which provides mechanism to: Inform operators and clients of historic preservation restrictions and laws Enforce permit conditions, regulations or laws Revoke permits if operators or clients knowingly damage historic properties Restrict operators to areas and intended uses described in their applications Control the number and frequency of users Require vehicles to park in designated areas Prohibit use of vehicles off-road Require measures to reduce debris and remove that created by their activities Direct operators to provide temporary toilet facilities when needed Require emergency plans which avoid historic properties Restrict access to the adze quarry until a management plan is developed Control visits to historic properties by creating vantage points with interpretative signs and self-guided and guided tours to selected properties SHPD reviews all permits case-by-case until classes of commercial activities having no effect on historic properties can be defined Monitor and assess the effects of commercial activities and adjust controls or restrictions accordingly Ask operators to participate in clean-ups if appropriate Distribute information on the location of rest rooms and parking areas to all operators

Table 15a

Long-Term Management of Historic Properties - Public Uses

Commercial Uses - Specific Activities

General Characteristics	Mitigation Measures
Snow-Related Activities Tours use relatively predicable areas despite variable snow falls Sightseeing Tours: Most clients remain near vehicles and on established roads or trails Low numbers of clients leave trails or roads to climb cinder cones or visit areas of interest Film Industry Activities: Requires a permit from Film Branch (DBEDT) except for news coverage and filming astronomical activities Permit applications are reviewed by DLNR and UH on a case-by-case basis	For snow-related commercial activities: Retain restrictions that snow-related activities on cinder cones occur only in areas with sufficiently deep protective layers of snow Identify staging areas for snow-related activities For sightseers and hikers: Focus use on existing trails through visitor information, marking trail heads or showing trails on maps Formalize trails if monitoring indicates modifications are needed SHPD reviews any modifications to trails Commercial tours require a permit to hike to remote areas Require permits for commercial groups over a specified sizes that visit historic properties not designated for self-guided tours or areas illustrating Mauna Kea's natural history SHPD reviews permits for commercial tours to historic properties not designated for self-guided tours or to areas illustrating Mauna Kea's natural history For star-gazing at Hale Pohaku: Confine activities to existing facilities and previously altered surfaces Designate parking areas and enforce parking controls during periods of high use For film industry activities Require permit for all commercial film activities which include conditions to avoid or protect historic properties and the district SHPD reviews all permit applications on a case-by-case basis unless all activities are restricted to previously disturbed areas Include standard permit conditions addressing debris, parking, off-road vehicle use, and emergency precautions

In contrast to other public uses, the commercial permitting process itself provides a mechanism for informing users of historic preservation issues and for more clearly enforcing violations of regulations or permit conditions. The current restrictions and conditions are set out in the 1995 Revised Management Plan and signed permit agreements. The latter primarily repeats the basic conditions set out in the 1995 Revised Management Plan although the language is often expanded to clarify some of the conditions. The agreement also includes other standard conditions placed on most state lease or permit agreements such as those covering issues of liability and hazardous materials. Another document, an application submitted to UH, requires commercial operators to describe their intended uses and provide a map of where these activities will take place.

The intent of the historic preservation plan is to strengthen the permit process and conditions regardless of which agency eventually oversees commercial uses. The process should retain something similar to the three document types currently used if historic properties and the historic district are to be protected. One document should set out the basic conditions and restrictions under which commercial uses are to be regulated. This function is currently served by 1995 Revised Management Plan which may be superseded by administrative rules. The second is the signed permit or entry agreement which insures that the applicant is fully aware of and accepts the restrictions and responsibilities set out in the agreement. The third is the application form which should require clear descriptions of the scope of an applicant's intended uses and the areas to be used. This will not only help managers assess which areas are being used most frequently, but it binds the applicants to designated areas which are either free of historic properties or can be visited with specified precautions. These applications should also help managers identify more quickly when users, either commercial or public, are not in appropriate areas. To help commercial operators serve their clients more effectively, the process for changing or amending these applications should be relatively simple although still subject to appropriate review. In addition to these documents, an informational sheet should be prepared and distributed to commercial users which discusses the various restrictions and provides some background on the mountain's past. These could be similar to the guidelines now distributed to commercial operators on driving conditions and emergency procedures. The planned brochures may provide the desired information about the mountain's history and pre-history.

A number of existing conditions placed on commercial use permits already addresses actions that can effect historic properties or the historic district as a whole. Any regulations developed should retain the stipulation that a commercial use permit will be suspended if a commercial operator or his/ her clients have knowingly damaged any historic properties. They should also be informed of penalties authorized under Chapter 6E-11 for damage caused to historic properties or burial sites on state lands. Background checks on applicants should be conducted to see if any have been cited for disturbing or damaging historic properties. General provisions which allow the number of users and the frequency of use to be limited should also be retained as it provides a means of controlling the overall impact of visitor use on historic properties and the historic district. The on-going monitoring program proposed in this historic preservation plan should help assess whether the intensity of commercial uses, particularly when combined with other kinds of uses, needs to be adjusted or adjusted only in particular locations. Other conditions which apply to multiple kinds of commercial uses should be retained and, in some cases, strengthened because they address issues such as parking, off-road vehicle use, rest room facilities, debris, and emergencies which can affect historic properties or the historic district.

The 1995 Revised Management Plan restricts parking for commercial operators to specific areas if they are instructed to do so. It names four parking areas in the summit region (i.e., two visitor parking lots, the paved shoulders of the summit access road, areas near the observatories, and an unpaved area near the batch plant) and three at Hale Pohaku (i.e., 23 stalls next to the VIS, an unpaved parking lot near the Construction Camp, and the lower lot of the Mid-Level Facility) although it does not say that parking is confined to these areas. At Hale Pohaku, the number of vehicles allowed to park at the VIS and on the adjacent roadway at any one time is determined by UH. The permit agreement specifies that parking is restricted to areas where parking is indicated by signs although, to our knowledge, signs have not been systematically installed for this purpose. To clarify where commercial vehicles can park, a map should be prepared delineating and describing areas in the summit region and at Hale Pohaku where commercial vehicles are allowed to park. Distinctions could also be made between primary parking areas and secondary areas to be used if visitor numbers are particularly high. The map should reduce the need for extensive signage which can be visually intrusive. The designated parking areas would, in part, be based on the maps being prepared to depict previously disturbed ground surfaces which are the basis for determining if on-going activities have the potential to affect historic

properties [Section I-A(1)]. This would be similar to the map being recommended for public users. Off-road vehicle use is clearly prohibited in the 1995 Revised Management Plan, but as suggested in Section II-5(b), the wording of this prohibition could be strengthened by adopting the broader wording used in the NARS administrative rules. This wording should be repeated in the signed permit agreement.

The issue of toilet facilities is addressed in the Revised Management Plan by noting that the rest room facilities at the VIS are available for commercial users and by saying that commercial operators are to provide, operate, and maintain pre-positioned portable toilets above the VIS if required. In the permit agreement, this obligation to provide portable toilets is assigned to an association of commercial operators and, if toilets are required, their number and locations are to be determined by the association, DLNR, and UH. Neither document describes which set of circumstances would "require" portable toilets. Some of these conditions will not be needed if a permanent rest room facility is constructed in the summit region as has been proposed in the draft Master Plan. Until that time or if other circumstances require portable toilets, the circumstances in which toilets may be required should be defined more clearly in the administrative rules and appropriate locations designated in advance. These locations should be shown on a map and should be those which have been previously disturbed and can accommodate some parking. When possible, the toilets should be positioned to minimize their visibility. Given that we consider the summit cluster a historic property, toilet facilities for commercial uses should not be placed on this cluster of cones unless there is a compelling reason to do so.

In the Revised Management Plan and the permit agreement, commercial operators are required to pick up and remove any rubbish generated by their activities. Food and drink containers in particular must be disposed of properly if operators provide refreshments or a meal during the tour. While this adequately considers intentionally created rubbish, it does not address the possibility of rubbish or personal belongings being carried away in windy conditions. A general provision should be added to the permit agreement asking commercial operators to take all necessary precautions to prevent debris or personal belongings from being accidentally carried away by high winds and to warn clients to be cautious in these situations. The accidental distribution of some debris is probably inevitable despite the best intentions and precautions. If this proves to be the case and commercial operations appear to be contributing to the problem, their staff should be asked to participate in organized clean-ups of the effected

areas or contribute to the clean-up effort in some manner. The monitoring plan recommended by the historic preservation plan should help assess the degree to which commercial activities are contributing to debris accumulations in general or in particular areas.

Provisions of the Revised Management Plan and the permit agreement primarily address emergency situations by focusing on the need for operators to have appropriate emergency and rescue supplies or equipment available, to have individuals with first aid or medical training present, and to be well versed in the lines of communication should public medical or rescue units be needed. The permit agreement, however, also asks that the association of commercial uses develop an emergency plan that anticipates the full range of emergency scenarios and describes how these scenarios will be handled. Given the concern that emergency rescue efforts could inadvertently damage historic properties, the emergency plan should specified emergency routes for each scenario to insure that no historic properties are along or near these routes. Stipulations should include measures which prevent scarring or rutting of the cinder cones, particularly the cluster of cones forming the summit which is considered a historic property. This emergency plan should be integrated with that prepared for all on-going activities [Section I-A(3)] which includes provisions to make maps of historic properties readily available and specifies contingency plans should rescue and emergency operations need to take place beyond the areas of expected commercial use.

a. Snow-Related Commercial Activities. The 1995 Revised Management Plan characterizes the know commercial or organized snow-related activities as being downhill skiing, snow play and sledding tours, cross-country skiing tours, and meets, races or events organized for these kinds of activities. Services provided for downhill skiing and cross-country skiing tours or events usually include transportation from anticipated drop-off and pick-up points. Participants in all these activities can be accompanied by guides or event leaders and, in the case of downhill skiing, ski instructors are sometimes present.

   Two conditions included in the 1995 Revised Management Plan have implications for the protection of historic properties. The first states that these snow-related activities shall only take place when there is sufficient snow for a particular activity. This stipulation can, potentially, protect the cinder cones in the summit region which are either part of a historic property or contribute to the environmental setting of the

historic district. The depth and extent of snow coverage can provides a protective layer on the steep cinder slopes during these snow-related activities. If the snow is not sufficiently deep or its distribution patchy, these activities could cause scarring or accelerate erosion of the cinder slopes. If possible, the permitting process should attempt to define what "sufficient snow" is for specific kinds of activities. As has been suggested for those participating in non-commercial, snow-related activities, participants should be advised to remain on the snow covered sections of the cinder slopes as much as possible.

The second condition is that suitable staging areas be identified in the permit applications of those conducting tours or organizing events. This condition also states that these staging areas shall not be located near any archaeological sites. This conditions should be reworded to require applicants not only to identify the staging areas, but to delineate areas where the sporting activities are most likely to take place. This should not be too difficult as the favored areas for these sports are relatively well known and routinely used despite considerable variations in snow falls. They generally coincide with appropriate slopes and places where transportation can be used to drop-off and pick-up participants. Once these are submitted, it can be determined which areas contain known historic properties and what measures should be taken to avoid these properties. With the summit cluster of cones being considered a historic property, it is impossible for these snow-related activities to avoid all historic properties completely although, as stated above, steps can be taken to avoid damaging the cinder cones. Maps being prepared to show areas where non-commercial snow-related activities should be allowed could be used as a guide for these applications and for assessing the potential of each application to effect historic properties.

b. Commercial Tours. This category groups most of the non-snow related activities for which commercial tours are offered or anticipated. This includes hiking tours; simple sight-seeing with a picnic or photography stops; daytime tours of the observatories; or star-gazing tours at Hale Pohaku. Although extreme sports are not mentioned, they would fall in this category if commercial operators conduct or facilitate the sport. Tours are generally conducted by a paid guide and entail commercially provided transportation. The most commonly conducted tours take visitors to the summit after a stop at Hale Pohaku. Time at the summit is spent viewing the landscape from preferred vantage points, taking a tour of an observatory

when arranged, and dropping-off and picking up those who wish to take short hikes to the true summit or to Lake Waiau. Some tours drive visitors to the top of Pu`u Poliahu. The stop at Hale Pohaku can include time viewing the VIS displays and a short hike to the top of Pu`u Kalepeamoa along a path established and becoming more prominent with usage. Transporting visitors to Hale Pohaku at night is apparently growing increasingly more popular. A specific tour can be designed to focus on any one or several aspects of the routine tours depending on the individual interests of clients or groups. School groups and others with an interest in the natural or cultural history of the mountain or astronomy also rely on commercial vendors for transportation. Under the 1995 Revised Management Plan, UH was given the right to "operate concessions and sell astronomy-related items" at the VIS and other UH facilities within their leased lands. They also retain the right to contract for shuttle service to take visitors to the summit for unspecified activities and events.

As with non-commercial public uses, the probability of routine tours directly effecting historic properties is relatively low because a majority of the clients do not stray far from the vehicles due to altitude and weather conditions. Those going for short hikes generally do not wander from existing paths to the summit or to Lake Waiau and are limited by the tour's time constraints. This is also true of short hikes taken to the summit of Pu`u Kalepeamoa at Hale Pohaku. Exceptions could be those hikers who may leave established routes, particularly if they are looking for short-cuts. This could contribute to the deterioration of cinder cone slopes or create multiple, unsightly paths. An example may be those visitors on commercial tours who climb to the top of Pu`u Hau Kea and then slide or run down the cone's steep slopes. If visitors on commercial tours were to hike well beyond the frequented areas, they would be more likely to access areas with historic properties. Most vulnerable would be those properties located near roads or visible from a distance. This could include some shrines, portions of the Mauna Kea Adze Quarry, and several potential burial sites.

The approach to minimizing the potential effects of commercial activities parallels those proposed for public users. Adequately informing the operators, guides, and clients that historic properties are located in the summit region and at Hale Pohaku and stressing the need to prevent their alteration should reduce the chance of historic properties being inadvertently damaged. This can be accomplished by

distributing information sheets on historic properties to all operators and making brochures available to their clients. Establishing self-guided tours to selected historic properties [Section II-A(3-a)] should focus visitor attention on historic properties prepared to accommodate visitation and foot traffic. This would reduce the probability of tour participants wanting to wander and accidentally damaging historic properties or defacing the landscape. Allowing those on commercial tours to participate in guided tours conducted under the control and guidance of a management specialist [Section II-A(3-a)] would also focus visitor use. All historic properties visited by commercial tours should be monitored to assess the cumulative impacts of public and commercial visitation. If impacts appear to be too great, then the number commercial users and their frequency should be reduced.

To minimize the impacts of those taking short hikes, the frequented routes to the summit peak, to Lake Waiau, and to the top of Pu`u Kalepeamoa should be more formalized. This would focus use on already established paths which lead to attractions clearly preferred by visitors. Formalizing the trails could include little more than marking the trails on visitor information materials (i.e., maps, brochures, displays at the VIS) and more clearly designating the trail head. For example, unobtrusive signs could be installed indicting the route's distance and destination. Structural modifications to the trails, such as curbing or footholds, need not be added unless the monitoring program suggests that trail use is creating conditions requiring these modifications. Any substantial alteration of an existing route would be subject to review by SHPD. Hikers should be asked to stay on the established routes in information given them in visitor materials or by commercial operators. As some members of the community have asked that the road to the top of Pu`u Poliahu be closed for cultural, environmental, and practical reasons, the existing unpaved road could be restricted to hikers. This would create another opportunity for hikers without opening a previously undisturbed or infrequently visited area. This could be particularly important for photographers searching different perspectives of the summit region. Participants in commercial tours should not be allowed to hike to distant parts of the Science Reserve without prior permission of the agency managing the reserve or being accompanied by a management specialist. Guidelines should be developed with SHPD on which kinds of requests can and cannot be granted without SHPD review and comment.

Tour groups visiting with the goal of learning about the mountain's cultural or natural past are more likely to wander from established routes to see features or areas of interest and, if unguided or ill-informed, could unknowingly damage historic properties. These groups should be encouraged to follow the same procedures as those not using commercial services [Section II-A(3)]. If the size of the group exceeds a specific number, for example 15, a permit should be required and permit conditions tailored to the areas being visited and the visit's intent. All permit conditions should include measures to protect historic properties. If the groups are interested in cultural history, they should be encouraged to visit those properties designated for visitation or participate in one of the proposed tours led by rangers. As suggested earlier [Section II-B(b)], routes should be developed for groups interested in multiple aspects of the mountain's natural and cultural history. This would help control where groups go and group leaders could be given information on how to recognize and avoid historic properties located along or near the chosen routes.

Tours conducted for stargazing at Hale Pohaku are unlikely to effect historic properties if activities are confined to facilities designated for this purpose and parking is controlled. If the visits include short walks with flash-lights, the routes taken should be confined to those used during the daylight hours. Presumably activities conducted by UH that require contracting shuttle services or involve concessions would be confined to existing facilities and would thus not directly affects historic properties. If UH sponsored commercial activities are to take place beyond existing facilities, then they should be subject to the same conditions and restriction concerning historic properties as other commercial users. Those participating in extreme sports who utilize commercial services or those commercial operators sponsoring an extreme sports event should be subject to the same review and permit procedures established for non-commercial participants [Section II-B(c)].

Commercial activities within the NAR are prohibited unless a Special Use permit is obtained. Applications will be considered only if these activities do not impact the resources of a NAR or do not impinge on public use of the area. Public use is given priority over commercial uses should access or the level use need to be controlled or limited. The 1997 management policies for the NARS program set out the following five criteria used when evaluating commercial use permits: activities

cannot be conducted elsewhere; they are consistent with the protective and educational purposes of the NARS program; they do not degrade the reserve's resources; groups do not exceed the maximum number recommended for that reserve; the operator has adequate liability coverage; and the activity must have an educational component approved by the Department. The interface, however, between issuance of commercial use permits by Land Division and the Special Use permit approved by the NARS commission remain somewhat ambiguous. Commercial operators with a Special Use permit cannot reach the most commonly visited places within the NARS without entering or parking in the Science Reserve and some current holders of commercial use permits from the Land Division now allow clients hike into the NAR (e.g., to Lake Waiau, down the Humu`ula Trail) without obtaining a Special Use permit. Hopefully, the attempt of this historic preservation plan to integrate aspects of the long-term management and monitoring of historic properties in the Science Reserve and the NAR will help to resolve of these ambiguities.

A condition on the current commercial use permit states that there shall be no tours to the Mauna Kea Adze Quarry until a management plan is developed by NARS, the UH, and SHPD. It is not clear whether the management plan referred to in this condition is that being prepared for the Science Reserve or one developed specially for the NAR. Despite attempts of the historic preservation plan to address some of the long-term management issues of the NAR, it does not address public visits to the adze quarry in sufficient detail to warrant removing this condition from commercial permits. Once management responsibilities for the Science Reserve and other UH management areas are officially assigned, the issue should be reexamined, hopefully within the context of a management plan for the NAR. This particular permit condition concerning visits to the Adze Quarry is ambiguous because it does not address private groups that visit the quarry with the appropriate NARS permits but contract commercial operators for transportation. Also in question are those commercial tour operators who provide transportation for clients hiking down the Humu`ula Trail. This trail passed through what is considered the Mauna Kea Adze Quarry and past one of the quarry's prominent shelter caves. Technically, however, if hikers remain on the trail, they do not pose a direct threat to any of the quarry's features.

c. Film Industry Activities. The 1995 Revised Management Plan does not require a permit for commercial uses involving still photography, filming for television, or moving pictures, but instead requires the applicant to obtain permission from the Film Branch of the State Department of Business, Economic Development and Tourism. Review of this application is on a case-by-case basis and concurrence must be obtained from DLNR and UH. News coverage and filming astronomical activities are excluded from this process. The proposed Master Plan recommends that commercial film projects require a special permit. These special permits or comparable application process should continue to be reviewed and granted on a case-by-case basis. The potential effects of these uses on historic properties could vary greatly with the areas used during production, the scale of equipment needed for the shoot, and the actions of subjects being photographed. All applications should be reviewed by SHPD unless all activities involved in the production take place in previously disturbed areas as defined when the impact of on-going activities are assessed [Section I-A (1)]. Permit conditions should include standard provisions concerning parking, the containment and removal of debris, off-road vehicle use, and emergency precautions that apply to all commercial users.

The 1997 management polices adopted by the NARS commission state that commercial film activities require a Special Use permit in addition to a film permit obtained through the Film Branch of the State Department of Business, Economic Development and Tourism. Staff also recommended a number of permit conditions for the Mauna Kea Ice Age NAR in particular which include, for example, limiting crew size and prohibiting participants from climbing cinder cones.

3. Research

The research activities addressed here include those conducted to collect data, systematically make observations, or evaluate the status of resources within the context of research or educational objectives. These activities can range from relatively low-impact efforts, such as those in which researchers hike to specific areas to record information, to more intrusive efforts such as setting up instruments to record data over time. Not included are activities associated with astronomical research which are discussed in another section (Section I) or educational efforts that generally consist of groups or individuals wanting to view natural or cultural features of interest [Section II-B (1-b) and II-B (2-b)]. As a category, research was not directly addressed in the

Table 16

Long-Term Management of Historic Properties - Public Use

Research

General Characteristics	Examples of Activities	Potential Affects on Historic Properties and District	Mitigation Measures
Data collection, observations, and resource evaluation with research or educational objectives May require work in remote areas away from established roads or commonly visited areas Subject to State Conservation District Use regulations in all four management areas and may require a permit Subject to NARS rules if conducted within the NAR and may require a Special Use Permit Conservation District Use or Special Use applications reviewed by SHPD for potential effects on historic properties Permits can include conditions to avoid effects on historic properties Compliance with federal historic preservation laws required if research is federally funded or conducted by a federal agency Frequency of permit requests is low	Record distribution of flora or fauna Collect geology samples Survey to map geological units Record distribution of historic properties Install instruments to record climatic conditions	Low probability of effects if research involves only observations Higher probability of effects if research involves collecting samples or installing instruments Inadvertent alteration of shrines, adze quarry features, or burial sites by researchers Alteration of the landscape by installing equipment or instruments Visual intrusion by installed equipment or instruments on the historic district	Prepare guidelines for which kinds research projects require permits Prepare guidelines for appropriate and enforceable research permit conditions Raise awareness that research may require a permit Provide researchers information on historic properties and warn them against the alteration of historic properties whether their research requires a permit or not Provide researchers with information given visitors on debris, prohibitions on off- road vehicle use, and emergency procedures During visitor registration process inquire if research will be conducted

1995 Revised Management Plan and, in the proposed Master Plan, it is briefly mentioned within the broader category of education and research.

Research activities taking place in the Science Reserve or at Hale Pohaku are currently regulated through the State Conservation District Use permitting process administered by DLNR. Under the Conservation District Use regulations, data collection is a permitted use in these two areas because they are classified as Resource Subzones of the Conservation District. The level of permit required for data collection primarily depends on the degree of ground disturbing activities involved in the research (§13-5-22 and 24). If data collection does not involve any form of "land use," a permit is not required. As the definition of "land use" in this context includes the alteration or removal of materials or natural resources (§13-5-2), any research that involves collecting materials or resources would require a permit. Research involving incidental ground disturbance, such as that required to install equipment, requires a departmental permit while data collection that causes more than incidental ground disturbance requires DLNR Board approval.

Research conducted within the NAR usually requires a Special Use permit approved by the NARS commission and issued by the DLNR Board. The uses permitted must also be consistent with Conservation District Use regulations. The administrative rule for the NARS program allows Special Use permits to be issued for otherwise prohibited uses if these activities are conducted for the purposes of research (§13-209-4 and 5). Examples of prohibited uses which may be allowed for research include the removal or disturbance of any plant or animal life, of geological features, and of historical or prehistoric remains. According to the 1997 management policies for the NARS, favorable consideration is given an application if the project contributes to knowledge applicable to the goals and objectives of the NARS, if the resources collected cannot be obtained elsewhere, and if collection will not severely deplete or damage the integrity of the resource. Conditions can be placed on Special Use permits which are appropriate to the resources found in a particular NAR or are tailored to the proposed research.

Applications for research in the Science Reserve and the NAR that need department or board approval are usually circulated to the various DLNR divisions for review and concerns raised are included in the permit as conditions. More specifically, SHPD must

be given the opportunity to review and comment on any research involving the disturbance of historic properties or the removal of any archaeological materials.

The application of these regulations to particular research activities should be clarified through guidelines prepared in consultation with the staffs of NARS and the Land Division which administers Conservation District permits. The guidelines would help illustrate, through examples, which kinds of research activities are considered a "land use," which cause "incidental ground disturbance," and which constitute "ground disturbance" when these criteria are applied by Land Division staff. For the NAR, examples should clarify which kinds of research activities would and would not require a Special Use permit given current interpretations of "prohibited activities." This would not only help expedite the application process, but would help rangers or management specialists identify which individuals should have obtained permits if they are noticed working off of established roads or when they register to enter the summit region. If administrative rules are adopted to manage the Science Reserve, provisions should be considered to require a level of scrutiny or disclosure that is not now always applied to research projects under the Conservation District administrative rule.

For research projects requiring permits, SHPD should continue to review applications on a case-by-case basis and projects should not begin until written concurrence has been obtained from SHPD (Chapter 6E). The staffs of the Land Division, NARS, and SHPD need to continue to coordinate the review of these applications if they are to be effective. They should also ensure that the appropriate conditions are included in the permits issued. To help expedite the review process, the guidelines proposed to help clarify which kinds of research activities need permits could also recommend standard conditions to be placed on most Conservation District or Special Use permits issued for the summit region. These standard conditions should address the protection of historic properties and the potential impact of debris, off-road vehicle use, and emergency rescues on the historic district. Permit conditions for projects proposing to install equipment temporarily should require removal of all equipment within a specified time period after the project's completion. If equipment is to be installed on a more permanent basis or over longer periods of time, then the visual impact of any equipment on the historic district should be considered and mitigated when possible. Activities needed to maintain such equipment over time should also be addressed.

Despite existing regulations, some researchers are not aware of them or that their projects could be subject to regulation. Even the best-intended researcher, particularly those in the natural or physical sciences which can involve collecting, could inadvertently disturb historic properties out of ignorance. Raising awareness of these requirements would help reduce the potential effects of these projects on historic properties because the permit application process provides a mechanism to inform researchers of historic properties that could be affected by their actions. It also provides managers with recourse if permit conditions are not followed. Applicants should also be made aware that research funded with federal monies, such as the National Science Foundation, or conducted by federal agencies are also subject to the Section 106 review process (NHPA). The probability that projects could affect historic properties is relatively high given the number of known historic properties in the summit region, the proposal to consider it a historic district, and the designation of the Mauna Kea Adze Quarry as a National Historic Landmark. Those seeking information on conducting research should be encouraged to contact SHPD or the management staff of the proposed Office of Mauna Kea Management to discuss what measures could be taken to avoid potential effects on historic properties or the historic district before they submit their applications. This would reduce the time needed for application review and approval.

Those research projects not requiring permits would probably be those that simply involve hiking to specific locations to make and record observations. Even if no permit is required, researchers should be encouraged to meet with appropriate staff prior to conducting their research so that they can be fully informed of the kinds of historic properties in the areas they intend to work and the need to avoid disturbing these properties. Other precautions would be similar to those given recreational users or hikers wishing to independently visit the more remote areas [Section II-A (3)]. The need to control and remove debris, to prohibit the use of off-road vehicles, and to consider emergency procedures should be emphasized. If all public users will be required to register before going up the summit road, the registration process can inquire if individuals will be conducting research. If they are and a permit is not needed for the intended activity, then they should be briefed at that time on the nature and distribution of historic properties in their areas of interest and of all the appropriate precautions.

4. Cultural Practices and Access

Policies

Members of the Hawaiian community and representatives of native Hawaiian organizations, including the Office of Hawaiian Affairs, shall be approached to take the lead in making recommendations and setting policies regarding access and cultural practices on Mauna Kea.

A Kupuna Advisory Committee composed of individuals knowledgeable about Hawaiian cultural practices shall be formed. It is to advise the Mauna Kea Advisory Board on cultural matters. This Advisory Board, in turn, shall set policy for the proposed Office of Mauna Kea Management which is responsible for implementing policies concerning cultural practices. To assure due consideration be given to cultural practices, the Mauna Kea Advisory Board shall include a member of the Kupuna Advisory Committee.

Current Context

The 1995 Revised Management Plan identified cultural practices as a permitted use but stated that such activities must be otherwise consistent with the plan's provisions and must not involve physical impacts. The Plan also restricted practices to daylight hours unless permission was obtained from DLNR and UH.

Cultural practices and visitation are not restricted in the NAR unless they involve prohibited activities or the disturbance of historic properties. Practices that involve the gathering of resources or the disturbance of geological features or historical properties require a Special Use Permit. The 1997 Management Policies for the NARS specifically address the issue of Native Hawaiian gathering rights and the collecting of resources for traditional Hawaiian cultural purposes. The policies reaffirm such activities are permitted only if a Special Use Permit is obtained and that the claimed use is consistent with other applicable laws. Appendix D of the Management Policies outlines criteria to evaluate whether Special Use applications should be recommended or denied. For traditional religious access and practices, a permit would be recommended if the activity cannot be conducted elsewhere; will be consistent with the protective and educational purposes of NARS; does not degrade the natural resources of the Reserves; and will not be used for commercial purposes.

In a recent example, the Special Use Permit issued for native Hawaiian gathering on Maui included a number of conditions that controlled the number of gathering trips allowed; the specific kinds of resources that could be taken and in what quantities; who could participate in the allowed trip; and prohibited the use of any of the gathered resources for commercial purposes. Under the current management structure, most permits issued for the Mauna Kea Ice Age Reserve ask the applicant to notify the Mauna Kea Support Services and DOCARE prior to entry to help both agencies monitor permitted and non-permitted use of the area.

Appendix D of the NARS Management Policy also recommends that gathering be limited to native Hawaiians who are residents of the island where the Reserve is located. This recommendation, if adhered to, denies gathering rights to people with strong cultural ties to Mauna Kea who no longer reside on the island of Hawaii. Considering the mobility of people today, this recommendation needs to be re-examined.

The State historic preservation law, Chapter 6E, Hawaii Revised Statutes, does not specifically address native Hawaiian cultural practices or access issues. However, it protects historic properties from alteration or destruction. Destruction or alteration can only occur on State land when authorized by DLNR.

Discussion

The 2000 Master Plan reaffirms that access for traditional and customary practices is to be permitted, as is access to the summit unless construction work poses a danger. The Master Plan suggests Hawaiian cultural and religious practices may be managed or coordinated if they will have a significant impact on the physical landscape or historic properties. If conflicts appear to be unresolvable, native Hawaiian practices and values are to be given priority.

The following sections identify a number of cultural practices which could affect known historic properties. Discussions have already been raised concerning a number of these practices, and the others may be reasonably anticipated. These practices include use of the ancient shrines, visitation of burial sites, procuring stone from the adze quarry, practices associated with Lake Waiau, and contemporary religious worship which could involve construction of new features or structures for cultural purposes. Guidance

from the Hawaiian community and the Kupuna Advisory Committee shall be sought to address these issues.

a. Visitation and Use of Ancient Shrines

Policies

Access shall not be denied or unduly restricted for any native Hawaiian wanting to visit the shrines within the summit region.

No restrictions shall be placed on any religious observance that is deemed to be appropriate by the Kupuna Advisory Committee.

A program to regularly monitor the condition of ancient shrines shall be established.

Discussion

Although access to shrines shall not be denied or unduly restricted for any native Hawaiian, these persons should be informed of the same general precautions and prohibitions as are all public users. These would include warnings about the effects of altitude and cold, windy weather conditions as well as the prohibition of off-road vehicle use and the need to control debris.

Ancient shrines usually were constructed for worship by a specific family. It is difficult, with the passage of time, to understand the full intent or consequences of a shrine's particular form and construction. In some instances, components of a religious feature may have been intentionally set aside, hidden, or toppled after the completion of particular ceremonies. In other cases, it might be culturally improper for an individual, not connected to the original builder, to alter or even use the shrine.

Some current cultural practitioners may want to restore or reconstruct ancient shrines according to their needs or beliefs. Practitioners may want to alter shrines by adding components such as more up-rights or features such as a platform or wall to a shrine's foundation. These would be additions in that no physical evidence suggests that more up-rights or more elaborate foundations were ever associated with the shrine. The recent addition of up-rights to some religious sites elsewhere in Hawaii makes this a possibility. The concerns of those wishing to express their religious feelings through the alteration of shrines and of those wanting the shrines to be left as they were last

used needs to be discussed within the Hawaiian community and addressed by the Kupuna Advisory Committee.

Another impetus for reconstructing historic properties is for public interpretation and education programs. Reconstruction is a way to return a site to what it may have looked like when it was being actively used. In a reconstructed state, it may better convey the potential mood and setting of past cultural practices. If some shrines are going to be reconstructed, preference might be given to those easily accessible for public visitation. Again, this issue needs to be discussed within the Hawaiian community and addressed by the Kupuna Advisory Committee.

Another form of alteration, one that has already occurred, is the marking of shrine slabs with writing or symbols. The markings were scratched in the surface of the tabular up-rights by those who believed it was done for cultural reasons. This should be distinguished from what would clearly be classified as graffiti which should be prohibited and remedied if possible. It should be noted that none of the shrine up-rights found throughout the summit region appear to have been marked with petroglyphs or other intentional markings. The Hawaiian community and the Kupuna Advisory Committee needs to consider this issue as well.

As with other public uses, shrine disturbing activities are most likely to occur at shrines near access roads which are also the most likely to be visited by the general public and may even be those designated for self guided tours [Section II-A (3)]. Such shrines shall be documented in greater detail so that an exact record exists of the position, number, and arrangement of all up-rights in the shrine. This would allow someone to analyze these configurations with precision in the future despite any recent alterations. Existing plan view maps of the shrines should enable rangers or management specialists to verify, during routine monitoring, whether new components are being added to shrines. The monitoring program shall periodically assess the cumulative effects of visits by cultural practitioners and the public on the most frequently visited shrines. If the effects of heavy usage become apparent and lead to the deterioration or scarring of these areas, measures should be considered to control the frequency and number of commercial or public visitors to particular shrines.

b. Access to Burial Sites.

Policies

Native Hawaiians shall not be restricted from visiting burial sites for cultural reasons.

Any disturbance of a burial site shall be reported immediately to the rangers or SHPD.

Discussion

Although no restriction is placed upon native Hawaiian visitation to burial sites, it would be beneficial to inform the rangers or management specialists of such intentions. This notification will assist the staff on patrol with maintaining security at these sites.

c. Extraction and Collection of Stone from Mauna Kea

Policy

Guidance shall be sought from the Hawaiian community and the Kupuna Advisory Committee to establish direction for the utilization of this resource.

Current Situation

The NARS administrative rule prohibits the extraction of stone from the quarry without a Special Use permit and the existing policies suggest that such a request would be closely scrutinized. The rule prohibits the disturbance of any "geological features" which could be a potential source of usable stone. The other source of stone would be the prehistorically extracted materials that remain within the complex as blocks, partially formed implements, and flakes. As "prehistoric remains," any damage to or disturbance" of these previously worked stones is prohibited. One criterion used to evaluate the appropriateness of issuing a Special Use permit is whether the "activity cannot be conducted elsewhere." This could favor the approval of an application because there are relatively few known quarry complexes of any size in Hawaii and most are located on other islands.

The Science Reserve is classified as a Resource Subzone within the Conservation District. If a suitable source of stone were to be found, a Conservation District Use approved by the DLNR Board and potentially a management plan, would be required for the "extraction of any material or natural resource."

The 1997 management policies state, under the heading of Native Hawaiian Rights, that any disturbance of religious or historic sites is strictly prohibited.

Discussion

One reason for caution in extracting stone from Mauna Kea is that, unlike some plants and animals, the prehistoric record is not a renewable resource. Any removal or extraction of stone within the quarry complex, including unaltered stone and previously worked material, could have an adverse affect on this National Historic Landmark (NHL).

The most probable source for stone today would be the NHL quarry complex and most of the outlying workshop areas. These places were once used in ancient adze manufacture. They are located within the boundary of the NARS. There is a remote possibility that some suitable stone sources lie within the Science Reserve.

Some native Hawaiians have claimed that the extraction and removal of stone from the Mauna Kea Adze Quarry should be considered a native Hawaiian gathering right protected by the State Constitution.

Any protocol developed by the Kupuna Advisory Committee and the Hawaiian community related to the gathering of stones might address: where and how the blocks or reduced materials are considered for removal, these pieces should be chosen so that their removal does not alter the overall appearance or composition of the deposit. All removal locations should be documented.

d. Deposition of Piko and Collection of Water from Lake Waiau

Policies

Guidance shall be sought from the Hawaiian community and the Kupuna Advisory Committee as to the appropriate utilization of this area.

An appropriate procedure shall be developed to address the desire for privacy when conducting activities in this area.

Discussion

Practices and beliefs associated with Lake Waiau include: 1.) the association of waters from Lake Waiau with healing practices and 2.) the depositing of *piko* (umbilical cord)

either in the lake or in an appropriately secured place adjacent to the lake.

Given the growing interest in native Hawaiian medicinal practices in recent years, people should be aware that lake waters might be taken in inappropriate quantities or even become a commodity. Considering the cultural significance of the lake, it might be deemed appropriate to protect this resource.

The practice of depositing *piko* at the lake ideally would be done in private. Requests might be made to exclude the public from the vicinity of the lake while any rituals associated with the practice are observed. Such exclusions would allow practitioners to maintain the silence and prevent unexpected disturbances or interference by the curious.

e. Construction of New Religious or Cultural Features

Policy

Guidance shall be sought from the Hawaiian community and Kupuna Advisory Committee with regards to the construction of new religious features and the long-term management of these features. Those constructions not complying with the guidance established by the Hawaiian community and the Kupuna Advisory Committee shall be subject to removal.

Current Context

Whether all new features constructed for religious purposes in the Science Reserve or at Hale Pohaku require a permit is somewhat ambiguous as these kinds of minimal structures and this type of land use are not specifically addressed in the Conservation District regulations.

The 1995 Revised Management Plan for Mauna Kea states that cultural activities are permitted if they do not involve physical impacts. Whether the construction of modest shrines constitutes a physical impact will need to be determined.

Under the NARS regulations, any construction is a prohibited use and requires a Special Use permit. Whether the erection of modest shrines is to be construed as construction remains to be determined.

Discussion

The construction of new features for cultural purposes within the summit region has been an on-going activity. In addition casual visitors have constructed stacked stone piles, apparently in commemoration of their visit. Any policy on the construction of religious or cultural features might consider which kinds of features and locations are appropriate or inappropriate, and whether a review process should be instituted. If new shrines are erected it might be prudent to have a description of the feature and its location recorded so that it can be protected by rangers on patrol and checked as part of the ongoing monitoring program.

f. Offerings and Conducting Ceremonies

Policy

A staff person or a specially designated individual or organization shall be responsible for the culturally appropriate removal of offerings that are made on Mauna Kea.

Discussion

At a number of religious sites and culturally significant places in Hawaii, accumulations of offerings have become obtrusive and distracting to the point that they can have an adverse effect on historic properties. This has been true at *heiau* in State Parks and at places like Kilauea Crater which are open to public. If this practice becomes common on the ancient shrines, at Lake Waiau, at the summit or elsewhere, then policies will probably be needed to deal with these offerings. Organic offerings become a problem as they deteriorate or are dispersed by winds while inorganic offering, such as stones or objects made of modern materials, remain at the site for considerable periods of time unless removed.

Culturally appropriate means of handling the removal of offerings should be devised by the native Hawaiian community and the Kupuna Advisory Committee to apply to all areas within the Science Reserve, the NAR and at Hale Pohaku that could be the focus of observances. Any actions should be coordinated with the NARS commission as it is the hope that the staff hired by the Office of Mauna Kea Management will also monitor specified areas within the NAR and could also be responsible for tending to offering left there as well.

III. Consultation with Native Hawaiian Organizations and Individuals

Policies

Members of the native Hawaiian community and representatives of native Hawaiian organizations shall be consulted on the development of this historic preservation plan before it is finalized. Copies of the draft plan shall be distributed to interested parties and organizations, when the supporting background information is complete. Meetings shall be held to discuss the plan in more detail.

Members of the native Hawaiian community and representatives of native Hawaiian organizations shall be turned to take the lead in making recommendations and setting policies on access and cultural practices on Mauna Kea.

A mechanism shall be developed to assure Native Hawaiians are consulted on individual development projects as discussed in Section I-B(6).

A roster of individuals, families, or organizations that wish to be consulted when individual development projects are proposed shall be maintained by the University of Hawaii.

Discussion

Native Hawaiians may wish to be involved in management decisions and even in management activities, such as the surveys conducted to monitor the condition of historic properties or to complete the inventory. A mechanism needs to be developed to assure groups and individuals have the opportunity to participate. A roster of individuals, families, or organizations that wish to be contacted under specified circumstances should be maintained. This approach could also accommodate those who are concerned about a particular place or area but do not wish to disclose its location or the nature of its significance. They could appear on the roster as wanting to be consulted about any planned activity or issue occurring in the general vicinity and then decide if they wish to act on any concerns they have.

The constitution and role of the proposed Kupuna Advisory Committee in the consultation process will also need to be defined. They might help integrate the diverse concerns raised on a particular issue or development and then help shape these concerns into proposed management policies or actions. They can also serve as a point of contact for those native

Hawaiians who wish to raise a concern but do not want to discuss it with agency staff members. In turn, they can be informing those in the community of issues or actions brought before them at committee meetings. They should not, however, be viewed as a substitute for consultation with native Hawaiians.

IV. Cooperative Agreements

The UH should incorporate, where appropriate, stipulations or conditions that address preservation and management issues in written agreements it has with user organizations who construct and operate facilities on Mauna Kea. This would better define who is responsible for fulfilling specific management obligations, particularly if historic properties are located within or very near areas covered by sub-leases or actively used by the other party. Some of these stipulations and conditions may be included in the individual land use permits obtained when the observatories or related infrastructure were constructed.

V. Review of Historic Preservation Plan

A process shall be established to conduct a review of the historic preservation plan by all the major parties affected by the plan's provisions every three to five years. These parties shall include, at a minimum, representatives of UH and any of the individual observatories wishing to participate, interested members of the native Hawaiian community including the Kupuna Advisory Committee and the Office of Hawaiian Affairs, and staff of the following agencies: the Office of Mauna Kea Management; the Land Division of DLNR who oversee the issuing of Conservation District Use permits; the NARS program who are responsible for managing the Mauna Kea Ice Age Reserve; the State Historic Preservation Division who review projects or actions for their affects on historic properties, and the Division of Forestry and Wildlife of DLNR if issues of hunting or management of the *mamane* forest arise. Other interested parties, such as the commercial tour operators or recreational skiers, should be informed of the review and invited to comment if they choose. The primary intent of the review is to assess the effectiveness of the plan and its implementation, to identify any omissions, and to remove or revise provisions that have proved unrealistic. SHPD would be primarily responsible for making any of the requested amendments or revisions.

Appendix

Management Documents to be Generated by the Historic Preservation Plan

I-A. Current Maintenance Programs and Routine Operations Performed by UH or Observatories:

List of Maintenance Activities and Routine Operations Excluded from Historic Preservation Review and Compliance Process

Map and Descriptions of Altered Ground Surfaces in the Summit, the Road Corridor, and at Hale Pohaku.

List of Maintenance Activities Needing Prior Review and Potential Compliance Measures

Emergency Plan to Avoid or Minimize Damage to Historic Properties during Emergency Activities

I-B. Planned Development and Construction Projects

Guidelines for Preparing Historic Property Treatment Plans for Mauna Kea:
- Interim and Long-Term Preservation Plans
- Monitoring Plans
- Burial Treatment Plans
- Inadvertent Burial Treatment Plan

Map and Descriptions of Showing Areas of High and Low Probably of Historic Properties in the Summit Region, Road Corridor, and at the Mid-Level Facilities

II-A. Management Actions and Plans

Monitoring Plan to Assess the Long-Term Condition of Historic Properties and the Historic District

Plan to Complete the Inventory and Documentation Historic Property within the Management Areas and NARS

Public Interpretation Plan and Products
- Plan for Self-Guided Tours
- Plan for Guided Tours
- Independent Hikers
- Brochure
- Displays
- Information Material

Plan for Debris Removal, Monitoring, and Prevention

Policies for Preventing and Deterring Use of Vehicles Off of Established Roads

Map of Designated or Allowed Parking Areas

II-B. Management of Public Uses

Map of Areas Designated for Commercial and Non-Commercial Snow-Related Activities

Proposed Areas for Natural History Tours

Describe and Compile Map of Potential Hunting Areas within the Science Reserve

Policies on Commercial Tour Visits to Historic Properties Not Designated for Self-Guided Tours

Guidelines for Assessing which Research Projects Require Permits

Appendix K. Biological Resources Technical Report

Preface

The Arthropod and Botanical Inventory and Assessment has been updated since the Draft EIS was completed. Changes made to this technical report since the Draft EIS was completed are not illustrated as they are within this preface and the body of the Final EIS. No substantial changes were made but minor modifications were made related to the Access Way Options, primarily to indicate that Option 1 has been dropped from consideration and Option 3 has been refined to lessen impacts to wēkiu bug habitat. Botanical resources are discussed in Section 3.4 of the Final EIS.

ARTHROPOD AND BOTANICAL INVENTORY AND ASSESSMENT

THIRTY METER TELESCOPE PROJECT
MAUNA KEA SCIENCE RESERVE
NORTHERN PLATEAU AND HALE PŌHAKU
HĀMĀKUA DISTRICT, ISLAND OF HAWAIʻI

May 2009

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EXECUTIVE SUMMARY

The Thirty Meter Telescope (TMT) Observatory Corporation is preparing an Environmental Impact Statement (EIS) for the proposed construction and operation of an optical/infrared observatory within the Astronomy Precinct of the Mauna Kea Science Reserve on Hawai‘i Island in the State of Hawai‘i. The proposed TMT Observatory would be located within the western portion of the area known as the Northern Plateau. During construction, support activities would occur within the existing Batch Plant Staging Area and at a Construction Staging Area within or near the Hale Pōhaku Mid-Elevation Support Facilities.

Sampling of the flora and arthropod fauna in the proposed use areas was conducted September 25 through October 8, 2008. A second visit occurred February 23 – 25, 2009 to evaluate options for the TMT Mid-Level Facility at and near Hale Pōhaku. A third visit occurred April 17 – 23, 2009 to sample for Wēkiu bugs in Area E, the Batch Plant Staging Area, and along the three options for the Access Way, and to sample for vegetation and arthropods at the proposed TMT Mid-Level Facility.

During the September 2008 sampling, forty-five live-traps were deployed in Area E, along the 4-wheel drive road, at the Batch Plant Staging Area, and at two control sites (Pu‘u Poli‘ahu and the Pu‘u Hau‘oki above the 4-wheel drive road on which the Subaru Observatory sits) for a three-day detection of Wēkiu bug (*Nysius wekiuicola*) presence. Three Wēkiu bugs were captured (one 5th instar nymph on Pu‘u Poli‘ahu, one 5th instar nymph and adult female on Pu‘u Hau‘oki). No Wēkiu bugs were detected at any of the sites proposed for construction activity. Sixteen other arthropods were detected at the Astronomy Precinct project areas, six of which are endemic to Hawai‘i.

Two days during the Fall sampling period were spent surveying Area E for lichens and mosses; ten lichen and two moss species were found. Seven species of vascular plants were also detected; two native grasses, two non-indigenous weedy species, and three ferns.

Six days during the Fall sampling period were used to survey for arthropods and plants at portion of the planned TMT Mid-Level Facility within Hale Pōhaku. Twenty-six species of arthropods, nine endemic to Hawai‘i, and sixteen species of plants, none that are endemic to Hawai‘i, were identified there.

During the April 2009 sampling, twenty-four live-traps were deployed in Area E, along the 4-wheel drive road, at the Batch Plant Staging Area, and at two control sites (Pu‘u Poli‘ahu and Pu‘u Hau‘oki) for a three-day detection of Wēkiu bug (*Nysius wekiuicola*) presence. One hundred and five Wēkiu bugs of various life stages were captured at the control sites (forty-five on Pu‘u Poli‘ahu and sixty on Pu‘u Hau‘oki). Forty-one Wēkiu bugs of various life stages were detected along the 4-wheel drive road (Access Way Options 2 and 3), but none were seen in Area E or at the Batch Plant Staging Area.

Additional sampling at the planned TMT Mid-Level Facility detected seven additional arthropod species, (five endemic, one indigenous, and one purposeful introduction), one endemic snail, and four additional plants (three endemic and one nonindigenous).

The results of the surveys indicate there are no special concerns or legal constraints related to arthropod and botanical resources in the Project areas. No species listed as endangered or threatened species were detected at the Project construction areas (DLNR 1997, Federal Register 1999, 2005, 2006). There are endangered silversword (*Argyroxiphium sandwicense sandwicense*) in an exclosure adjacent to the proposed TMT Mid-Level Facility which lies within critical habitat of the endangered bird, *palila* (*Loxioides bailleui*). One species currently proposed for federal listing, *Nysius wekiuicola*, was detected along the 4-wheel drive road, within the limits of proposed Access Way Options 2 and 3. Species of Concern were detected at Area E, (the Douglas' bladder fern, *Cystopteris douglasii*), and at the proposed TMT Mid-Level Facility (*Hylaeus difficillis, H. flavipes, and Succinea konaensis*).



Sampling for Wēkiu bugs at the edge of snow on Puʻu Poliʻahu in April, 2009.

1.0 INTRODUCTION

1.1 TMT Project

The TMT Observatory is proposed to be located on Maunakea on Hawai‘i Island in the State of Hawai‘i. Maunakea currently hosts eight optical and/or infrared observatories; the first Maunakea observatories were built in the 1960s. The TMT Observatory would be located on a roughly 5-acre site within the 525-acre Astronomy Precinct of the 11,288-acre Mauna Kea Science Reserve (tax map key [TMK] 4-4-15: 9), below the summit of Maunakea. The entire Science Reserve is designated as part of the State of Hawai‘i Conservation District, resource subzone.

The TMT Observatory would be located in the western portion of the area known as the Northern Plateau within the Astronomy Precinct, within the area identified as Area E in the Mauna Kea Science Reserve Master Plan (UH, 2000). The 2000 Master Plan identified Area E as a preferred location for the future development of a Next Generation Large Telescope (NGLT). Area E, a 36-acre area, was identified as a preferred location because it was anticipated to provide suitable observation conditions with minimum impact on existing facilities, Wēkiu bug habitat, archaeological sites, and viewplanes. Area E ranges in elevation from 13,100 to 13,300 feet; the summit of Maunakea is at elevation 13,796 feet. Area E is located approximately 1/2-mile northwest of the eight existing optical/infrared observatories located near the summit, at elevations of 13,600 to 13,775 feet.

Within Area E, the TMT Observatory would be located at one of two locations:

- The Project site near the end of the existing 4-wheel drive road, at an elevation of approximately 13,150 feet at a location known as “13N” in reference to its elevation and its location on the Northern Plateau, or
- An alternative site designated “E2” by the Project because it is a second site being considered within Area E; the area is approximately 500 feet south of 13N along the existing 4-wheel drive road.

The TMT Observatory would be the primary development of the Project, but not the only one. The “Project” is the sum of the following components:

- “TMT Observatory” refers to the components of the Project located below the summit, in the upper elevations of Maunakea. The TMT Observatory generally consists of the 30-meter telescope, instruments, dome, support building, and parking within a roughly five acre area.
- The “Access Way” refers to the portion of road and other infrastructure that would be provided to access and operate the TMT Observatory. Improvements in the Access Way would generally include a surface roadway and underground utilities. Beyond the core of the SMA facility the route of the Access Way would follow the existing SMA roads and

existing 4-wheel drive road to the extent possible. There are three options being considered for the portion of the Access Way from the Maunakea Access Road through the core of the SMA area:

1. Option 1 – Through SMA. (No longer being considered) This option would follow the primary SMA road off the Maunakea Access Road, and then proceed through the lava flow before reconnecting with the SMA road.
2. Option 2 – Near SMA. This option would cut off the Maunakea Access Road at the currently blocked old 4-wheel drive road and connect with the SMA road once beyond the SMA core.
3. Option 3 – 4-Wheel Drive Road. This option would follow the currently blocked old 4-wheel drive road and then connect with the SMA road.

- "TMT Mid-Level Support Facility" refers to facilities and improvements located at or near the existing 20 acre Hale Pōhaku facility to support the TMT Observatory. This includes all permanent improvements at or near Hale Pōhaku, which would generally consist of dormitory, office, cafeteria, and recreations facilities in the eastern portion of the lower part of Hale Pōhaku; a parking area in the western portion of the lower part of Hale Pōhaku; and electrical and communications equipment.
- "Headquarters" refers to facility located in the lower elevations of Hawai‘i Island to manage activities at and support operation of the TMT Observatory and TMT Mid-Level Support Facility. This includes all permanent improvements at a lower elevation location in Hilo but is not discussed in this report.
- "Satellite Office" refers to the smaller facility located in the lower elevations of Hawai‘i Island to provide additional support to the TMT Observatory and TMT Mid-Level Facility. This includes all permanent improvements at a lower elevation location in Waimea but is not discussed in this report.
- "Construction Areas" would include:
    1. "Batch Plant Staging Area" is an approximately 4 acre staging area where the Maunakea Access Road forks near the summit. This area would primarily be used for storing bulk materials and a cement batch plant.
    2. "Hale Pōhaku Staging Area" is an area at or near Hale Pōhaku that would be used for construction staging. This area would be used for parking, vehicle washing and inspection prior to proceeding up to the observatory site, and the storage of materials needed for construction work at Hale Pōhaku.
    3. "Port Staging Area" is an existing warehouse and/or yard near the port where Project components are received. This area would be used for receiving materials and assembly of those materials to the extent possible prior to transport to either another staging area or the construction site. This area is not discussed in this report.

1.2 Physical Setting

Maunakea is a dormant shield volcano and the tallest mountain on earth, rising more than 32,000 feet from the ocean floor to its summit, 13,796 feet above sea level. At the summit the night sky is dark and transparent, providing what is considered to be among the best astronomical observation conditions in the world (Parker 1994).

The Mauna Kea Science Reserve (MKSR), an 11,288-acre area at the top of Maunakea, is home to the largest observatory complex in the world. The MKSR is leased by the State of Hawai‘i to the University of Hawai‘i (UH), which in turn subleases certain areas to various observatories. Astronomy institutes worldwide make use of the unparalleled astronomical capabilities on Maunakea.

The MKSR is also home to unique plants and animals living in an alpine ecosystem. The summit region is an island within an island, separated from other ecosystems by high elevations as well as vast oceans. The species found there are not only unique; they are sometimes rare[2] and limited in population and area of distribution. For example, the Wēkiu bug lives only in loose cinder habitats on the cinder cones above 11,715 feet on Maunakea (Porter and Englund 2006). There is a similar species, *Nysius aa* that occurs in the upper elevations on Maunaloa (Polhemus 1998).

The upper elevations of the MKSR receive almost no rainfall and snow accumulates only during the winter season. Temperatures often drop below freezing at night and reach up to 50º F during the day. Solar radiation is extreme, and evaporation rates are high. The harsh environmental conditions limit the composition of the resident floral and faunal communities found there. Under these harsh conditions, only hardy lichens, mosses, and scattered grasses, shrubs, ferns and arthropods have managed to adapt and survive (Cuddihy 1989).

Below 11,700 feet is an alpine shrublands and grasslands ecosystem growing on ‘a‘a lava flows, cinder cones, and air-fall deposits of lapilli and ash (Wolfe and others 1997). Growing well above the tree line (~9,500 feet), and becoming sparser with increasing elevation, are native shrubs, grasses, sedges, and ferns (Cuddihy 1989). The fauna of the alpine shrub zone has not been well studied. Many species of birds have been observed flying in this zone, but because the principal food resources do not occur here, they are presumably just passing through. There may be resident arthropod species in this zone, but no systematic survey has been conducted.

Below the alpine shrublands and grasslands are the *māmane* subalpine woodlands that extend down to the Saddle Road. The open-canopied *māmane* forest is home to the endangered bird,

[2] There are several terms that are used to describe the status of species. These include:
Endangered species – Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened species – Any species which is likely to become endangered within the foreseeable future.
Candidate species – Any species being considered by the Secretary of the Interior for listing as an endangered or a threatened species, but not yet the subject of a proposed rule.
Species of Concern – Those species about which regulatory agencies have some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA).
Rare species – Those species that occur very seldom, but are not classified threatened or endangered.
Sensitive species – Those species which rely on specific habitat conditions that are limited in abundance, restricted in distribution, or are particularly sensitive to development.

palila (*Loxioides bailleui*). The subalpine woodlands are dry most of the year, and *māmane* trees (*Sophora chrysophylla*) intercept fog that provides them and other plant species with the small amounts of moisture they need to survive (Gerrish 1979). The understory of the subalpine forest is comprised largely of native shrubs. In undisturbed areas clumps of the native grasses are the most abundant ground cover. Non-indigenous plants and grasses are the most abundant ground cover in areas that have been disturbed around Hale Pōhaku. The *māmane* forest on Maunakea has a diverse arthropod fauna. More than 200 arthropod species have been collected there.

Cattle grazing has degraded much of the forest along the lower sections of the Maunakea Access Road. The vegetation of the open pastures is largely introduced grasses including rattail grass, velvetgrass, sweet vernal grass, hairy oatgrass, and fescues (Mueller-Dombois and Fosberg 1998).

1.3 Current Study

The Thirty Meter Telescope (TMT) Observatory Corporation, a non-profit organization, is preparing an Environmental Impact Statement (EIS) for the proposed Project. Pacific Analytics, LLC was contracted by Parsons Brinckerhoff, the company preparing the TMT EIS, to conduct an arthropod and botanical inventory and assessment of Area E, the proposed Access Way, the Batch Plant Staging Area, and TMT Mid-Level Support Facility, including a special survey for Wēkiu bugs in the affected areas above 11,715 feet.

The primary objectives of the inventory and assessment are to provide a general description of the flora and arthropod fauna of the TMT Project sites, evaluate the habitats, and search for and assess the potential for threatened and endangered species as well as species of concern (DLNR 1997, Federal Register 1999, 2005, USFWS unpublished).



View of Area E and existing 4-wheel drive road.

2.0 METHODS

2.1 Permit

An application for a Research, Collection and Access Permit was submitted August 14, 2008 to the Hawai‘i Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) and after review, a permit (FHM09-170) was granted on September 24, 2008, valid through September 23, 2009. The Wēkiu bugs were sampled under separate Research, Collection and Access Permits (FHM08-135 and FHM09-181) granted to Jesse Eiben, valid from December 1, 2007 through April 1, 2010.

2.2 Schedule and Personnel

Sampling of the flora and arthropod fauna in Area E, the proposed Access Way, the Batch Plant Staging Area, and portions of the TMT Mid-Level Support Facility was conducted September 25 through October 8, 2008. Wēkiu bug traps were opened and operated from September 25 – 28, 2008. A lichen survey in Area E was conducted over two days September 29 – 30, 2008. Arthropod sampling and botanical surveying continued through October 10, 2008.

Additional botanical sampling by was conducted at the proposed TMT Mid-Level Support Facility February 23-24, 2009.

Additional Wēkiu bug and arthropod sampling was conducted in the summit region April 20 – 23, 2009 and at the TMT Mid-Level Support Facility April 17 – 23, 2009.

Gregory Brenner, Pacific Analytics, LLC and Jesse Eiben, UH Mānoa, were the investigators conducting the arthropod sampling. Dr. Brenner has a PhD in entomology from Oregon State University, Corvallis, and fourteen years of experience studying the arthropod fauna of Hawai‘i, during which he has conducted numerous scientific studies of the arthropods on Maunakea. Mr. Eiben is a Doctoral candidate in the University of Hawai‘i’s Department of Plant and Environmental Protection Sciences and has been conducting research on Wēkiu bug autecology and systematics for his dissertation since 2005.

Gregory Brenner and Clifford Smith were the investigators conducting the lichen, bryophyte and botanical sampling. Dr. Brenner is familiar with the flora of Hawai‘i having conducted many scientific studies of the plants on Maunakea and elsewhere in Hawai‘i. Dr. Smith has a PhD in botany and is Professor Emeritus of the Department of Botany, UH Mānoa. He is the leading expert in lichens of Hawai‘i, and has conducted research on Hawaiian lichens since 1958.

2.3 Nomenclature

The nomenclature used in this report follows the Hawaiian Terrestrial Arthropod Checklist, Third Edition (Nishida 1997) and the Manual of the Flowering Plants of Hawai‘i (Wagner and others 1990). Hawaiian and scientific names are italicized.

Species are discussed as being endemic, indigenous, non-indigenous, adventive, and purposely introduced. These terms are defined as:

- Endemic – A species native to, or restricted to Hawai‘i.
- Indigenous – A species native to Hawai‘i but that naturally occurs outside of Hawai‘i as well.
- Non-indigenous – A species not native to Hawai‘i.
- Adventive – Not native, a species transported into a new habitat by natural means or accidentally by human activity.
- Purposely introduced – A species released in Hawai‘i for a particular purpose, usually to control a weedy plant or another insect.

2.4 Arthropod Sampling

2.4.1 Trapping

Wēkiu Bug Traps

Pitfall live-traps were used to sample Wēkiu bugs in Area E and at the Batch Plant Staging Area. A live-trap design very similar to those described by Englund and others (2002) and Brenner (2002a) was used to attract Wēkiu bugs. The modifications in design are as follows.

Two 10oz clear plastic cups were used for each trap. The upper cup was punctured with one small hole in the bottom center through which a small absorbent wick made of tissue (Kimtech Science) was pushed. A small amount of water was poured into the bottom of the lower reservoir cup. The attractant shrimp paste was placed in the upper cup contacting the wick, on a few small pieces of rock in the cup, smeared on the side of the cup, and on a cap rock.



Installing pitfall live-trap

The traps were dug into the available ground substrate with a goal of achieving a depth where moisture was present in the ash layer. The lip of the cup was not necessarily placed flush with the ash layer, and there was no wire mesh surround to provide structure surrounding the cups. This cup design has been successful for attracting and capturing Wēkiu bugs during 2007 and 2008 (Eiben, unpublished). A cap rock was placed over the traps and elevated above the ground approximately 0.6 in with smaller rocks.

Most sites selected for sampling used a pair of traps within 16.4 feet of each other in different microhabitat types (ex. large rock jumble vs. ash layer near the surface) to attempt to sample the diversity of the habitat. The traps were checked daily for three consecutive days after installation. Wēkiu bugs captured were removed for the duration of the sampling period to prevent recounts and were held for up to three days in captivity with food and water sources. After sampling was complete, all Wēkiu bugs were released near the trap in which they were captured.

In September, 2008, forty-five pitfall live-traps were used to sample for Wēkiu bugs. Thirty-three traps were installed within Area E, and three traps were placed along the unused portion of

the 4-wheel drive road that is blocked (Figure 1), two pairs and one single trap were installed at the Batch Plant Staging Area, and one pair was placed on both the Pu‘u Hau‘oki and Pu‘u Poli‘ahu as controls (Figure 2).

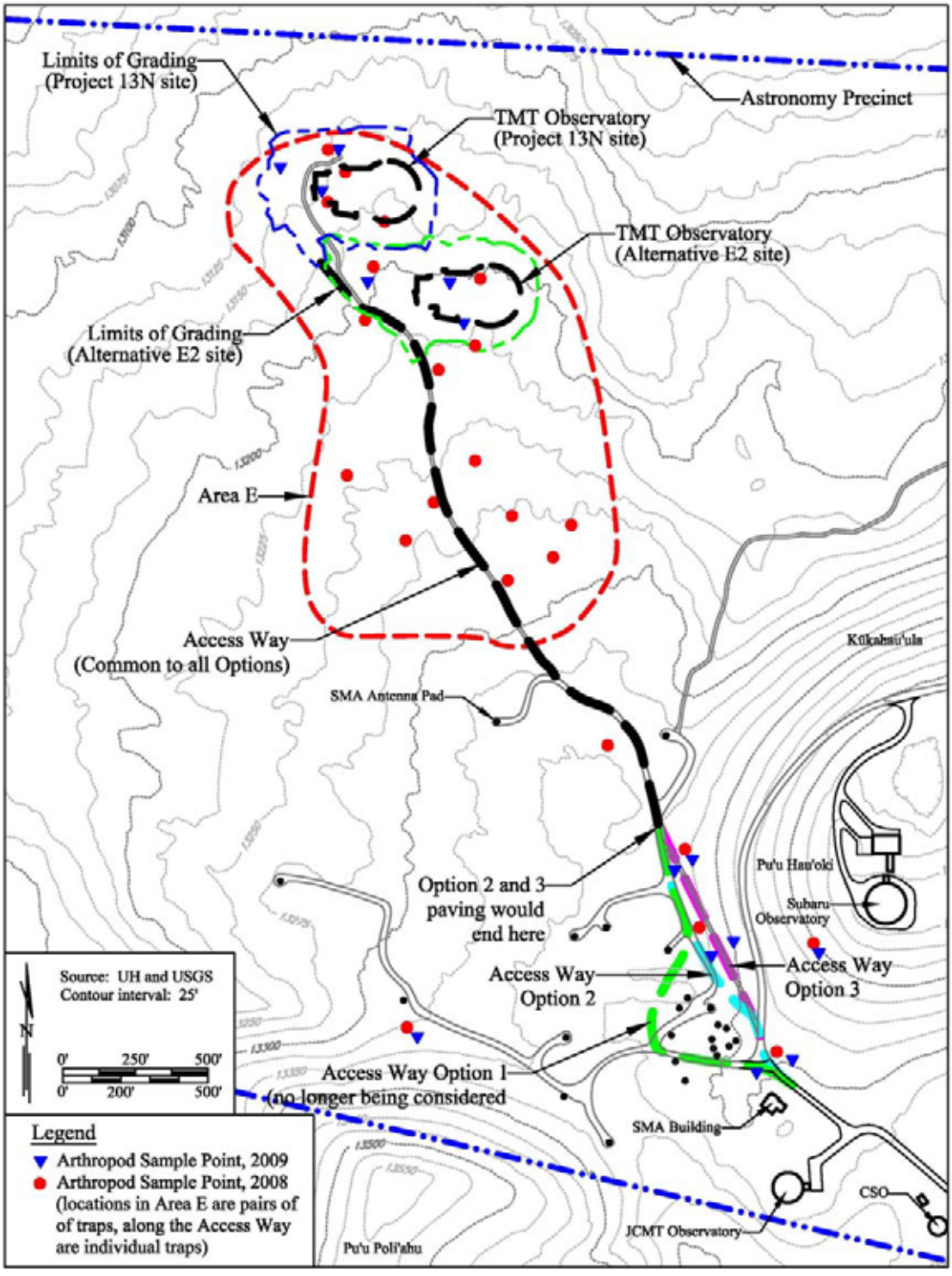

Figure 1. Pitfall Live-Traps sites within Area E and along Access Way options.

In April, 2009, twenty-four traps were used to sample for Wēkiu bugs. Twelve traps were installed within Area E, six traps were placed along the unused portion of the 4-wheel drive road (Figure 1), one pair was installed at the Batch Plant Staging Area, and one pair was placed on both the Pu‘u Hau‘oki and Pu‘u Poli‘ahu as controls (Figure 2).

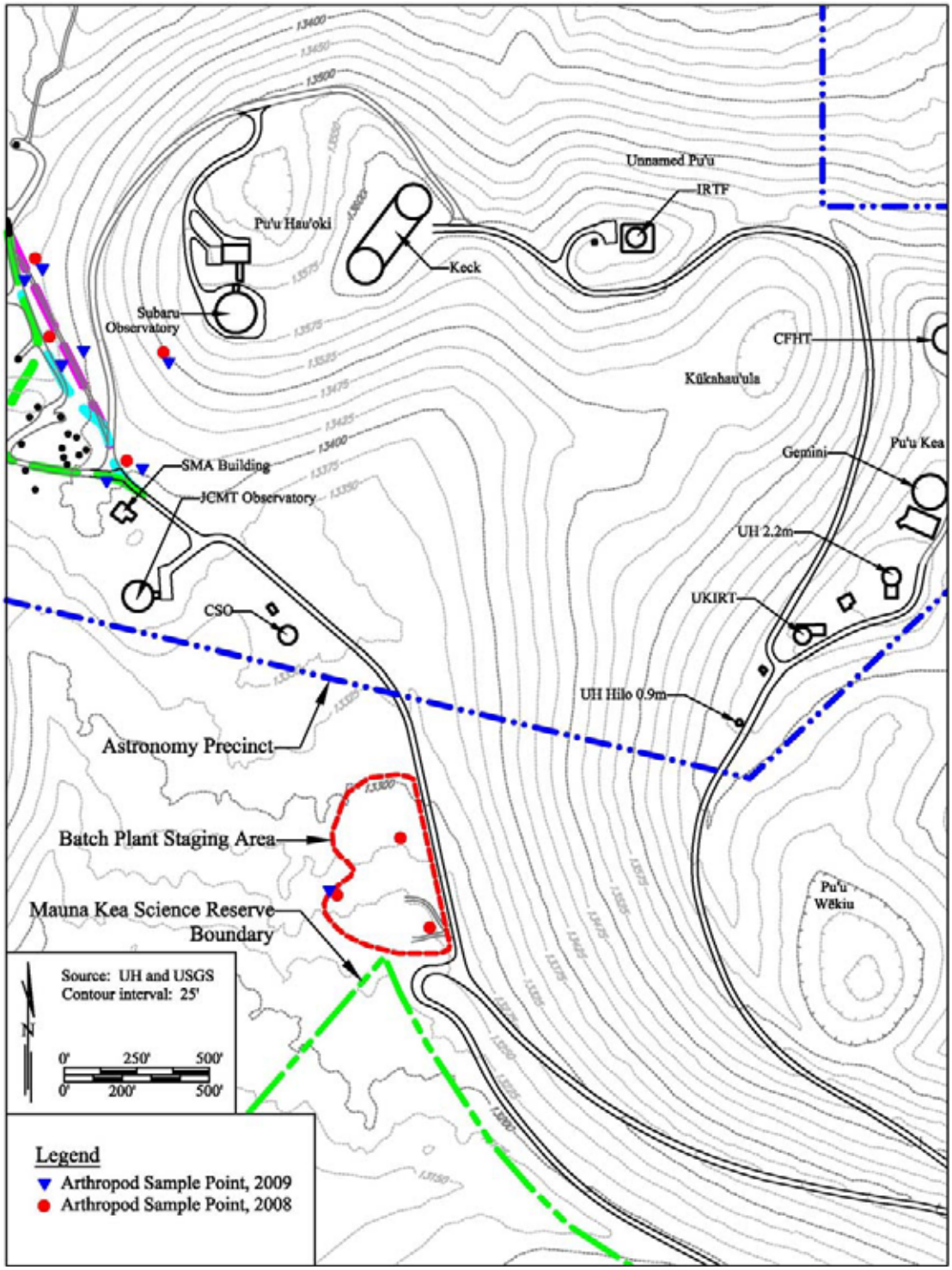

Figure 2. Pitfall Live-Traps sites at the Batch Plant Staging Area, Pu‘u Poli‘ahu, and Pu‘u Hau‘oki.

Pitfall Traps

Pitfall traps were used to sample the arthropod ground fauna in Area E, along the 4-wheel drive road, and at the Batch Plant Staging Area, in the same locations used to sample for Wēkiu bugs (Figures 1 and 2), and at the TMT Mid-Level Support Facility (Figure 3). These traps were 10oz cups placed into the ground so that the lip of the cup is level with the substrate. A small amount of soapy water was placed into the trap to kill and preserve specimens that fall into the traps. A cap rock was placed over the traps and elevated above the ground approximately 0.6 inches with smaller rocks.

The target of pitfall trapping in this study was ground-active arthropod species. Three pitfall traps were set at the Batch Plant Staging Area, and eight were installed in vegetation surrounding the proposed TMT Mid-Level Support Facility. Traps were open for 6 to 8 days, October 2 through October 10, 2008. During the Spring 2009 sampling, two traps were set at the Batch Plant Staging Area, and ten at the TMT Mid-Level Support Facility. Traps were open April 17 through April 23, 2009.

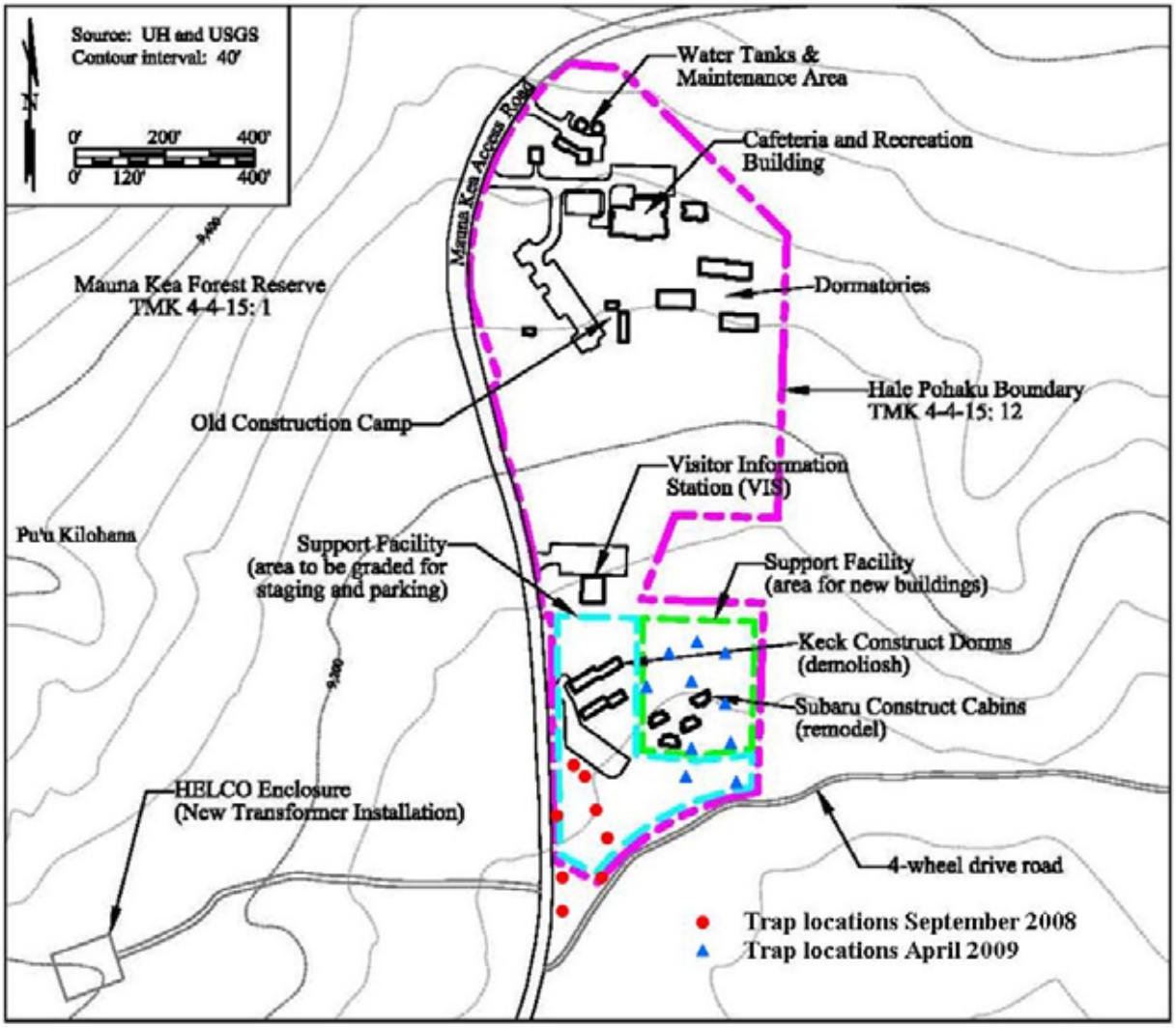

Figure 3. Pitfall Live-Traps sites at the TMT Mid-Level Support Facility.

Bait Trapping

Meat is a good attractant for some flies, ants, and beetles. Some insects are attracted to the smell of the rotting meat and come to the trap. The trap consisted of a small plate filled with soapy water with a rock in the center covered with Spam© (Hormel Foods Corporation). Two bait traps were used at the Batch Plant Staging Area and four bait traps were set at the Hale Pōhaku Construction Staging Area. The traps were left open for 4 days and checked daily in October 2008.

2.4.2 Foliage Sampling

Approximately four hours per day for eight days (in October 2008 and April 2009) were used to sample foliage in and surrounding the TMT Mid-Level Support Facility. The entire site and the areas of surrounding foliage were sampled.

- Aerial Netting – Flying insects were captured in aerial nets and placed into killing jars. After the specimens died they were transferred into collecting vials and processed in the laboratory at the end of each day.
- Sweep Netting – Grasses, small shrubs and other low-lying vegetation was sampled with a sweep net. The heavy net was brushed along the top of the vegetation or grass, capturing insects. The insects were placed into killing jars, and later into collecting vials for processing.
- Foliage Beating – Foliage was sampled using beating sheets. A 19.7 inch square sheet was placed under a branch and the stem was struck with a short stick. Arthropods on the foliage were dislodged and fell onto the sheet where they were collected with an aspirator into vials.
- Visual Inspection – Plants were visually inspected for arthropods that were not collected by other methods.

Litter Sifting

Rocks and dead logs were turned over and leaf litter was sorted through to locate and collect arthropods. Arthropods were collected into vials using an aspirator or forceps.

Night Sampling

UV lights were used to attract moths and other nocturnal insects. A cloth sheet was hung on a rope at night with an ultraviolet fluorescent tubes placed at the top of the sheet. As insects were attracted and alighted on the sheet, they were captured in vials. High winds some nights required that the sheet be placed on the ground with the light suspended a few feet above it to attract insects.

The phases of the moon can influence the attraction of insects to artificial light (Williams and others 1956). A bright moon may compete with the light source resulting in a reduced catch. The moon was waxing during the September/October 2008 sampling period, with approximately 15 to 50 percent illumination.



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2.4.3 Specimen Curation

The contents of the traps were cleaned in 70 percent ethyl alcohol and sorted into the morpho-species for identification. Hard-bodied species, such as beetles, true bugs, large flies and bees were mounted on pins, either by pinning the specimen or by gluing the specimens to paper points. Soft-bodied specimens, such as immature stages, spiders, Collembola, Psyllids, Aphids, small flies and wasps, and centipedes, were stored in vials filled with 90 percent ethyl alcohol.

2.4.4 Identification

Identification to the species level for all specimens was not feasible in the time frame for this study. Important groups of endemic species, species of concern, and potentially threatening non-indigenous species were given first priority for identification. Specimens will be deposited in the B.P. Bishop Museum when sampling and identification are complete.

References for general identification of the specimens included *Fauna Hawaiiensis* (Sharp (ed) 1899-1913) and the 17 volumes of *Insects of Hawai'i* (Zimmerman 1948a, 1948b, 1948c, 1948d, 1948e, 1957, 1958a, 1958b, 1978, Hardy 1960, 1964, 1965, 1981, Tentorio 1969, Hardy and Delfinado 1980, Christiansen and Bellinger 1992, Liebherr and Zimmerman 2000, and Daly and Magnacca 2003). Other publications which were useful for general identification included *The Insects and Other Invertebrates of Hawaiian Sugar Cane Fields* (Williams 1931), *Common Insects of Hawai'i* (Fullaway and Krauss 1945), *Hawaiian Insects and Their Kin* (Howarth and Mull 1992), and *An Introduction to the Study of Insects Sixth Edition* (Borror, Triplehorn, and Johnson 1989).

For specific groups specialized keys were necessary. Keys used to identify Heteroptera included those by Usinger (1936, 1942), Ashlock (1966), and Gagné (1997). Keys used to identify Hymenoptera included Cushman (1944), Watanabe (1958), Townes (1958), Beardsley (1961, 1969, 1976), Yoshimoto and Ishii (1965), and Yoshimoto (1965a, 1965b).

2.5 Lichen, Bryophyte, and Botanical Sampling

Prior to field work, a search was made of the literature to review previous botanical, lichen and bryophyte studies conducted in or near the project area. Identification guides were also consulted to prepare the investigators for field identification.

2.5.1 Lichen and Bryophyte Sampling

An intensive walk-through survey method was used to inventory the lichens and bryophytes. Over two eight-hour days, September 29-30, 2008, two people walked through all of Area E with special attention to the TMT Observatory footprint sites, recording lichen and bryophyte species as encountered. All principal habitat types were investigated. Small caves were given extra sampling attention to confirm all species of lichens and bryophytes were detected. Care was taken to avoid disturbance of flagged archaeological sites and any other site that gave the appearance of archaeological significance.

Three habitat types found within Area E were examined. Those types are:

Type 1 - Pahoehoe lave flows covered about 50 percent of the area. The general topography was essentially flat and smooth with many folds. In several areas small caves were found which ranged from about one foot to almost six feet deep.
Type 2 - Small islands of ash covered about 10 percent of Area E. The ash was typically covered with small stones or broken lava.
Type 3 - Rubble of shattered stones constituted about 40 percent of the habitat. Three different subtypes were found in Type 3 habitat;

1. with stones somewhat embedded in ash;
2. where stones rested on ash subsurface; and
3. where there was no evidence of ash between or below the stones.

The undersurfaces of twenty-five rocks were examined each of the three rubble habitats subtypes and counts were made of lichens present to quantify abundance. All rocks that were examined were replaced in their original position as precisely as possible.



Dr. Clifford Smith examines lichens in a lava tube at Area E of the MKSR.

Small samples of all species detected were taken as vouchers. Voucher specimens will be deposited in the B.P. Bishop Museum in Honolulu. Larger specimens were taken of several species whose identity could not be confirmed in the field. These samples were studied in the laboratory or were sent to other lichen experts for identification confirmation.

2.5.2 Botanical Sampling

An intensive walk-through survey method was used to record the flora at the three Project construction areas – Area E, the Batch Plant Staging Area, and Mid-Level Support Facility area at Hale Pōhaku. Plant identifications were made in the field. Plants that could not be positively identified were collected for later determination using plant keys and other identification aides. Notes were taken of the distribution of species within and surrounding each of the sites.

The botanical inventory of Area E and the Batch Plant Staging Area was conducted concurrently with the arthropod and Lichen sampling over six days. Plant species were examined repeatedly as they were encountered to confirm identification.

The botanical inventory at Hale Pōhaku was conducted over six days between October 1 and October 10, 2008. Species of plants around the perimeter of the Construction Staging Area were visited several times over the six day period to confirm identifications. Additional botanical sampling was conducted February 23-24, 2009 and April 17-23, 2009 to survey the TMT Mid-Level Support Facility beyond the Construction Staging Area.

2.5.3 Identification

References for general identification of the specimens included *Field Guide to Rare and Unusual Plants on the Island of Hawai'i* (Delay et al 2004), *Handbook of Hawaiian Weeds* (Haselwood and Motter 1966), *Hawaiian Heritage Plants* (Kepler 1984), *Trailside Plants of Hawai'i's National Parks* (Lamoureux 1976), *Hawaiian Forest Plants* (Merlin 1995), *Hawai'i's Vanishing Flora* (Kimura and Nagata 1980), *In Gardens of Hawai'i* (Neal 1965), *Plants and Flowers of Hawai'i* (Sohmer and Gustafson 1987), *A Tropical Garden Flora* (Staples and Herbst 2005), *Ferns of Hawai'i* (Valier 1995), *Manual of the Flowering Plants of Hawai'i* (Wagner and others 1990), and *Hawai'i's Ferns and Fern Allies* (Palmer 2003).



Construction Staging Area at Hale Pōhaku.

3.0 RESULTS and ANALYSIS

3.1 Area E, the Access Way, and Batch Plant Staging Area

3.1.1 Arthropods

Previous Studies

The first reports of insects at high elevations on the Island of Hawai‘i were from Maunaloa (Guppy 1897, Meinecke 1916, Bryan 1916). The first published collection of insects from Maunakea was by Bryan (1923), followed by Bryan (1926) and Swezey and Williams (1932). These first investigators believed that the summit areas were “absolutely sterile” and that all the insects found there were aeolian, i.e., blown up from surrounding lowlands by wind. These early reports mention a few species of parasitic wasps, flies, true bugs, and butterflies that were more commonly found at lower elevations. It is interesting to note that the first hint of a high elevation resident was by Guppy (1897), when he mentioned a “parasitical bug” that was feeding on the bodies of dead butterflies. This insect may have been the *a‘a* bug not formally described until 1998 (Polhemus 1998).

Insects from high elevations on Maunakea were not mentioned in the literature again until 1971 (Gagné 1971) when acacia psyllids (a lowland species that infests *koa*) were found in great numbers on observatory walls and washed up in shore debris at Lake Waiau. Howarth (1971) was the first to hypothesize aeolian ecosystems in Hawai‘i in which the major nutrient source is windblown material from outside the ecosystem. While that study was conducted on Kilauea, his new paradigm was soon to be applied to Maunakea.

In 1980, Howarth and Montgomery described the ecology of a high altitude aeolian ecosystem on Maunakea based on new observations of arthropods near the summit (Mull and Mull 1980, Mull 1980). In this landmark paper, the authors report the “discovery” of a new flightless lygaeid bug of the genus *Nysius*, called the Wēkiu bug (Mull and Mull 1980). Ashlock and Gagné (1981) described this new species as *Nysius wekiuicola*.

At least five studies for Maunakea arthropods have been used to support Environmental Assessments (EA) or EISs. In preparation of the EIS for the Mauna Kea Science Reserve: Complex Development Plan (RCUH 1983), an assessment was made of the arthropod fauna and aeolian ecosystem near the summit of Maunakea (Howarth and Stone 1982). That study found Wēkiu bugs in high density on the summit cinder cones, in moderate density on the plateau northeast of the cinder cones, and in low density on the northwest plateau where Area E and the 4-wheel drive road are located (Figure 4). The investigators reported seventeen resident arthropod species, ten presumed to be indigenous Hawaiian arthropods. Besides Wēkiu bugs from the area of study, a Lycosid spider (*Lycosa* sp[3].), two mites (Families Anystidae and Eupodidae), three sheetweb spiders (*Erigone* spp. and one unknown genus), a centipede (*Lithobius* sp.), two Collembola (*Entomobryoides* spp.), and a noctuid moth (*Archanarta* sp.) were also found. Only the lycosid spider was found in high abundance in Area E and along the

[3] The abbreviation “sp.” is used when the actual specific name cannot be specified.

4-wheel drive road. The noctuid moth was widely dispersed but nowhere abundant, and was hypothesized to feed on foliose lichens (Howarth and Stone 1982). A third species of Collembola that was found was unidentified, and its status was unknown.

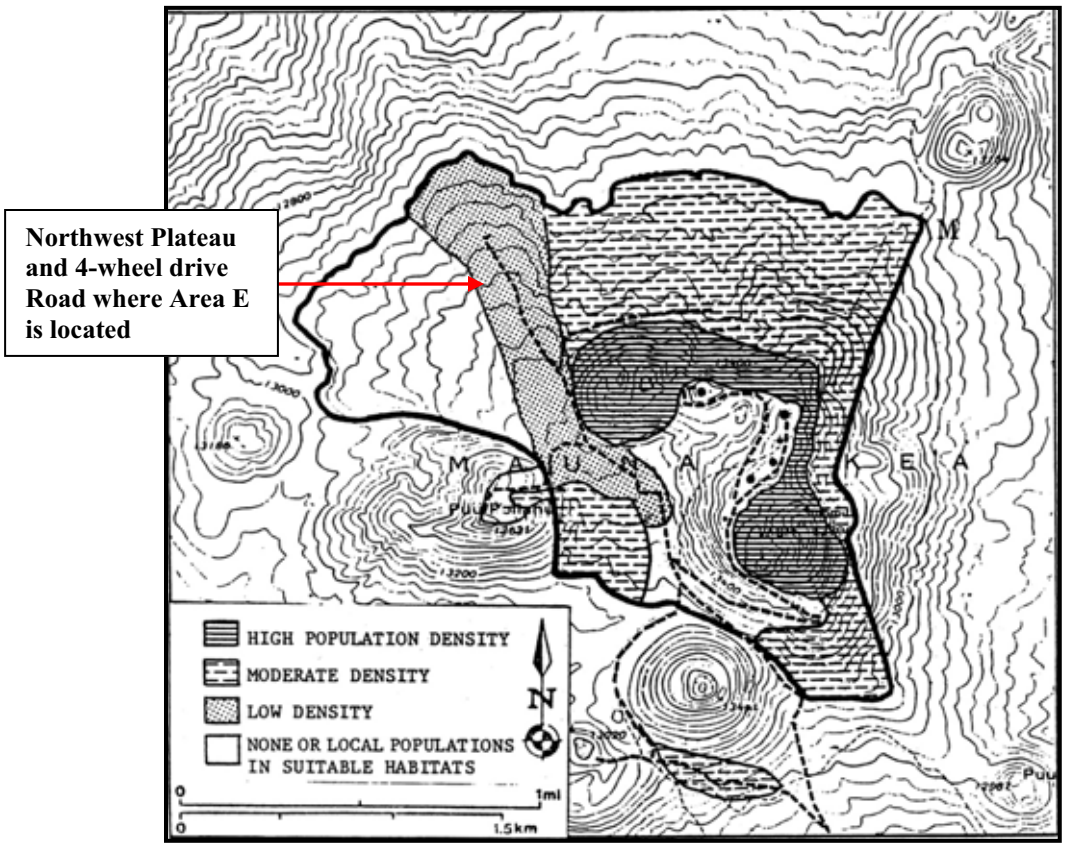

Figure 4. Population Densities of Wēkiu Bugs during 1982 Study.
(Source Howarth and Stone 1982)

The study also reported a large number of transient (aeolian) species presumably that were blown up the mountain by wind, and that represented a food source for resident species.

The study concluded that the lava flows and andesitic rocks of Area E and the 4-wheel drive road were habitat to the noctuid moth, Lycosid spider and centipede, and that Wēkiu bugs were relatively rare because of the rarity of suitable microhabitat. The islands of talus slopes and highly fractured rocks surrounded by lava flows were thought to have moderately high populations of Wēkiu bugs, presumably because the stable rocks provide favorable microclimates.

The next study was a provisional arthropod assessment conducted for the Caltech Submillimeter Observatory (CSO) (Howarth 1982). No Wēkiu bugs were detected during the March sampling, but many of the other species identified from the previous study were found to occur at the CSO site.

The 1988 study of the invertebrate fauna at the proposed Very Long Baseline Array (VLBA) site (Montgomery 1988) found no Wēkiu bugs, but at least four of the resident native species mentioned in the 1982 study along with several non-indigenous species of flies and wasps.

An arthropod assessment of selected areas of the MKSR (Howarth and others 1999) was conducted over two years, 1997 and 1998, to support the revised MKSR Master Plan EIS (UH 1999). The investigators reported nine resident species detected during the sampling, four endemic to Hawai‘i. A total of sixty-nine species of arthropods were collected in this study, ten that were likely endemic to Hawai‘i.

In July 1998, twenty-five pitfall traps were placed along the 4-wheel drive road on the North Plateau (now known as Area E). No Wēkiu bugs were detected there during that study, though they were collected on nearby cinder cones.

Wēkiu bugs were relatively rare during the 1997/98 study and analysis revealed an average decline of 99.7% in Wēkiu bug capture rates compared to the 1982 study. The investigators cited possible causes for the decline as changing weather patterns, habitat disturbances, presence of harmful alien species, and long-term population cycles. Because Wēkiu bugs were more abundant in disturbed areas compared to non-disturbed areas, the investigators raised “the possibility that observatory construction had not impacted Wēkiu bug or lycosid spider distributions at the summit, outside of the immediate vicinity of paved and covered areas” (Howarth and others 1999).

A 2001 study by the Smithsonian Institution (Polhemus 2001), found Wēkiu bugs abundant on Pu‘u Hau Kea inside the Mauna Kea Ice Age Natural Area Reserve adjacent to the MKSR. The cinder cone was found to be composed almost entirely of deep layers of cinder lying over a basal layer of moist, compacted ash. The study was conducted over four days in June 2001 and deployed traps similar to those used during the 1982 Howarth and Stone study. No other arthropods were reported from the sampling.



Adult Wēkiu bug captured in a live-trap during June, 2005.

A long-term baseline monitoring study was started in February 2002 for the Outrigger Telescopes Project proposed for the W.M. Keck Observatory (Brenner 2002a – 2006b). The study comprised ten pitfall live-traps at permanent sampling stations inside the Pu‘u Hau‘oki crater below the Keck Observatory and at ten permanent sampling stations inside Pu‘u Wēkiu. Sampling was conducted quarterly from February, 2002 through May, 2006. Microclimate data were taken using HOBO© data loggers to gain understanding about the relationship between Wēkiu bug abundance and habitat temperature.

Seven thousand nine hundred and twelve Wēkiu bugs were collected over the four and one-half years of sampling. Wēkiu bugs were more abundant on Pu‘u Hau‘oki where both Subaru and Keck sit than on Pu‘u Wēkiu (Table 1). The results of this study supported the conclusion of the 1999 study, that observatory construction had not impacted Wēkiu bug and lycosid spider distributions at the summit, outside of the immediate vicinity of paved and covered areas.

The study also found that Wēkiu bug activity appeared to vary with temperature (Figure 5), and populations fluctuated year to year. These results suggest that the 1999 study may have been conducted during years of particularly low Wēkiu bug abundance and that the decline reported was an artifact of timing.

While the presence of other arthropods was regularly reported in the Quarterly Reports, many of the same species collected in previous studies were detected during this study (Pacific Analytics unpublished data). The noctuid moth was found to be present on both cinder cones that were sampled, along with Lycosid spiders, centipedes, and many other species.

TABLE 1: Quarterly Baseline Monitoring Average Trap Capture Rates

Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year Avg.
Pu‘u Wēkiu 2002*	0.03	0.03	0.3	0.2	0.1
Pu‘u Wēkiu 2003	2.8	11.5	0.5	0.0	3.7
Pu‘u Wēkiu 2004	0.00	2.0	0.03	0.06	0.5
Pu‘u Wēkiu 2005	1.14	0.64	1.26	0.12	0.79
Pu‘u Wēkiu 2006	0.00	3.12			1.56
Pu‘u Hau‘oki 2002	1.0	10.3	4.0	4.0	4.8
Pu‘u Hau‘oki 2003	18.5	90.6	12.4	0.8	30.6
Pu‘u Hau‘oki 2004	2.1	8.8	0.4	0.21	2.9
Pu‘u Hau‘oki 2005	15.92	5.09	5.99	0.62	6.91
Pu‘u Hau‘oki 2006	0.00	30.16			15.08

The average number of Wēkiu bugs per trap per 3-days for each of the Quarterly Baseline Monitoring Sampling Sessions.
Yearly average trap capture rates for Baseline Monitoring are in RED.
* - different trap locations on Pu‘u Wēkiu in 2002 (Source Brenner 2006b)

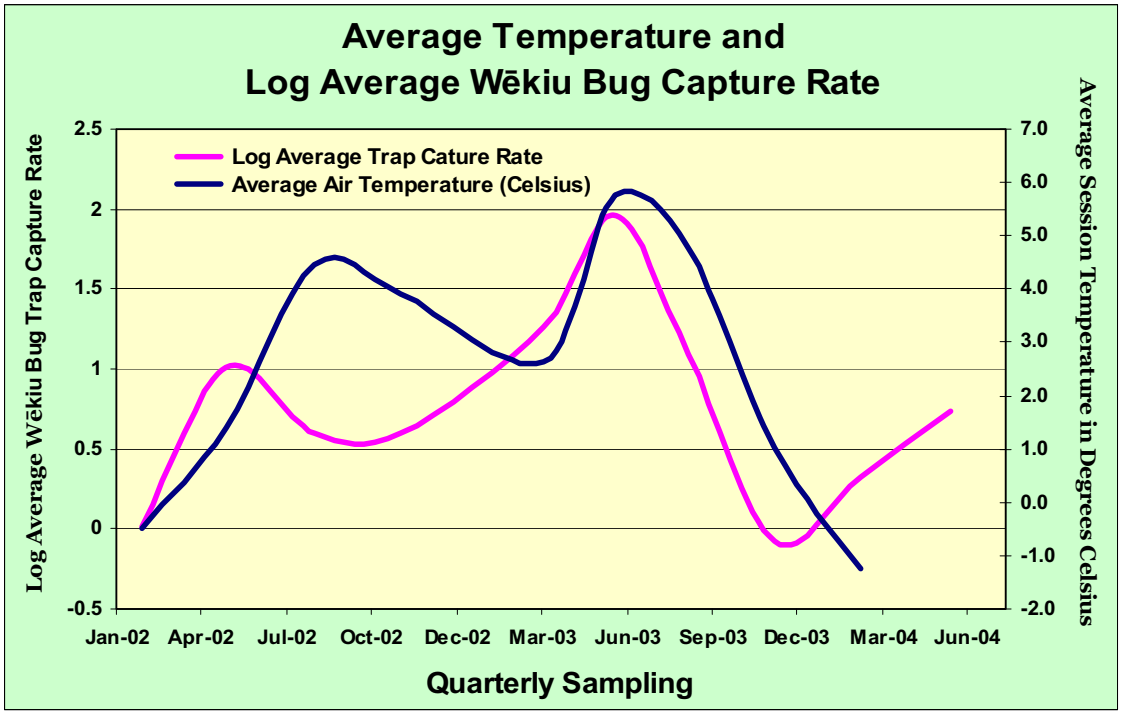

Figure 9. Plot of Baseline Monitoring Session Average Temperature (Celsius) and Natural Log Average Number of Wēkiu Bug Trap Capture Rate per Session on Pu‘u Hau‘oki. (Source Brenner 2006b)

Research conducted in 2005 studied the composition of cinder in known Wēkiu bug habitat on summit cinder cones. This study found evidence of a correlation between the number of Wēkiu bugs captured at adjacent monitoring stations during concurrent sampling and the proportion of cinder less than ~2 inches and greater than ~ 0.5 inches. The study also found that the size

distribution of cinder on Puʻu Wēkiu was not different from that on Puʻu Hauʻoki (Brenner and Lockwood 2005).

The study concluded that "By placing 0.5 inch to 2 inch restoration cinder 12-inches to 18-inches deep and allowing it to size-sort over time, we feel that the resulting restoration will be similar to existing Wēkiu bug habitat where high numbers of these bugs have been found." The results of the study may be used for future habitat restoration activities.

Four reports of arthropod research were produced by the B.P. Bishop Museum from October, 2002 through April, 2007 (Englund and others 2002, Englund and others 2005, Englund and others 2006, Englund and others 2007) that give an account of the results of sampling over a large portion of the MKSR. The purpose of these studies was to gather information about the distribution of Wēkiu bugs throughout the MKSR.

These four studies found Wēkiu bugs on at least 15 cinder cones ranging in elevation from 11,715 feet to 13,796 feet. The studies generally conclude that Wēkiu bugs are restricted to rims and inner craters of cinder cones where loose cinders provide interstitial spaces large enough to allow movement through the cinder habitat.

The authors hypothesized that weather, abiotic factors, temperature, and substrate moisture all may influence Wēkiu bug activity. Trap efficiency of pitfall live-traps vs. glycol dead-traps was examined during these studies. It was reported that glycol dead-traps were about forty times more effective at capturing Wēkiu bugs. As a result of these tests, they conclude that there is no quantitative evidence of an actual decline in the population of Wēkiu bugs since 1982 (Englund and others 2002).

A fifth report (Porter and Englund 2006) details the accounts of a study on possible geologic factors that may influence Wēkiu bugs. This study found the Wēkiu bugs appear to prefer non-glaciated cinders and lava spatter in areas where glacial erratics are lacking. They concluded that "Because the [Wēkiu] bugs apparently do not like bedrock substrates, telescopes sited on the glacially modified lava flows in the summit region may have little or no local impact on the bugs" (Page 13 in Porter and Englund 2006).

There have been other studies of arthropods in the higher elevations of Maunakea but these studies are ongoing and their data are not complete or available (S. Nagata personal communication).

In summary, considering the information contained in all reports and published papers, at least 114 species of arthropods have been collected from the MKSR. Many of these species' identifications have not been determined or are undescribed species. Based on known generic distributions, thirty-one of the 114 species were identified as potentially endemic to Hawaiʻi.

As many as twelve indigenous Hawaiian species may be residents of the higher elevations of Maunakea, including Area E (Howarth and Stone 1982, Howarth and others 1999). This potential native resident fauna includes three species of spiders, three species of mites, three species of Collembola, a centipede, a moth, and a true bug. There are non-indigenous species thought to also be residents of this region, including mites, spiders, flies, true bugs, and barklice (Howarth and Stone 1982; Howarth and others 1999).

Some of the non-indigenous arthropods reported may pose a threat to the native Hawaiian arthropods that are residents of the higher elevations of the MKSR, as predators or competitors for food resources.

Current Study Results

Findings

During the Fall sampling period, twenty-two species of arthropods representing ten orders and eighteen families were collected from the Batch Plant Staging Area, Area E, and along the 4-wheel drive road. While as many as seven of these species collected may be endemic to Hawai‘i, at most four found in Area E could be considered residents of the sites. These include two spiders, the wolf-spider (*Lycosa* sp.) and the sheetweb spider (*Erigone* sp.), the noctuid moth, and perhaps the unknown Collembola species. A fifth indigenous resident species, the Wēkiu bug (*Nysius wekiuicola*) was collected along the 4-wheel drive road.



Lycosid spiders live among rocks.

Despite intensive sampling (123 trap nights), no Wēkiu bugs were detected at the Batch Plant Staging Area, in Area E or along the 4-wheel drive road during the October 2008 sampling (Eiben 2008). Three Wēkiu bugs were detected at the two control sites, Pu‘u Hau‘oki and Pu‘u Poli‘ahu, indicating that this species was active in known habitats.

During the Spring sampling period, one hundred and forty-six Wēkiu bugs were observed in the baited live-traps and in the immediate vicinity of the traps (Eiben 2009). The counts comprise one hundred and two adult males, thirty-nine adult females, and five nymphs. No Wēkiu bugs were captured or observed in Area E or at the Batch Plant. Forty-one Wēkiu bugs were found in the six live-traps placed along the proposed Access Way Options 2 and 3. An additional one hundred and five Wēkiu bugs were observed in and near traps at the two control sites, sixty at Pu‘u Hau‘oki and forty-five at Pu‘u Poli‘ahu. Eighty-five percent of the Wēkiu bugs captured in the live-traps survived and were released into the habitat from which they were collected.

Analysis

The arthropod fauna of Area E, the 4-wheel drive road, and the Batch Plant Staging Area was found to be generally the same as that detected in historic collections. Resident native species detected during this study like the Lycosid spider and sheetweb spiders of the genus *Erigone*, are known from the Northern Plateau as well as being abundant over a large part of the MKSR (Howarth and Stone 1982, Howarth and others 1999). The native noctuid moth is also known from elsewhere in the MKSR and is always noted as being in low abundance (Howarth and Stone 1982, Howarth and others 1999, Pacific Analytics unpublished data). It is unlikely that disturbance and habitat loss due to construction of the Project would significantly impact these species.

The unidentified Collembola that was found at the Batch Plant Staging Area may or may not be endemic to Hawai‘i. The fact that it was detected only at the Batch Plant Staging Area indicates that this species is able to survive a highly disturbed habitat. The cinder stored at the Batch Plant

Staging Area is used for road maintenance and is moved frequently. The rest of the area is used as parking and vehicles regularly move over the open ground. Therefore, it is unlikely that construction activity related to the Project would significantly impact this species.

The other native arthropods that were collected at these sites are not considered residents of the higher elevations of the MKSR and were likely blown into the area by strong winds where they may eventually become prey for the resident species. The Lygaeid bugs found feed on plants and the vegetation at these sites is generally sparse and lacks the host plants necessary to sustain a population of these insects.

The lack of Wēkiu bug detection during the September sampling should not be taken as evidence that this species does not use the areas as habitat. Wēkiu bugs were detected at low density along the 4-wheel drive road in 1982 (Howarth and Stone 1982). Wēkiu bug activity has been found to be seasonally variable and the late September sampling period was not optimal for Wēkiu bug detection (Howarth and others 1999, Brenner 2002a-2006b, Polhemus 2001, Englund and others 2002, Englund and others 2005, Englund and others 2006. Englund and others 2007, Eiben pers. com.). As expected, we observed much higher trap capture rates during the Spring sampling period. Wēkiu bugs have a seasonal occurrence and are usually much more abundant from March through June (Brenner 2006b, Englund et al. 2007).

The lava substrate in Area E is not considered to be ideal Wēkiu bug habitat (Howarth and Stone 1982, Howarth and others 1999, Brenner and Lockwood 2005). Wēkiu bugs have only been found in Area E during one study, and occurred during a particularly abundant year for the bugs (Howarth and Stone 1982). No Wēkiu bugs have detected at this locality since that study in 1982 until the current study. However, construction activities could potentially impact Wēkiu bugs within the Maunakea Summit Region. Dust generated during excavation and site preparation could drift into Wēkiu bug habitat. Trash and construction materials may also be blown off the site by the strong summit winds. Dust and wind-blown debris are believed to have an adverse impact on Wēkiu bug habitat, but impacts could be mitigated. It is not likely that construction activities within Area E would have a significant impact on the Wēkiu bug populations elsewhere within the MKSR if the recommendations in this report are followed (see Section 4.0 Recommendations).

The loose cinder adjacent to the existing 4 wheel-drive road is highly suitable as Wēkiu bug habitat, consisting of different sized cinders larger than ½ inch in a depth of 2 to 10 inches above the ash layer (Eiben 2009). Construction of the Access Way options 2 and 3 would disturb that habitat.

Wēkiu bugs have never been detected at the Batch Plant Staging Area and are not likely to use the area as habitat. The stockpiled cinder is disturbed regularly because of road maintenance and does not have structure suitable for Wēkiu bug habitat. The Batch Plant Staging Area is disturbed regularly and activity there has not appeared to impact Wēkiu bug populations elsewhere, therefore construction activities there would not likely have any significant impact. However precautions should be taken to prevent accidental habitat damage and the introduction of non-indigenous arthropods to ensure protection of the native arthropod species within the MKSR (see Section 4.0 Recommendations).

3.1.2 Lichens, Bryophytes, and Vegetation

Previous Studies

Early accounts of the high elevation flora of Maunakea began in 1826 (Goodrich 1826). Hartt and Neal (1940) provide an excellent review of the early expeditions to the summit of Maunakea. According to historic reports, few plants grew above 11,000 feet. The early botanists describe the flora as consisting of *māmane* (*Sophora chrysophylla*) extending to about 10,000 feet, and only *Dubautia*, silverswords, ferns, and grasses extending as high as Lake Waiau (Hartt and Neal 1940).

The first reported systematic survey of mosses and vascular plants from the higher elevations of Maunakea occurred in 1935 (Neal 1939). The investigators reported finding a total of 146 species and varieties from an altitudinal range of 5,800 feet to the summit. Only lichens, mosses, and one fern, *Asplenium adiantum nigrum*, were detected at the summit region. The report noted that the fern also was observed at many lower altitudes (Neal 1939, Hartt and Neal 1940).

Botanical surveys of the MKSR conducted for evaluating potential impacts due to construction of observatories started in 1982 (Smith and others 1982). The first of these surveys found six resident vascular plants; two indigenous ferns, two indigenous grasses, and two non-indigenous weeds. These species occur elsewhere in the Hawaiian Islands, and the two grasses (*Trisetum glomeratum* and *Agrostis sandwicensis*) are more common at lower elevations.

One of the ferns, the endemic *Cystopteris douglasii*, is designated as a Species of Concern by the U.S. Fish and Wildlife Service (USFWS) (1999). It is known from high elevations on Haleakalā and Maunakea and may also occur in moist forests on Kauai, Oahu, Lanai, and Maui (HBMP 2008, PBIN 2008). The other fern is the spleenwort, *ʻiwaʻiwa* (*Asplenium adiantum-nigrum*).



Rhizocarpon geographicum on rocks in Area E.

The bryophytes (mosses) from Maunakea were first described by Bartram (1939) and new notes were added in subsequent studies (Bartram 1952). Lichens were not treated systematically until Smith and others (1982) conducted a survey on Maunakea near the summit in their report to support the development of the MKSR Complex Development Plan (RCUH 1983). In this study, which covered the summit region above 13,000 feet, about twenty-five species of lichens and twelve species of mosses were found. Three areas of intense study were found to have a rich variety of lichens, including *Pseudephebe pubescens*, a lichen species never before collected in Hawaiʻi. The investigators concluded that suitable niches for mosses and lichens were dispersed over the summit area and that limited construction above 13,000 feet would not endanger habitats for these species, but recommended that the three areas of rich lichen variety be surveyed before development to determine if construction would remove any populations of *Pseudephebe pubescens*.

During development of the CSO, three species of lichens and two species of mosses were added to the summit list (Sohmer and others 1982). Later studies related to the development of the

Subaru Observatory confirmed the findings of the previous studies and added no new species to the list of plants that occur near the summit of Maunakea (Char 1990). The last study completed for observatory development was conducted in 1992 (Char 1992). The investigators mapped areas of high lichen concentrations; one of these concentrations falls within Area E.

Current Study

Findings

Three lichen/bryophyte habitat types were found to occur at Area E and along the 4-wheel drive road (Smith 2008).

Type 1 – Pahoehoe lave flows covered about 50 percent of the area. The general topography was essentially flat and smooth with many folds. In several areas small caves were found which ranged from about one foot to almost six feet deep.
Type 2 – Small islands of ash covered about 10 percent of Area E. The ash was typically covered with small stones or broken lava.
Type 3 - Rubble of shattered stones constituted about 40 percent of the habitat. Three different subtypes were found in Type 3 habitat;

1. with stones somewhat embedded in ash;
2. where stones rested on ash subsurface; and
3. where there was no evidence of ash between or below the stones.



Lichen colony found at Area E.

Ten species of lichens and two species of bryophytes were found within Area E (Appendix B). There is an extremely low cover (<1 percent) of lichens and bryophytes. They are confined to protected habitats almost always on the north-facing sides of rocks or the head of small collapsed lava tubes. In these sheltered, amenable habitats, lichens are locally common.

In 2 quantitative samples from each of these three subtypes, lichens were found only in the subtype b and c habitats. In subtype b, *Lecanora polytropa* was found under 2 of 50 rocks sampled. In subtype c, *Lecanura polytropa* was found under 22 of the 50 rocks sampled, and *Acarospora sp.* was under one of the 50 rocks. None of the *L. polytropa* had fertile thalli.

There is a marked difference in the distribution of the various lichens. The dark to black species (*Rhizocarpon ?hochstetteri, Pseudephebe miniscula, Umbilicaria aprina* and *U. hirsuta*) are found on the open face of northern facing rocks, (*Candelariella vitellina, Lecanora polytropa* and *Lecanora sp.*) at the base of northern facing rocks, and (*Lepraria ?incana*) on the roof of the small lava tubes in Type 1 habitat. The presence of the dark species in the most exposed inhabited areas is in keeping with McEvoy and others (2007) finding that melanic pigments play a photoprotective role in light acclimation. The other species do not have such protection though the apothecia and areoles of *L. polytropa* are often light to dark grey in more exposed situations. *Lepraria* species frequently grow in protected shaded and humid habitats.

It has been hypothesized that the resident native noctuid moth in the Maunakea Summit Region feeds on foliose lichens (Howarth and Stone 1982). This has not been confirmed. The foliose lichens found in Area E do not show evidence of feeding and therefore do not appear to be necessary to support any herbivore trophic level.

None of the lichen species present contain cyanobacteria so if nitrogen fixation is taking place none of it comes from lichens.



Umbilicaria **lichen on rocks in Area E show no sign of herbivore damage.**

Seven species of vascular plants were found in Area E, two native grass species, two introduced weeds and two native spleenwort ferns, and one bladder fern. Three of these species also occur at the Batch Plant Staging Area (Appendix C).

The spleenwort, *ʻiwaʻiwa* (*Asplenium adiantum-nigrum*), is a species indigenous to Hawaiʻi but found on all major islands in Hawaiʻi and elsewhere in the world (Clapham and others 1962, Wagner and others 1990, Palmer 2003). At higher elevations within the MKSR it grows in well protected areas at the base of rocks, between large boulders, or in rock crevices where water accumulates. Elsewhere in Hawaiʻi it grows on cinder plains, lava flows, and in dry forests in elevations ranging from 2,000 feet to approximately 13,000 feet (Valier 1995). This fern is uncommon in Area E and at the Batch Plant Staging Area, usually occurring as individual plants in protected areas that are sheltered from direct sun.

The spleenwort, *ʻoāliʻi* (*Asplenium trichomanes* subsp. *densum*), is an endemic species of fern. This delicate fern is uncommon in Area E, occurring in crevices of rocks. Also known from Haleakalā, this species is locally abundant in full sunlight in open areas on lava fields and in *kīpuka* from 3,936- 8,856 feet on East Maui and Hawaiʻi (Palmer 2003).



ʻiwaʻiwa **grows in rock crevices at Area E.**

The bladder fern, (*Cystopteris douglasii*), is a species endemic to Hawaiʻi. It occurs in Area E infrequently in open, exposed areas on weathered rock. It is also known from scattered locations throughout the summit (Smith and others 1982).

Analysis

There is a very low diversity and cover of plants in Area E, along the 4-wheel drive road, and at the Batch Plant Staging Area. The vascular plants appear to be confined to the western side of the larger pāhoehoe flows in Area E. The two endemic grasses found both occur throughout the Hawaiian Islands and are more abundant at lower elevations (Wagner and others 1990) and therefore not threatened by construction activities. The indigenous spleenwort ferns have a broad

distribution and are more abundant at lower elevations (Palmer 2003), thus would not be significantly impacted by construction activities.

A few individual bladder ferns (*Cystopteris douglasii*) were detected at Area E during our survey. This fern is considered a Species of Concern (USFWS 1999). It occurs on five islands in Hawai‘i (Palmer 2003, HBMP 2008, PBIN 2008) and has been designated as a Priority Species-5 plant with more than 5,000 individuals and/or more than 40 populations remaining state wide (Evans and others 2006). On East Maui it grows between 1,500 and 3,000 feet in mesic forests and cave mouths (Palmer 2003). On the Island of Hawai‘i this species is found scattered throughout the higher elevations of the MKSR and on the eastern slopes of Maunaloa in the Pōhakuloa Training Area (USACE 2003). Thus, Area E does not provide unique habitat essential for its survival (Char 1990). Populations of this fern in habitats adjacent to Area E and the 4-wheel drive road could be impacted by excessive dust and wind-blown trash that cover these plants and block needed sunlight. Damage to these populations would be reduced by following the recommendations contained in this report (Section 4.0 Recommendations)

The two non-indigenous plant species, *Hypocaeris radicata*, and *Taraxacum officinale* are not abundant at the study sites and have not appeared to have spread since 1999.

Lichens and bryophytes were found to be generally confined to the northerly aspect of rocks or under overhangs and even then the abundance of species is much higher in those areas facing north.

There is a very low diversity and cover of lichens and mosses in Area E. All of the species detected are found at somewhat lower elevations at least on the southern side of the mountain, and none of the species are unique to Hawai‘i. Project construction activities would not likely have a significant impact on the plant, lichen, and moss species found at the surveyed sites.

3.1.3 Access Way Options

Option 1 – (No longer being considered) The terrain along this option is similar to that found in Area E, and is not considered to be ideal Wēkiu bug habitat (Howarth and Stone 1982, Howarth and others 1999, Brenner and Lockwood 2005). No sampling has been conducted here, but it is likely that Wēkiu bugs only occupy this area during extreme population explosions that push the insects into marginal habitats.

Option 2 – The terrain along this option has about a 15 percent slope and would require extensive fill to be functional. The ground here is a combination of loose cinder and lava and, like the terrain of Option 1, is not considered to be ideal Wēkiu bug habitat, however, ten Wēkiu bugs were detected in adjacent habitat during the Spring 2009 sampling session.

Option 3 – The terrain here is loose cinder and is contiguous with Pu‘u Hau‘oki cinder cone. The cinder here is considered to be ideal Wēkiu bug habitat, although no Wēkiu bugs were collected here during the 2008 sampling, but thirty-one were collected during the Spring 2009 sampling. This option would require disturbing the cinder cone and Wēkiu bug habitat, and the road would also bisect and isolate portions of habitat. While Wēkiu bugs have been observed crossing existing dirt and cinder roads, none have ever been observed on pavement. Because this option disturbs and displaces Wēkiu bug habitat, mitigation measures similar to those proposed

for the Outrigger Telescope Project would likely have to be implemented (see Recommendations).

3.1.4 Summary

The results of this arthropod and botanical survey indicate there are no special concerns or legal constraints related to invertebrate and botanical resources in the project areas. No species listed as endangered or threatened were detected at the project construction areas (DLNR 1997, Federal Register 1999, 2005, 2005). One species currently proposed for federal listing, the Wēkiu bug (*Nysius wekiuicola*), was observed along the 4-wheel drive road. Some Wēkiu bug habitat could be disturbed if Option 2 or 3 are chosen for the proposed Access Way. The amount would be small compared to the amount of available habitat for this species and would likely not threaten its survival on Maunakea. One species of concern, Douglas' bladder fern (*Cystopteris douglasii*), was found in Area E, but this species also occurs on Maui and on the eastern slopes of Maunaloa, thus Area E does not provide unique habitat essential for its survival (Char 1990).

3.2 Construction Staging Area, Hale Pōhaku

3.2.1 Arthropods

Previous Studies

Several entomologists have collected in the *māmane* forest near Hale Pōhaku, but no one has published a systematic study of the arthropods found there. Swezey (1954) summarized early sampling and listed forty-one species from *māmane* (*Sophora chrysophylla*) and twenty different species from *naio* (*Myoporum sandwicense*) that occur on the Island of Hawai'i.



Honeybee foraging *māmane* blossoms.

A unpublished 1988 study conducted in the *māmane* near *Pu'u La'au* added forty-seven species of insects and spiders to the list of arthropods from the *māmane* forest on Maunakea (Gagne and Montgomery unpublished). These species could be expected to occur near Hale Pōhaku as well. There is no doubt that the subalpine forest arthropod fauna is larger than these studies indicate and that additional studies will likely expand the list.

A recent survey along the Saddle Road realignment route found 214 species of arthropods (USDOT 1997). This is the closest systematic survey to Hale Pōhaku that has been conducted. Many of the species collected during the study are likely to occur at or near Hale Pōhaku.

No endangered, threatened, or special status arthropod species were detected during any of the previous studies near Hale Pōhaku described above.

Current Study

Findings

Thirty-three species of arthropods and two snails were observed on or near the TMT Mid-Level Support Facility area within Hale Pōhaku. Fifteen of the species detected are endemic to Hawai‘i, seventeen are purposeful or adventives non-indigenous species, and three are of unknown origin. The endemic species include the difficult yellow-faced bee, *Hylaeus difficillis*, the yellow-footed yellow-faced bee, *Hylaeus flavipes*, a succineid snail, *Succinea konaensis*, and several common plant bugs and moths.

Analysis

The arthropod fauna at the TMT Mid-Level Support Facility area consists mostly of non-indigenous species and common endemic species that are abundant throughout the *māmane* forest, and occur on other islands. None of the species found are designated as serious pests, and no ants were detected during the sampling. Two endemic yellow-faced bees were detected; *Hylaeus difficillis*, and *H. flavipes*, both previously designated USFWS Species of Concern. Species of Concern is an informal term, and is not defined in the federal Endangered Species Act (ESA). The term commonly refers to species that are declining or appear to be in need of conservation. Many agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts, but the designation carries no special protection and is no longer used by the USFWS Pacific Region (USFWS personal communication). The difficult yellow-faced bee, *Hylaeus difficillis*, was observed only during the Spring sampling period and normally may forage at higher elevations during warmer weather. This species also occurs on Maui, Lanai, and Molokai and it is unlikely that disturbance due to construction and staging activities of the Project would significantly impact this species. The yellow-footed yellow-faced bee, *Hylaeus flavipes*, was observed during both sampling periods foraging on *māmane*. This species also occurs on Maui and Lanai and construction activities would not likely impact the species.

Little is known about the distribution of the succineid snail. It is known to occur near *Pu‘u La‘au* on the western slopes of Maunakea. The impact of construction activity on this species is unknown.

3.2.2 Botanical

Previous Studies

Many of the same botanists that explored the upper elevations of Maunakea also studied the vegetation of the subalpine *māmane* forest (Hartt and Neal 1940). The upper limits of this forest do not reach above 10,000 feet and many of these early botanists noted seeing sheep and cattle grazing in the area.

At least five botanical studies have taken place at Hale Pōhaku. The first complete study of the flora was conducted for the Hale Pōhaku Master Plan (Gerrish 1979). *Māmane* trees six to twenty-five feet tall were found to cover about 25 percent of the undisturbed area. The ground was covered by several common grasses, hairy horseweed (*Erigeron bonariensis*), common groundsel (*Senecio vulgaris*), and mullein (*Verbascum sp.*). In all, thirty-two plant species were identified, nine native to Hawai‘i. One endemic species, *Stenogyne microphylla*, a trailing

perennial vine up to several feet long, with greenish yellow flowers, is considered rare and occurs only on two islands in Hawai‘i.

The second botanical study was conducted in 1985 (Char 1985). In this study of the area twenty-six plant species, nine native to Hawai‘i, were detected where temporary construction housing was built. A small population of the threatened species of Hawaiian catchfly (*Silene hawaiiensis*) was reported in rocky areas on the steep slopes adjacent to and above the maintenance area in the northern/upslope portion of Hale Pōhaku.

The third botanical survey at Hale Pōhaku was conducted to assess the impacts of the new facilities built to support construction of the Subaru Observatory (Char 1990). A total of thirty-seven plant species were observed. The same nine Hawaiian native plants identified in 1979 could still be found at the site.



Wand mullein (Verbascum virgatum) is common at the Construction Staging Area.

The fourth study was conducted as part of the MKSR Master Plan EIS (Char 1999). Fifty-three plant species were found to occur, sixteen native to Hawai‘i.



Māmane tree (Sophora chrysophylla) just outside the boundary of Hale Pōhaku.

The most recent botanical survey at Hale Pōhaku was conducted at the Construction Staging Area to assess potential impacts on *palila* habitat due to use by the proposed Outrigger Telescopes Project (Brenner 2004e).

None of the plants identified in these studies that occur below the Visitors Center are listed as threatened and endangered species, nor are any candidates for listing (USFWS 2006).

Current Study

Findings

During the Fall sampling period, the entire Construction Staging Area (CSA) and the surrounding region within 100 feet of the area boundaries were surveyed for plants. No *māmane* trees were found within the existing construction staging area boundaries, but the area surrounding the existing CSA was found to contain twenty-five. The locations of the sixteen closest *māmane* trees surrounding the CSA were mapped (Figure 10).

The groundcover at the CSA and surrounding area is composed of mixture of low growing introduced plants and grasses. Besides the *māmane* trees, no other native plants were observed, except possibly some scattered bunches of native grasses outside the CSA boundaries.

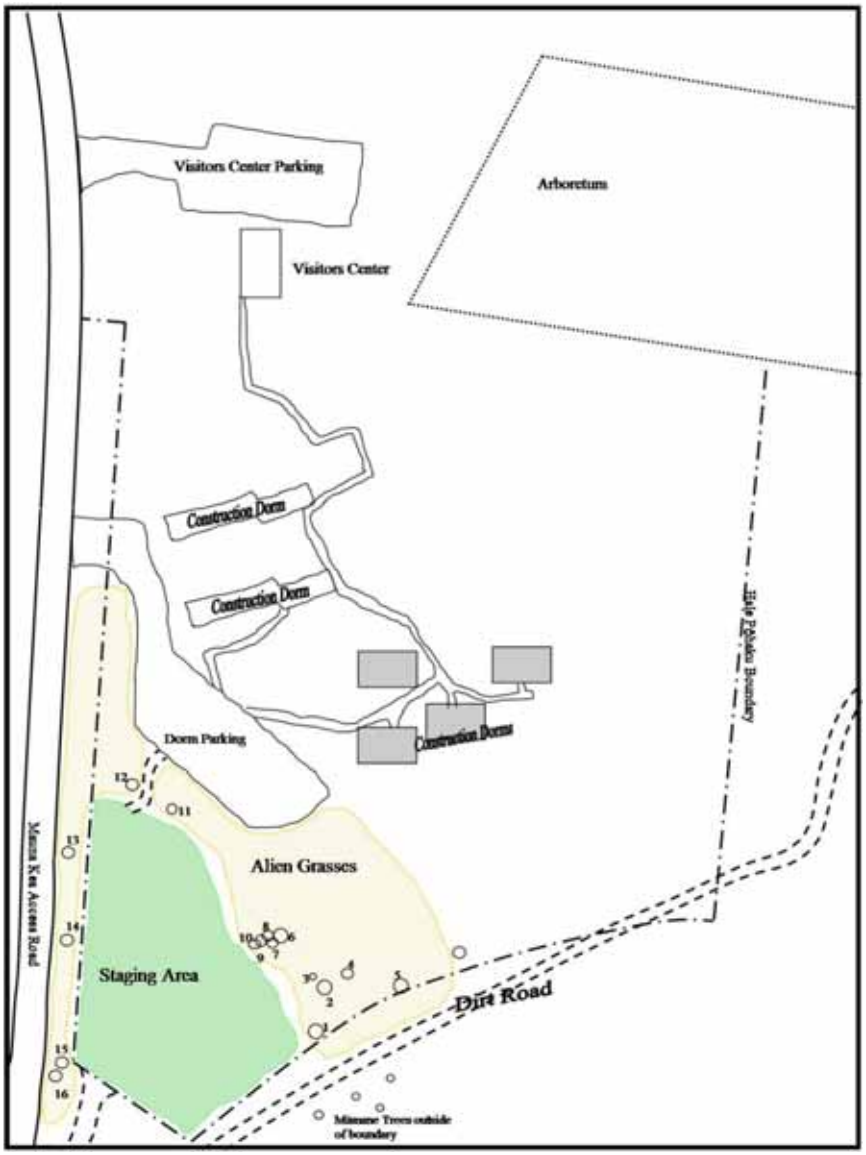

Figure 10. Map of Vegetation Surrounding Hale Pōhaku Construction Staging Area

The ground cover of the site and surrounding area consists of a mixture of grasses, dominated by needlegrass (*Nassella cernua*). The other plants that make up the ground cover include common groundsel (*Senecio vulgaris*), pin clover (*Erodium cicutarium*), woolly mullein (*Verbascum thapsus*), and evening primrose (*Oenothera stricta*).

The entire TMT Mid-Level Support Facility area was sampled during the 2009 sampling periods (see Figure 3). The area east of the existing dorms was found to have a moderate density of *māmane* trees with an understory of indigenous and nonindigenous grasses and shrubs. Indigenous plants include *māmane* trees (*Sophora chrysophylla*), *ʻaheahea* (*Chenopodium oahuense*), hinahina (*Geranium cuneatum*), *māʻohiʻohi* (*Stenogyne rugosa*), littleleaf stenogyne (*Stenogyne microphylla*), *ʻoāliʻi* (*Asplenium trichomanes* subsp. *densum*), Hawaiian bent grass

(*Agrostis sandwicensis*), pili grass (*Trisetum glomeratum*), and another grass (*Deschampsia australis*).

Analysis

The CSA is highly disturbed, mostly open ground with almost no vegetation. The few patches of plants consist of introduced weedy species. The vegetation surrounding the CSA is sparsely spaced *māmane* trees with grass and herbaceous groundcover. This surrounding vegetation may be susceptible to fire and care should be exercised to prevent such an occurrence.



Rabbitfoot clover (*Trifolium arvense*) is a low growing introduced weedy plant that occur at the CSA.

No *palila* were seen in *māmane* trees immediately adjacent to the CSA. The principal locality for *palila* is at *Pu'u La'au* and *palila* are rarely seen near Hale Pōhaku. Fire is a threat to the *māmane* forest and precautions should be taken to prevent it. It is unlikely *palila* would be significantly impacted by temporary use of the CSA if the recommendations contained in this report are followed.

The indigenous plants that grow within the TMT Mid-Level Support Facility boundary are common and all occur on other islands in Hawai'i. The proposed approximately 5 acre area studied represents a small fraction of the *māmane* subalpine forest habitat and Project use of the area would likely not substantially impact the vegetation surrounding the site.

Area Use Options

The area being considered for the TMT Mid-Level Support Facility (Figure 10) is located near the lowest reaches of the Hale Pōhaku boundary.



Primrose (*Oenothera stricta*) is one of the more abundant and showy, introduced weedy plants that occur at the CSA.

The area comprises three general areas; 1) the CSA described above; 2) the land around the Construction Dorms and Cabins; and 3) an area of open ground with scattered *māmane* trees above the existing dorms and east of the existing cabins. There are neither native Hawaiian species listed as threatened or endangered, nor any candidates for listing or are species of concern that were found within the entire 4.9 acres being considered. Nine native plant species occur within the area: *māmane* trees (*Sophora chrysophylla*), *'aheahea* (*Chenopodium oahuense*), hinahina (*Geranium cuneatum*), *mā'ohi'ohi* (*Stenogyne rugosa*), littleleaf stenogyne (*Stenogyne microphylla*), *'oali'i* (*Asplenium trichomanes* subsp. *densum*), Hawaiian bent grass (*Agrostis sandwicensis*), pili grass (*Trisetum glomeratum*), and another grass (*Deschampsia australis*). All

of these species occur over a wide range and most on other islands in Hawai‘i and none are considered rare or threatened.

To the east of the area is a forest reserve with native Hawaiian components, including those found within the area, and a fern (*Asplenium adiantum-nigrum*). The forest reserve is within the designated critical habitat for the federally listed endangered bird *palila* (*Loxioides bailleui*).

The only serious threats to the surrounding forest reserve that is posed by the use of this area for dormitory development and observatory construction activities are the potential for fire and the increased potential for introduction of non-indigenous plants and arthropods. Other impacts may also include wind-blown trash, construction debris and dust. All of these impacts can easily be mitigated or prevented by implementing sensible and well thought out management practices. Planning for development of the area should include considerations for protecting the surrounding forest reserve and *palila* critical habitat.

3.2.3 Summary

The results of this arthropod and botanical survey at the TMT Mid-Level Support Facility area indicate there are no special concerns or legal constraints related to invertebrate and botanical resources in the Project areas. No species listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawai‘i endangered species statutes were detected at the CSA or Area 1 (DLNR 1997, Federal Register 1999, 2005, 2006). The *māmane* forest that surrounds Hale Pōhaku is designated *palila* critical habitat. Care must be taken to reduce all threats to this habitat by use of the TMT Mid-Level Support Facility. By following the recommendations contained in this report those threats could be reduced. Three invertebrate formally designated Species of Concern occur within the TMT Mid-Level Support Facility boundary, the difficult yellow-faced bee (*Hylaeus difficillis*), the yellow-footed yellow-faced bee (*Hylaeus flavipes*), and the succineid snail (*Succinea konaensis*). The habitat for the two bees is extensive on Maunakea, and construction activity at the TMT Mid-Level Support Facility would likely not impact their populations. Little is known about the distribution of the succineid snail, other than that it is known to occur near *Pu‘u La‘au* on the western slopes of Maunakea. The impact of construction activities on this species is unknown.

4.0 RECOMMENDATIONS

4.1 Area E, Access Way, and Batch Plant Staging Area

Habitat Disturbance should be minimized - The rocks and cinder within Area E are home to lichens, mosses, and endemic arthropods, therefore disturbance should be minimized at the construction site and in the surrounding habitats.

Recommendation 1: Disturbance should be minimized. Construction activities should be limited to the footprint pad and road improvements, and no cinder or other materials should be side-cast into adjacent habitat.

Recommendation 2: Dust can impact lichens, mosses, and ferns and is believed to degrade Wēkiu bug habitat. Water should be applied to excavation sites and cinder stockpiles to minimize dust generation.

Recommendation 3: High winds can spread dust to surrounding habitat. It is recommended that dust-generating activities be suspended during high winds.

Recommendation 4: (No longer being proposed by the Project) Soil-binding stabilizers such as DuraSoil are currently being used on unpaved roads within the MKSR. These compounds help reduce dust and road maintenance and their use is encouraged. However, soil-binding stabilizers should be used sparingly, and should never be applied to habitat adjacent to the roads or observatory use areas.

Recommendation 5: Oil spills and other contaminating events have occurred at observatories in the past. While these spills have always been contained immediately and have not resulted in serious ecological damage, care should be taken to avoid any spills. The Project staff and contractors should follow Federal guidelines specifying the use and disposal of oil, gasoline, dangerous chemicals, and other substances used during observatory construction and maintenance.

Recommendation 6: Contractors should minimize the amount of on-site paints, thinners, and solvents. Painting and construction equipment should not be cleaned on-site. Contractors should keep a log of hazardous materials brought on-site and report spills immediately to a designated Project representative and the proper authorities.

Recommendation 7: Construction trash containers should be tightly covered to prevent construction wastes from being dispersed by wind.

Recommendation 8: Construction materials stored at the site should be covered with tarps, or anchored in place, and not be susceptible to movement by wind.

Recommendation 9: If construction materials and trash are blown into habitat, they should be collected with a minimum of disturbance.

Recommendation 10: Option 3, developing the existing 4-wheel drive road as the Access Way, should be avoided because it disturbs, displaces, and isolates portions of Wēkiu bug habitat. However, as redesigned the impact would be lessened. It would likely require mitigation measures similar to those suggested for the Outrigger Telescopes project, such as habitat restoration. Option 2 crosses marginal Wēkiu bug habitat and would likely have no significant impact on Wēkiu bugs, but may entail some mitigation. The ideal option from a biological resources view is Option 1. It disturbs a minimal amount of only marginal habitat.

Introduction of non-indigenous arthropods and plants should be avoided – Non-indigenous arthropods can be a threat to native species that reside at or near the summit. Ants are especially threatening and their introduction should be strictly prevented. Introduced plants can change the microhabitat conditions if they become established, thereby facilitating the establishment of other non-indigenous species.

Recommendation 11: Earthmoving equipment should be free of large deposits of soil, dirt and vegetation debris that may harbor alien arthropods and weed seeds.

1. Pressure-wash and/or otherwise remove alien arthropods and weed seeds from equipment and materials before moving them from lower elevations and up the Maunakea Access Road. This cleaning should be done in baseyards in Hilo or Waimea before continuing up Saddle Road.
2. Inspect large trucks, tractors, and other heavy equipment before proceeding up Maunakea Access Road from Hale Pōhaku. Clean and wash as necessary prior to proceeding up to the summit area.

Recommendation 12: All construction materials, crates, shipping containers, packaging material, and observatory equipment should be free of alien arthropods when delivered to the summit.

1. Inspect shipping crates, containers, and packing materials before shipment to Hawai‘i
2. Inspect construction materials before transport to the summit area

Recommendation 13: Outdoor trash receptacles should be provided for ready disposal of lunch bags and wrappers. These receptacles should be secured to the ground, have attached lids and plastic liners, and be collected frequently to reduce food availability for alien predators.

Recommendation 14: The construction site and staging areas should be monitored to detect new introductions of non-indigenous arthropod and plant species. New alien arthropod and plant introductions detected during monitoring should be eradicated immediately.

1. Ant eradication
2. Yellowjacket eradication
3. Alien spider eradication
4. Weed eradication

4.2 Construction Staging Area, Hale Pōhaku

Habitat Disturbance should be minimized – While the Construction Staging Area and the immediate surrounding area within Hale Pōhaku are highly disturbed, a native ecosystem exists nearby. Care should be taken to avoid disturbance of that ecosystem.

Recommendation 1: In previous botanical surveys conducted at this site it was recommended that efforts be directed to managing the natural resources on and around the site. The recommendations included plantings of native species and removing introduced species, such as mullein and the newly arrived Madagascar ragwort. These recommendations are still valid today.

Recommendation 2: Because of increased tourist traffic and resident recreational use of the surrounding area, it is possible that more non-indigenous species will be introduced. Construction vehicles and containers for the Project should be cleaned and inspected for alien species before proceeding up the Maunakea Access Road. These inspections are likely to intercept other alien species that may cause harm to the surrounding critical habitat at Hale Pōhaku.

Recommendation 3: Other habitat protection measures mentioned for Area E are also applicable at Hale Pōhaku. For example, control of trash, dust, and material is important to minimize disturbance to adjacent habitat. And, it is good practice to limit the amount of hazardous materials to decrease the potential for spills.

Recommendation 4: Another important habitat protection measure especially applicable at Hale Pōhaku is prevention of fire. The *māmane* forest surrounding the construction staging area is dry and susceptible to fire, and once started, a fire may be difficult to control. It is best to take precautions to prevent fire, such as advising personnel of the susceptibility of habitat to fire, limiting smoking to designated areas away from dry grass, and limiting the amount of activity that would cause sparks or fire that may spread to adjacent habitat. It is advisable to have fire extinguishers on hand and the construction staging area personnel should be trained in their use. These are practical measures that are usually applied at construction sites, but are especially important in natural areas where fire may have an impact on endangered species and their habitats.

Recommendation 5: The succineid snail (*Succinea konaensis*) occurs under fallen, dead trees. If dead trees are to be moved at the TMT Mid-Level Support Facility area, they should be placed outside the disturbance area. It may be preferred to have a qualified biologist present to search for and remove individual snails and relocate them with the dead trees.



Jesse Eiben checking Wēkiu bug traps on Puʻu Hauʻoki in April 2009.

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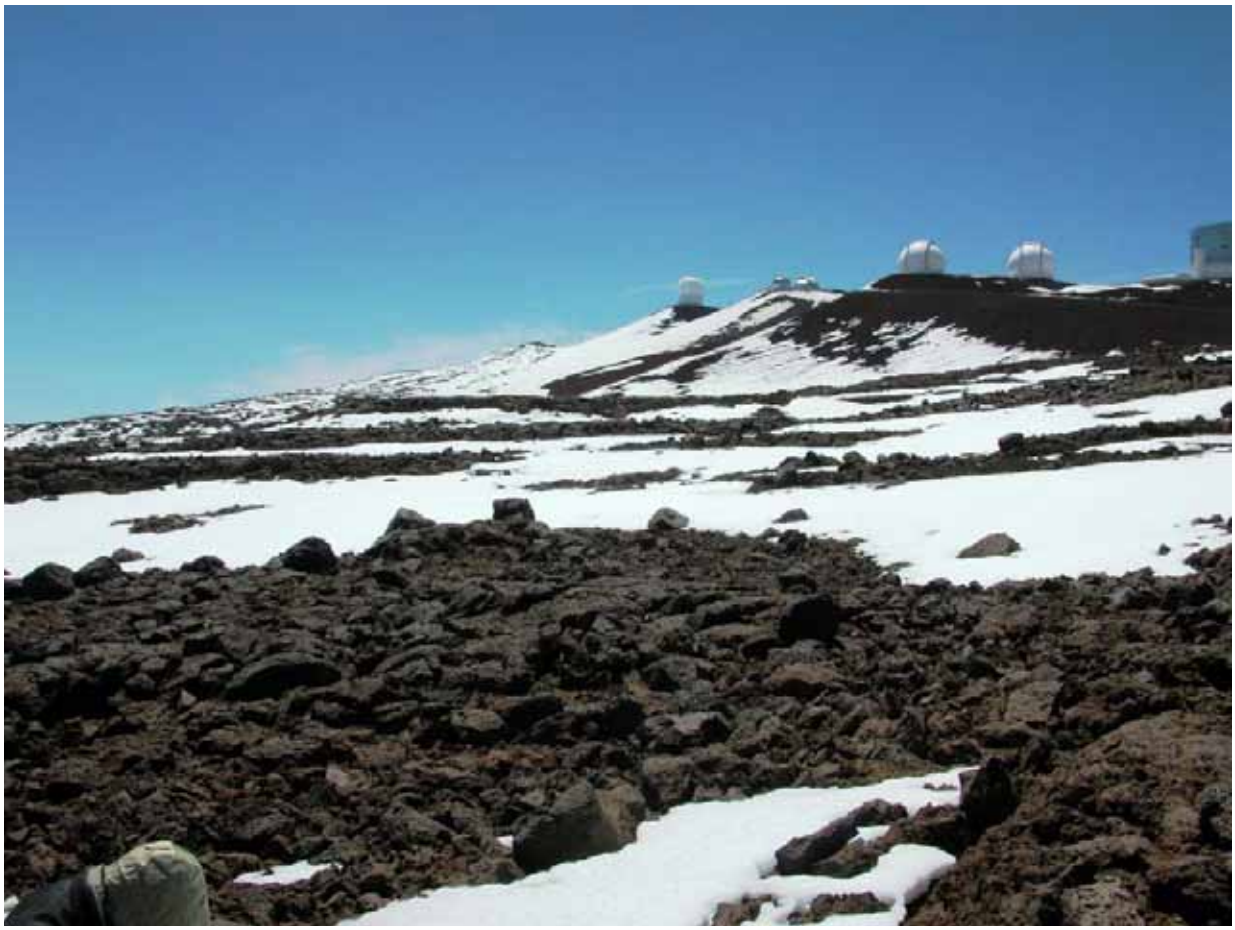

Looking towards the summit observatories from Area E in April 2009.

APPENDIX A

Results of the Thirty Meter Telescope Proposed Site Evaluation for the Wekiu Bug (*Nysius wekiuicola*): Fall 2008.

Technical Report prepared by Jesse Eiben, M.S.

Results of the Thirty Meter Telescope Proposed Site Evaluation for the Wekiu Bug (*Nysius wekiuicola*): Fall 2008



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Summary
A four day sampling regime with the use of 45 baited attractant live traps designed for monitoring the presence and absence of the Wekiu bug (*Nysius wekiuicola* Ashlock and Gagné) was used to create part of the biological assessment of a proposed site for the Thirty Meter Telescope on Maunakea, Hawai‘i. Three Wekiu bugs were captured and counted before being released at the end of the sampling period on September 28, 2008. No Wekiu bugs were found in the area purported to be directly physically impacted by any possible observatory construction activity. The fall season is not the best time to look for the presence or absence of the Wekiu bug anywhere in its range, so there can be only limited conclusions drawn from this sampling period. However, there is broad accord among scientists that the type of rock substrate in the Northern Plateau is not known to regularly harbor large numbers of Wekiu bugs.

Introduction
As part of a project by Pacific Analytics, LLC for the Thirty Meter Telescope Project, I have been contracted to sample for the Wekiu bug in areas selected as possible sites for Project construction on the Northern Plateau of Maunakea. This project is different from, yet is informed by, scientific research I am conducting for my PhD in entomology at the University of Hawai‘i at Manoa involving the life history and population genetics of the Wekiu bug.

The Wekiu bug, *Nysius wekiuicola* Ashlock and Gagné, on the Island of Hawai‘i has been the focus of much attention in its native range on and near the summit of Hawai‘i’s tallest mountain, Maunakea. Since the bug’s formal description in 1983 by Ashlock and Gagné, the bug’s habitat and life history has been of great interest to scientists, conservationists, and the public as a whole. The specialized life history allowing the Wekiu bug to survive the extremes of temperature, solar radiation, and water and food availability make this insect a true marvel of adaptation. Due to its limited range, specialized habitat requirements, isolated populations, and habitat destruction, the Wekiu bug was is currently a candidate for listing priority 8 under the Endangered Species Act (Endangered, 2006). Explorations of the summit area over the past 10 years by entomologists representing the Bishop Museum, Pacific Analytics, LLC, and the University of Hawai‘i at Manoa have greatly enhanced our knowledge of the types of areas Wekiu bugs inhabit, their behaviors and life history (Pacific Analytics, 2006, Englund et al. 2007, Eiben, unpublished).

The objectives for this study are to provide presence and absence data of the Wekiu bug in a subset of its range on and near the summit of Maunakea as part of the biological assessment of a potential site for a new observatory in the Astronomy Precinct being prepared by Pacific Analytics, LLC.

Materials and Methods

Study Area:

The area of Maunakea being sampled for Wekiu bugs is known as Area E on the Northern Plateau of the mountain. In practical terms, the area encompasses a part of the west and northwest zone of the Astronomy Precinct on the summit of Maunakea. Specific locations for wekiu bug live-trap placements were haphazardly selected in Area E, along the 4-wheel drive road to Area E, around the Batch Plant, and in two control locations not in the expected

construction disturbance areas where Wekiu bugs have been found multiple times in 2007 and 2008 (Eiben, unpublished).

Trapping Methods:

A live pitfall trap design very similar to those described by Englund et al. (2002) and Pacific Analytics (2002) was used to attract Wekiu bugs. The modifications in design are as follows. Two 10oz clear plastic cups were used for each trap. The upper cup was punctured with one small hole in the bottom center through which a small absorbent wick made of tissue (Kimtech Science) was pushed. A small amount of water was poured into the bottom of the lower reservoir cup. The attractant shrimp paste was placed in the upper cup contacting the wick, on a few small pieces of rock in the cup, smeared on the side of the cup, and on a cap rock. The traps were dug into the available ground substrate attempting to achieve a depth where moisture was present in the ash layer. The lip of the cup was not necessarily placed flush with ash layer, and there was no wire mesh surround to provide structure surrounding the cups. This cup design has been successful for attracting and capturing Wekiu bugs during 2007 and 2008 (Eiben, unpublished). Most sites selected for sampling used a pair of traps within 16.4 feet of each other in different microhabitat types (ex. large rock jumble vs. ash layer near the surface) to attempt to sample the true diversity of the habitat (see Tables 1 and 2). The traps were checked daily and bugs captured were removed for the duration of the sampling period to prevent recounts. Bugs were held for up to three days in captivity with food and water sources.

Results

No Wekiu bugs were observed while hiking through the trapping areas, nor were any Wekiu bugs observed while emplacing the traps. Forty-five traps were placed for three or four days from September 25-28. Three Wekiu bugs were captured in two locations over the sampling period (see Table 1, Table 2, and Figure 1). One adult female and one 5th instar nymph Wekiu bug were captured in the control area near the SE base of Puu Hau Oki on September 26, 2008. One 5th instar nymph Wekiu bug was found in the control area on the E base area of Puu Poliahu on September 28, 2008. All three Wekiu bugs found in the traps were alive and were released alive in good condition where they were captured on September 28, 2008.

Discussion

Though the sampling effort (number of traps) for Wekiu bugs during this sampling period was quite intense given the area surveyed, there can be little information drawn from the lack of bugs found in Area E. During the fall season, the number of Wekiu bugs found on Maunakea throughout its range are much less than during other times of the year. The reason for this is unknown. Wekiu bugs are found in much higher numbers during the late spring and early summer, and these areas are correlated to lasting snow pack (Englund et al. 2007). The duration and availability of moisture sources may indeed be a limiting factor for the year-round distribution of the Wekiu bug within its range. The spring sampling period of Area E should be much more informative for determining the presence or absence of the Wekiu bug in the possible construction zone for the Project.

Acknowledgements

I would like to thank Greg Brenner of Pacific Analytics, LLC for his help in the field and valuable insights about the Wekiu bug and its habitat. Betsy Gagné at DLNR has proven

instrumental in obtaining permits for all work relating to the genus Nysius in Hawai‘i. The support of Stephanie Nagata at OMKM is crucial to all work involving the Wekiu bug and is always most helpful.

Table 1. Detail of baited shrimp trap locations and wekiu bug captures during September, 2008

Site Description	Trap Name	Paired traps	GPS Coordinates (NAD83)		Wekiu Bug Captures			
					25-Sep-08	26-Sep-08	27-Sep-08	28-Sep-08
Site 1 footprint	TMT1A	Yes	19°49'57.22"N	155°28'52.93"W	Install	0	0	0
Site 1 footprint	TMT1B	Yes			Install	0	0	0
Site 1 footprint	TMT2A	Yes	19°49'57.90"N	155°28'53.69"W	Install	0	0	0
Site 1 footprint	TMT2B	Yes			Install	0	0	0
Site 1 footprint	TMT3A	Yes	19°49'56.35"N	155°28'53.65"W	Install	0	0	0
Site 1 footprint	TMT3B	Yes			Install	0	0	0
Site 1 footprint	TMT4A	Yes	19°49'55.42"N	155°28'53.08"W	Install	0	0	0
Site 1 footprint	TMT4B	Yes			Install	0	0	0
Site 1 footprint	TMT5A	Yes	19°49'53.80"N	155°28'52.97"W	Install	0	0	0
Site 1 footprint	TMT5B	Yes			Install	0	0	0
Road	TMT6A	Yes	19°49'52.46"N	155°28'53.04"W	Install	0	0	0
Road	TMT6B	Yes			Install	0	0	0
Road	TMT7A	Yes	19°49'51.67"N	155°28'50.74"W	Install	0	0	0
Road	TMT7B	Yes			Install	0	0	0
Site area	TMT8A	Yes	19°49'52.10"N	155°28'49.69"W	Install	0	0	0
Site area	TMT8B	Yes			Install	0	0	0
Site area	TMT9A	Yes	19°49'52.68"N	155°28'48.22"W	Install	0	0	0
Site area	TMT9B	Yes			Install	0	0	0
Site 2 footprint	TMT10A	Yes	19°49'41.02"N	155°28'46.45"W	Install	0	0	0
Site 2 footprint	TMT10B	Yes			Install	0	0	0
Site 2 footprint	TMT11A	Yes	19°49'41.84"N	155°28'45.01"W	Install	0	0	0
Site 2 footprint	TMT11B	Yes			Install	0	0	0
Site 2 footprint	TMT12A	Yes	19°49'43.10"N	155°28'44.08"W	Install	0	0	0
Site 2 footprint	TMT12B	Yes			Install	0	0	0

Table 2. Detail of baited shrimp trap locations and wekiu bug captures during September, 2008

Site Description	Trap Name	Paired traps	GPS Coordinates (NAD83)		Wekiu Bug Captures			
					25-Sep-08	26-Sep-08	27-Sep-08	28-Sep-08
Site 2 footprint	TMT13A	Yes	19°49'43.61"N	155°28'45.84"W	Install	0	0	0
Site 2 footprint	TMT13B	Yes			Install	0	0	0
Site 2 footprint	TMT14A	Yes	19°49'46.49"N	155°28'47.39"W	Install	0	0	0
Site 2 footprint	TMT14B	Yes			Install	0	0	0
Site Area	TMT15A	Yes	19°49'43.79"N	155°28'51.78"W	Install	0	0	0
Site Area	TMT15B	Yes			Install	0	0	0
Site Area	TMT16A	Yes	19°49'45.55"N	155°28'53.47"W	Install	0	0	0
Site Area	TMT16B	Yes			Install	0	0	0
Road	TMT road1	No	19°49'28.63"N	155°28'40.01"W	N/A	Install	0	0
Road	TMT road2	No	19°49'32.48"N	155°28'41.26"W	N/A	Install	0	0
Road	TMT road3	No	19°49'38.27"N	155°28'44.31"W	N/A	Install	0	0
Road	TMT road4	No	19°49'43.75"N	155°28'48.79"W	N/A	Install	0	0
Batch plant	TMTbatch1A	Yes	19°49'12.65"N	155°28'27.44"W	N/A	Install	0	0
Batch plant	TMT batch1B	Yes			N/A	Install	0	0
Batch plant	TMT batch2A	Yes	19°49'12.72"N	155°28'29.82"W	N/A	Install	0	0
Batch plant	TMT batch2B	Yes			N/A	Install	0	0
Batch plant	TMT batch3	No	19°49'11.04"N	155°28'30.52"W	N/A	Install	0	0
Non-construction	TMT Pol contA	Yes	19°49'26.54"N	155°28'48.36"W	N/A	Install	0	1*
Non-construction	TMT Pol contB	Yes			N/A	Install	0	0
Non-construction	TMT Oki contA	Yes	19°49'25.72"N	155°28'31.66"W	Install	2**	0	0
Non-construction	TMT Oki contB	Yes			Install	0	0	0

*one fifth instar nymph captured
**one adult female and one fifth instar nymph captured



Figure 1. Overview map of study site sample locations within the Astronomy Precinct on Maunakea, Hawai‘i

*Astronomy Precinct outlined in purple

**Green dots indicate Wekiu bug capture locations

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APPENDIX B

Results of the Thirty Meter Telescope Proposed Site Evaluation for the Wekiu Bug (*Nysius wekiuicola*): Spring 2009.

Technical Report prepared by Jesse Eiben, M.S.

Results of the Thirty Meter Telescope Proposed Site Evaluation for the Wekiu Bug (*Nysius wekiuicola*): Spring 2009



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Summary
A four day sampling regime with the use of 24 baited attractant live traps designed for monitoring the presence and absence of the Wekiu bug (*Nysius wekiuicola* Ashlock and Gagné) was used to create part of the biological assessment of a proposed site for the Thirty Meter Telescope on Maunakea, Hawai‘i. A total of 146 wekiu bugs were observed and/or captured between April 20 and 23, 2009. In the past, Wekiu bugs have often been captured in greater numbers during late March, April and May than during the summer and fall (Eiben pers. obs.). This cycle of Wekiu bug activity was confirmed during the two sampling periods for the proposed TMT site. Wekiu bugs were found in areas impacted previously by construction and in areas that are considered unaltered habitat. No Wekiu bugs were found in the area of the proposed construction footprint of the Project construction, however there were many Wekiu bugs found along the currently closed unpaved 4-wheel drive road north of the SMA array. This road may be impacted by Project construction, and Wekiu bug habitat and populations will need to be taken into consideration in the event of the road reopening. There is still broad accord among scientists that the type of rock substrate in the Northern Plateau is not known to regularly harbor large numbers of Wekiu bugs, and this was confirmed during the spring 2009 sampling session.

Introduction
As part of a project by Pacific Analytics, LLC for the Thirty Meter Telescope, I have been contracted to sample for the Wekiu bug in areas selected as possible sites for observatory facility construction on the Northern Plateau of Maunakea. This project is different from, yet is informed by, scientific research I am conducting for my PhD in entomology at the University of Hawai‘i at Manoa involving the life history and population genetics of the Wekiu bug.

The Wekiu bug, *Nysius wekiuicola* Ashlock and Gagné, on the Island of Hawai‘i has been the focus of much attention in its native range on and near the summit of Hawai‘i’s tallest mountain, Maunakea. Since the bug’s formal description in 1983 by Ashlock and Gagné, the bug’s habitat and life history has been of great interest to scientists, conservationists, and the public as a whole. The specialized life history allowing the Wekiu bug to survive the extremes of temperature, solar radiation, and water and food availability make this insect a true marvel of adaptation. Due to its limited range, specialized habitat requirements, isolated populations, and habitat destruction, the Wekiu bug is currently a candidate for listing priority 8 under the Endangered Species Act (Endangered, 2006). Explorations of the summit area over the past 10 years by entomologists representing the Bishop Museum, Pacific Analytics, LLC, and the University of Hawai‘i at Manoa have greatly enhanced our knowledge of the types of areas Wekiu bugs inhabit, their behaviors and life history (Pacific Analytics, 2006, Englund et al. 2007, Eiben, unpub.).

The objectives for this study are to provide presence and absence data of the Wekiu bug in a subset of its range on and near the summit of Maunakea as part of the biological assessment of a potential site for a new observatory in the Astronomy Precinct being prepared by Pacific Analytics, LLC.

Materials and Methods

Study Area:

The area of Maunakea being sampled for Wekiu bugs is known as Area E on the Northern Plateau of the mountain. In practical terms, the area encompasses a part of the west and northwest zone of the Astronomy Precinct on the summit of Maunakea. Specific locations for Wekiu bug live-trap placements were haphazardly selected in Area E in the proposed footprint sites of the TMT Project, along the 4-wheel drive road to Area E, around the Batch Plant, and in two control locations not in the expected construction disturbance areas where Wekiu bugs have been found multiple times in 2007 and 2008 (Eiben, unpublished).

Trapping Methods:

A live pitfall trap design very similar to those described by Englund et al. (2002) and Pacific Analytics (2002) was used to attract Wekiu bugs. The modifications in design are as follows. Two 10oz clear plastic cups were used for each trap. The upper cup was punctured with one small hole in the bottom center through which a small absorbent wick made of tissue (Kimtech Science) was pushed. A small amount of water was poured into the bottom of the lower reservoir cup. The attractant shrimp paste was placed in the upper cup contacting the wick, on a few small pieces of rock in the cup, smeared on the side of the cup, and on a cap rock. The traps were dug into the available ground substrate attempting to achieve a depth where moisture was present in the ash layer. The lip of the cup was not necessarily placed flush with ash layer, and there was no wire mesh surround to provide structure surrounding the cups. This cup design has been successful for attracting and capturing Wekiu bugs during 2007 and 2008 (Eiben, unpublished). Most sites selected for sampling used a pair of traps within 5 meters of each other in different microhabitat types (ex. large rock jumble vs. ash layer near the surface) to attempt to sample the true diversity of the habitat (see Table 1). The traps were checked daily and bugs captured were removed for the duration of the sampling period to prevent recounts. Bugs were held for up to three days in captivity with food and water sources.

Results

A total of 146 Wekiu bugs were observed in the baited traps and in the immediate vicinity of the traps. Twenty four traps were placed for three full days starting on April 20 and removed on April 23. No Wekiu bugs were captured or observed in the area known as Area E on the Northern Plateau (12 traps), nor near the Batch Plant area (2 traps), 41 Wekiu bugs were found in 6 traps along the dirt road that is currently closed adjacent to the SMA array, and 105 Wekiu bugs were captured in four traps in two control locations not in areas with any planned direct impacts by construction activities of the Project (see Table 1, and Figure 1). Five nymph, 102 adult male, and 39 adult female Wekiu bugs were captured in total. Twenty seven live Wekiu bugs captured in the two “Poi Bowl, Pu’u Hau ‘Oki” control trap sites were collected and moved to the University of Hawai‘i lab colony by myself, Jesse Eiben, as per my permit allowances for the life history study of the Wekiu bug. There was an 85 percent survivorship rate of Wekiu bugs trapped in this sampling period with eighteen Wekiu bugs found dead in the traps, and four Wekiu bugs dying in captivity.

Discussion

The sampling effort during the spring sampling session was less intense (24 traps vs. 45 traps) than the fall sampling period because the spring is typically the active season for adult Wekiu bugs. As expected, we observed much higher trapping rates than in the fall of 2008 when Wekiu bugs are scarce and/or not attracted to traps. The weather at the summit during the sampling period of April 20-23, 2009 was quite cold and windy with the daytime high air temperature hovering only slightly above freezing at 34-41ºF and wind gusts up to 94 mph with ~45mph constant wind speeds. The lower trap catches on April 22 could be correlated to the overcast sky the previous day. Wekiu bugs were less likely to be active during the time between the traps were checked because they were simply too cold to be attracted and move in high numbers toward the baited traps on April 21st. Important to note is the complete lack of any recent wind deposited insect food sources for the Wekiu bugs. Virtually no by-catch of other insects was found in the traps, and the snow-covered areas of the mountain observed were bereft of insects.

Wekiu bugs were captured in places characterized as having large areas with an assemblage of different sized rock cinder scoria in a depth of approximately 2-10 inches before the ash layer was reached. This mixed rock tephra is found on the slopes of cinder cones. The areas where Wekiu bugs are found show a constant state of flux, with the scoria slowly moving down slope by the force of gravity and undergoing frost-heaves that continually 'sift' dust and ash down in depth thereby creating a natural and very slow sorting of rock scoria with larger rocks nearer the surface and smaller cinders being closer to the ash layer. This habitat type is apparently highly suitable for supporting populations of Wekiu bugs. There are many interconnected reasons why Wekiu bugs are associated with specific type of habitat. Wekiu bugs can use this depth of different sized cinder to thermoregulate by moving through the innumerable crevices that the assortment of rocks create. These crevices also provide paths for escape from predators (most likely the endemic lycosid spider). Temperature and humidity data show the incredible variation found in these few inches of rock, with humidity and temperature being oppositely correlated. Near the ash layer, the temperature is cool with high humidity, and at the surface where Wekiu bugs can bask in the sun, the temperature can be very high (up to 114º F) with extremely low humidity (10 percent) (Eiben unpublished). These microhabitats are necessary for the Wekiu bug physiologically, but can also create areas that hold and preserve prey items on which Wekiu bugs feed. As insects drop from the wind column and sift through the scoria, they can become protected from the intense desiccating conditions found at the surface. Of the traps that attracted Wekiu bugs, some traps were placed in areas with very little depth of this type of cinder tephra, however, since the effective range of these traps is unknown, the bugs could be attracted from adjacent deep cinder zones.

It has previously been shown that Wekiu bugs are found in much higher numbers during the late spring and early summer, and these areas are correlated to lasting snow pack (Englund et al. 2007). During this trapping session and others (Eiben, unpublished), it is apparent that Wekiu bugs are often found in areas that have no current adjacent snow pack (along the dirt road north of SMA, and at the lower trap sites on Pu'u Poliahu and Pu'u Hau 'Oki). The duration and availability of moisture sources may indeed be a limiting factor for the year-round distribution of the Wekiu bug within its range. When discussing insect populations and habitats, it essential to be cognizant that the individual organism does not seek out and use habitat on a very large scale. Population growth in an area will be at the whim of the food and climate (microclimate)

available. This is especially true on Maunakea, where weather events can drastically change the time and duration of activity possible and availability of fresh prey items for Wekiu bugs.

Acknowledgements

I would like to thank Greg Brenner of Pacific Analytics, LLC for his help in the field and valuable insights about the Wekiu bug and its habitat. Betsy Gagné at DLNR has proven instrumental in obtaining permits for all work relating to the genus Nysius in Hawai‘i. The support of Stephanie Nagata at OMKM is crucial to all work involving the Wekiu bug and is always most helpful.

Table 1. Detail of baited shrimp trap locations and wekiu bug captures during April, 2009

Site Description	Trap Name	Paired traps	GPS Coordinates (NAD83)	Wekiu Bug Captures				
				20-Apr-09	21-Apr-09	22-Apr-09	23-Apr-09	TOTALS
SMA Access Road	STMTR1-A	No	N19 49.482 W155 28.648	Install	9	0	3	= 12
SMA Access Road	STMTR1-B	No	N19 49.481 W155 28.653	Install	3	0	7	= 10
SMA Access Road	STMTR2-A	No	N19 49.505 W155 28.659	Install	2	0	5	= 7
SMA Access Road	STMTR2-B	No	N19 49.503 W155 28.656	Install	1	1	2	= 4
SMA Access Road	STMTR3-A	No	N19 49.549 W155 28.679	Install	1	0	6	= 7
SMA Access Road	STMTR3-B	No	N19 49.549 W155 28.686	Install	0	0	1	= 1
Site 1 Footprint	STMTF1-A	Yes	N19 49.968 W155 28.880	Install	0	0	0	0
Site 1 Footprint	STMTF1-A			Install	0	0	0	0
Site 1 Footprint	STMTF1-B	Yes	N19 49.975 W155 28.895	Install	0	0	0	0
Site 1 Footprint	STMTF1-B			Install	0	0	0	0
Site 1 Footprint	STMTF1-C	Yes	N19 49.932 W155 28.898	Install	0	0	0	0
Site 1 Footprint	STMTF1-C			Install	0	0	0	0
Site 2 Footprint	STMTF2-A	Yes	N19 49.903 W155 28.887	Install	0	0	0	0
Site 2 Footprint	STMTF2-A			Install	0	0	0	0
Site 2 Footprint	STMTF2-B	Yes	N19 49.908 W155 28.853	Install	0	0	0	0
Site 2 Footprint	STMTF2-B			Install	0	0	0	0
Site 2 Footprint	STMTF2-C	Yes	N19 49.885 W155 28.849	Install	0	0	0	0
Site 2 Footprint	STMTF2-C			Install	0	0	0	0
Batch Plant	STMTbatch	Yes	N19 49.175 W155 28.492	Install	0	0	0	0
Batch Plant	STMTbatch			Install	0	0	0	0
Non-Construction	STMTPol-A	Yes	N19 49.448 W155 28.802	Install - 1	14	6	21	= 42
Non-Construction	STMTPol-B			Install	2	0	1	= 3
Non-Construction	STMTPoi-A	Yes	N19 49.429 W155 28.517	Install	6	13	16	= 35
Non-Construction	STMTPoi-B			Install	3	5	17	= 25



Figure 1. Overview map of study site sample locations within the Astronomy Precinct on Maunakea, Hawai‘i

*Astronomy Precinct outlined in purple

**Green squares indicate Wekiu bug capture locations, size correlated to trap captures

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APPENDIX C

MAUNAKEA REPORT
The lichens and bryophytes in the proposed Thirty Meter Telescope sites
at the summit of Maunakea, Hawai‘i

Technical Report prepared by Clifford Smith, Emeritus Professor in Botany,
University of Hawai‘i at Manoa.

MAUNAKEA REPORT
The lichens and bryophytes in the proposed Thirty Meter Telescope sites at the summit of Maunakea, Hawai‘i.

Clifford W. Smith, Emeritus Professor in Botany, University of Hawai‘i at Manoa, 3190 Maile Way #410, Honolulu HI 96822. (Email: cliff@hawaii.edu).

INTRODUCTION

The summit area of Maunakea is barren land of massive cinder cones above andesite lava flows that erupted during the last period of glaciation; the lava flows erupting below the glacier cooled without crystallizing creating a particularly dense rock (Anon xxxx). The average daytime maximum air temperature is 50.1ºF and the low 24.8ºF; it freezes almost every night of the year (NOAA 2008). Such fluctuations are often referred to as ‘summer every day, winter every night.’ The average annual rainfall is 74 inches/year principally from November through April with little rain during June and July. Snow accumulates during the winter months sufficient for skiing but accumulation records have not been kept. UV radiation is intense; records from the Mauna Loa Observatory at 11,135 foot elevation are much higher than at sea level and will be higher still on the summit area of Maunakea (Bodhaine et al. 1997). Winds at the summit can reach 100 mph sufficient to abrade vegetation from rock surfaces (Anon xxxx).

In a general botanical survey of the summit area above 12,992 feet, Smith et al. (1982) recorded one species of algae, no hornworts or liverworts, possibly 12 species of moss, possibly 25 species of lichen, one fern and five flowering plants. All species occurred in very low abundance though there were very small, highly protected pockets where the lichens and mosses were common.

This survey was confined to a much smaller 40-acre area of the North Plateau.

STUDY SITE

The study site was the area being considered for the Thirty Meter Telescope just below the summit of Maunakea, Island of Hawai‘i. The area surveyed is called Area E, a 34-acre zone near the 13N Site located on the North Plateau of the Mauna Kea Science Reserve (MKSR).

METHODOLOGY

We spent two days in the area walking through the whole site recording all lichens and bryophytes observed. We search all four principal habitat types and spent some extra time investigating the small caves taking particular care not to disturb anything that looked of archaeological significance. We replaced all rocks that were picked up for examination as precisely as possible. We did disturb some of the rocks on the ground as we slide into the caves. We walked as much as possible on the large rocks and flows to prevent disturbance as well as for safety reasons.

The undersurface of 25 rocks of varying size were examined for lichens in rubble habitats. Counts were made of lichens present on the undersurface of rocks in the rubble areas to quantify abundance in these areas.

We removed small samples of all species found. Voucher specimens will be deposited in the B. P. Bishop Museum in Honolulu, Hawai‘i. Larger specimens were collected of species of whose

identity we were uncertain so they could be sent to other lichen experts for confirmation of their identity.

HABITAT DESCRIPTION

Substrate types

- Pahoehoe.- About 50% of the habitat was of this type. The general topography was essentially flat and smooth with many folds. The edges of the folds were steep and rounded. There were several areas where the flow had shattered, fallen away creating small cliff-like faces. In several areas particularly at the head of small draws that typically radiated away from the mountain top in a northerly direction, small caves were found which ranged from about one foot to almost six feet deep.
- Aa.- No aa was found in the study area.
- Ash.- Small areas of ash was found in about 10% of the area.
- Rubble of shattered stones - This environment constituted about 40% of the habitat. Because lichens can grow on the undersurface of rocks we counted the number of rocks on their undersurface. We selected three different situations; stones with somewhat embedded in ash, stones where ash subsurface stones rested on ash, stones where there was no evident between or below the stones. Twenty five stones were overturned and examined for lichens and then replaced in their original position, Stones of various sizes were examined. Lichens were found only in the group where ash was not evident. In all but one instance the only lichen found was *Lecanora polytropa* and none of the thalli were fertile.

Rock surface

There are two apparent rock types in the study area a dense bluish coloured rock that breaks with a smooth surface with very few cracks or bubble cavities and a brown rock with a rougher surface and numerous bubble cavities. Both are andesite rock formed under the ancient summit glacier. The rocks are acidic and low in calcium.

Topography

The overall topography is approximately 10º slope with a sharp decline to a lower plateau on the eastern side. The slope increases at the northern edge of the study.

- Site 1 has less andesite rock, at least there is less exposed smooth, blue rock, there are also several small ‘draws’ leading down the mountain. They do not appear to be drainage channels. They are important habitat because it is at the head of these draws that one finds good lichen habitat on the rock face and in the small caves underneath.
- Site 2 has large areas of andesite rock with many clean faces of the smooth, blue andesite rock. The draws are much wider here and do not support as good lichen communities.

Temperature

The average monthly temperatures at the summit range from -5 to 13ºC (NOAA 2008).

Average Maximum Temperature (1971-2000).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
(ºF)	42.0	42.5	40.3	41.4	47.5	49.3	50.9	49.9	50.5	48.3	45.1	42.7	46.0
(ºC)	5.6	5.8	4.6	5.2	8.6	9.6	10.5	9.9	10.3	9.1	7.3	5.9	7.8

Average Minimum Temperature

(ºF)	26.3	26.1	24.9	26.2	29.0	29.4	30.3	30.9	31.3	29.5	27.8	27.6	28.4
(ºC)	-3.2	-3.3	-3.9	-3.2	-1.7	-1.4	-0.9	-0.6	-0.4	-1.4	-2.3	-2.4	-2.0

There is a notable, as yet unmeasured, difference in the temperature of exposed (hot) and shaded (cold) areas of rock faces. The difference is quite abrupt particularly where the aspect of the rock face changes abruptly.

Rainfall (NOAA 2008)

Average Precipitation (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
(in.)	0.85	0.15	1.07	0.48	0.97	0.12	0.20	0.75	0.62	0.53	1.26	0.42	7.41
(mm)	216	38	272	122	246	30	51	190	157	135	320	107	1882

SPECIES LIST

Lichens

Acarospora c.f. depressa.
Small light brown areoles (<3 mm diam.). Not fertile.
On the underside of a 15 × 7 cm piece or rubble.
Probably much more common lower down.

Candelariella cf. vitellina
Orange crust rarely more than 1 cm diam. of compact rounded areoles or isolated apothecia. Not fertile.
On consolidated ash or *Grimmia* tussocks in well-sheltered situations exposed to light but not in positions where it is exposed to full sunlight for long periods.
A cosmopolitan species on siliceous and non-calcareous rock.
The size and clumped, almost erect, nature of the areoles and their separation from the apothecia might suggest that this is a different species. However, the K- staining reaction clearly excludes the possibility that it is a species of *Caloplaca*. The somewhat unusual growth form may be a

consequence of the unfavorable environment where the squamules rarely divide but continue to grow.

Lecanora polytropa
Thallus of small, often indistinct areoles to somewhat continuous yellow-green crusts with frequent apothecia. The apothecia sessile, the margin the same color as the thallus, the disc paler with a somewhat greasy appearance, often partly or completely grayish to black, frequently completely overlapping the areole.
On rock in cracks or on *Grimmia* tussocks in open situations and at the mouth of overhangs. It is also found on the undersurface of rocks in the rubble areas.
A cosmopolitan species on siliceous rock.
The most widely distributed species in the study area.

Lecanora sp.
One small (1 cm diam.) thallus of compact white squamules most covered with large apothecia with concolorous margins and 1 mm diam., light buff discs.
On a small rock chip among consolidated ash amongst Grimmia.

Lepraria ?incana
A thin crust of small gray to blue-gray granules with a delicate intervening web of white hyphae.
In deep shade of small caves. Generally on the floor but toward the cave mouth also on the roof. The species prefers shaded habitats and is not tolerant of direct rainfall. It requires the very humid conditions found in the protected caves and can absorbed moisture when the relative humidity is higher than 70 percent.
Cosmopolitan.
Confirmation awaiting chemistry.

Pseudephebe minuscula
Colonies up to 5 cm diam., black, richly branched, prostrate, closely appressed to the rock face, thread-like, wiry. Not fertile.
On exposed, N-facing, vertical or almost so, rock faces. It was only found on the smooth rock face of exposed andesite rock. Common on sheer north-facing rocks at the head of the small draws and occasionally more open areas.
Arctic-alpine, circumboreal.

Rhizocarpon geographicum
An immediately recognizable species of small yellow areoles surrounded by a black hypothallus, with occasional apothecia in the middle or to the edge of the areoles.
On exposed, N-facing, vertical or almost so, rock faces. It was only found on the smooth rock face of exposed andesite rock.
Cosmopolitan. Arctic-alpine, montane in the tropics.
Not common.

Rhizocarpon sp.
Small colonies (1-2 cm diam.) of brown, shiny areoles <0.5 mm diam., interspersed with a black hypothallus.
On exposed, N-facing, vertical or almost so, rock faces. It was only found on the smooth rock face of exposed andesite rock.
Reminiscent of *R. hochstetteri* but no apothecia were found.

Umbilicaria aprina
Small (1-2 cm diam.), gray to black thalli generally closely appressed to the rock face but with ascending edges where crowded, the upper surface with large white crystals particularly along ridges. Attached at one point only (umbilicate). Not fertile.
On exposed, N-facing, vertical or almost so, rock faces. It was only found on the smooth rock face of exposed andesite rock.
Abundant in a few areas. Also known in greater abundance and size particularly where protected from continuous insolation in the summit area down to at least 3660m.
Found on high tropical mountain in Africa and also in Scandinavia and Greenland.
The thalli are attached along cracks or in a few small gas pockets on the rock surface.

Umbilicaria hirsuta
Very similar to *U. aprina* but the upper surface is brown and there are no crystals on the upper surface.
Only one colony was found mixed in with *U. aprina*
A cosmopolitan species found in greater abundance at lower elevations.

Lichen Abundance Estimates:

Counts of lichens present on the undersurface of 25 rocks in the rubble areas.
Embedded rocks. No lichens in two separate situations.
Rocks over ash. *Lecanora polytropa* under two rocks in one sample, 0 in the other.
Rocks not over apparent ash. *Lecanora polytropa* under ten or 12 rocks in the two samples as well as being on rocks under the rocks examined. *Acarospora sp*. under one rock.

Bryophytes

Grimmia ?pulvinatum
Small tussocks of grayish moss with black leaves and a fine white terminal hair.
On consolidated ash in well-sheltered situations exposed to light but not in positions where it is exposed to full sunlight for long periods.

Pohlia cruda
Small tussocks of green moss often with an orange tinge.
On consolidated ash in well-sheltered situations exposed to light but not in positions where it is exposed to full sunlight for long periods.

GENERAL COMMENTS

- The lichens and bryophytes are confined to protected habitats almost always on the north-facing sides of rocks or the head of small collapsed lava tubes.
- There is an extremely low cover (<1 percent) and diversity of lichens (10 species out of a currently known 612 species in the islands) and bryophytes (2 species out of a currently known 273 species in the islands) in the area. In sheltered, amenable habitats, lichens are locally common.
- The distribution of the different lichens is thought to reflect their ability to tolerate UV irradiation, overall light intensity and the availability of water, both liquid and gaseous.
- There is a marked difference in the distribution of the various lichens. The dark to black species (*Rhizocarpon ?hochstetteri, Pseudephebe miniscula, Umbilicaria aprina and U. hirsuta*) are found on the open face of northern facing rocks, (*Candelariella vitellina, Lecanora polytropa* and *Lecanora sp.*) at the base of northern facing rocks and (*Lepraria ?incana*) on the roof of the small lava tubes or deeper inside the tube). The presence of the dark species in the most exposed inhabited areas is in keeping with McEvoy, M., Gauslaa, Y. & Solhaug, K.A. (2007) finding that melanic pigments play a photoprotective role in light acclimation. The other species do not have such protection though the apothecia and areoles of *L. polytropa* are often light to dark grey in more exposed situations. *Lepraria* species frequently grow in protected shaded and humid habitats.
- Concise determinations of some species is not possible under the time constraints of this study even though fruiting bodies may be present. Species growing in such severe habitats, particularly those growing on rocks, produce spores only during favorable conditions. The only sure way of finding good specimens would be to conduct monthly collections for at least one year.
- None of the plants show evidence of feeding and there do not appear to be any obligate herbivores present. Therefore, the plants present do not appear to be necessary to support any herbivore trophic level.
- None of the lichen species present contain cyanobacteria so if nitrogen fixation is taking place up there none of it comes from lichens. Lichens on lava flows down below contribute to the nitrogen budget particularly the very common *Stereocaulon vulcani*.

RECOMMENDATIONS

- Site E2, the upper, more southerly footprint site being considered for Project construction is the preferred site from a cryptogamic point of view. The number of species is lower and the abundance of those present is lower. There is less sheltered habitat present.
- There is a greater abundance of lichens at the same elevation adjacent to the proposed sites where there are mounds of rocks rather than the solid flows present in the proposed sites.

CONCLUSIONS

- There is a very low diversity and cover of plants in the study area.
- All of the species are found at somewhat lower elevations at least on the southern side of the mountain. None of the species are unique to Hawai‘i.
- Lichens and bryophytes are generally confined to the northerly aspect of rocks or under overhangs and even then the abundance of species is much higher in those facing north.
- The vascular plants appear to be confined to the western side of the larger pahoehoe flows.
- It was gratifying to note that much of the rubbish that was seen in the 1982 Survey of the summit area had been removed.

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Respectfully submitted,

Clifford W. Smith

Mauna Loa Observatory (11,135 ft)

Average Max. Temperature (ºF)	49.8	49.6	50.2	51.8	53.9	57.2	56.4	56.3	55.8	54.7	52.6	50.6	53.2
Average Min. Temperature (ºF)	33.3	32.9	33.2	34.6	36.6	39.4	38.8	38.9	38.5	37.8	36.2	34.3	36.2
Average Total Precipitation (in.)	2.39	1.53	1.73	1.28	1.01	0.49	1.16	1.49	1.34	1.14	1.74	1.98	17.30
Average Total SnowFall (in.)	0.0	1.0	0.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.7
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

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Abstract

A UV spectroradiometer was installed at Mauna Loa Observatory (MLO), Hawai‘i, in July 1995. This instrument, based on a commercially available double monochromator, uses a diffuser mounted as a horizontal receptor inside a quartz dome and views the whole sky. The instrument scans over the 290–450 nm spectral range with a band pass of about 1 nm for each 5° of solar zenith angle (SZA). The UV irradiances measured at MLO are much more intense than at low-altitude midlatitude locations. For observations at SZA 45° the erythemally weighted UV irradiances can exceed 21 μW cm^{-2}, which is approximately 15–20% greater than that seen at Lauder, New Zealand, for similar ozone amounts. The difference is primarily due to the higher altitude at MLO (3.4 km). For overhead Sun conditions at MLO the largest value of erythemal UV was 51.3 ± 3.1 μW cm^{-2}, which to our knowledge is the highest recorded any-where at the Earth's surface. UV irradiance is strongly correlated (inversely) with Dobson spectrophotometer total ozone measurements at MLO, with higher correlations at shorter wavelengths. The radiative amplification factor (RAF) for erythema at MLO is about 1.33 ± 0.2 at SZA 45°.

McEvoy, M., Gauslaa, Y. & Solhaug, K.A. (2007). Changes in pools of depsidones and melanins, and their function, during growth and acclimation under contrasting natural light in the lichen Lobaria pulmonaria. New Phytologist **175(2)**: 271-282.

Abstract

["In conclusion, the highly responsive melanic pigments play a photoprotective role in light acclimation, whereas the constant amount of depsidones across a wide spectrum of growth ranges and irradiances is consistent with herbivore defense functions."]

Appendix L. Geological Technical Report

GEOLOGIC TECHNICAL REPORT

Thirty Meter Telescope Project

Island of Hawai‘i

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April 2009

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1.0 Maunakea Summit Region

Geohazards Consultants International, Inc. was requested to prepare a geologic study to evaluate the geologic substrate underlying the proposed sites for the Thirty Meter Telescope (TMT) Project. The principal focus of this report is to describe the geologically unique structures present within the areas being considered for the site of the TMT Observatory on Maunakea, and to evaluate their uniqueness relative to other similar areas on this great volcano.

We were also asked to evaluate the stability of the ground and any soils present as to suitability for construction activities, as well as to discuss geologic hazards that could impact facilities. This report is based on four days of field investigation at the sites, literature research, and inspection of available stereographic aerial photography and satellite imagery. A geologic field evaluation of comparable geologically unique features on Maunakea's south summit area was also undertaken. Geologic perspectives relative to proposed TMT Mid-Level Facility in the Hale Pōhaku area are also given as an Addendum at the end of this report.

1.1 Regional Setting

Maunakea is one of five volcanoes comprising the Island of Hawai'i. This dormant shield volcano is the highest of the five, and the highest mountain in the interior Pacific basin. Because of its elevation, Maunakea's summit has been repeatedly glaciated during the past few hundred thousand years, and preserves the best glacial record of any oceanic volcano on Earth. Maunakea has erupted 12 times within the last 10,000 years, and though it has been at least 4,600 years since its last eruption, it is anticipated that the volcano will erupt again at some time in the future; such an eruption would likely occur on the flanks of the volcano, below the summit and astronomical facilities. The geologic history of Maunakea was thoroughly discussed by Wolfe and others (1997) and in more general terms focusing on unique geologic features by Lockwood (2000).

1.1.1 Glacial History

Maunakea's glacial history was recognized early by Wentworth and Powers (1941) and has been well documented by Porter (1979a, 1979b, 1979c, 1987), and by Porter and others (1977). Although periods of abnormal cold and extensive glacial activity have characterized much of the past two million years on Earth, known as the Pleistocene Epoch, Maunakea only grew high enough to have been glaciated beginning a half million years ago. If present, however, glacial deposits of such older times are buried by younger volcanic rocks, and the earliest glacial deposits exposed are no older than 200,000 years (Wolfe and others, 1997), based on revised radiocarbon dating. The lava flow underlying Area E was erupted during the youngest period of glaciation, known as Mākanaka time. The Mākanaka ice cap completely covered the summit area down to about 12,000 feet between approximately 40,000 and 13,000 years ago, according to the latest radiocarbon-dating of glacial deposits (Wolfe and others, *ibid.*). The ice cap had an estimated area of around 27 square miles (Porter, 1979c), and was relatively thin at no more than 300 feet thick. The cinder cones of Maunakea's summit likely projected above the glacier, although they were doubtless snow-covered most of the year. Porter believed that an ice-free

interglacial period separated Mākanaka time into an upper and lower period, but Wolfe and others dispute that conclusion and feel that glacial ice was always present during this period. Regardless, surface features of the flow surface in Area E show convincingly that these lavas were emplaced beneath glacial ice or snow.

1.1.2 Geologic Hazards

The potential for renewed volcanic activity in this region is extremely remote. Maunakea last erupted about 4,600 years ago, and the volcano is considered to be dormant (Lockwood, 2000; Mullineux and others, 1987). Although Wolfe and others (1997) mapped a dozen separate post-glacial (post- 10,000 year old) eruptive vents on Maunakea's middle flanks, none younger than 40,000 years occur in the summit area, and future eruptions will likely occur well below the summit and will not pose any direct threat to astronomical facilities.

The most significant geologic hazards that would potentially impact the TMT Observatory are related to seismic activity. Hawai'i Island is one of the most seismically active areas on Earth, and about two dozen earthquakes with Magnitude 6 or greater have been documented on Hawai'i since the devastating earthquakes of 1868; those that caused damage are listed in Table 1. Four major earthquakes have occurred on Hawai'i since the first astronomical facilities were constructed on Maunakea (1975 – M=7.2; 1983 – M=6.7; 1989 – M=6.1; 2006 – M=6.7). The first three of these only caused minor impact to then existing astronomical facilities, but the epicenter of the M=6.7 earthquake in 2006 was closer to the Maunakea summit than the others (Robertson and others, 2006), involved Peak Ground Acceleration forces of up to 0.26 g, and caused minor to significant damages to the Keck, Subaru, UH 88 and CFHT observatories. The Keck observatories were not fully operational for more than three months after this earthquake. Earthquake impacts on these observatories and engineering recommendations to mitigate future damage were discussed in detail at the "*Mauna Kea Observatories Earthquake Workshop*" held in Kailua-Kona on March 23, 2007 – results reported at http://www.gemini.edu/node/227.

Future earthquakes will impact the Maunakea summit area repeatedly in the future, and any future construction must include design for significant seismic forces. The summit of Maunakea is susceptible to seismic intensities of up to VII on the Modified Mercalli Intensity Scale (Wyss and Koyanagi, 1992; Figure 1).

Table 1: Summary of Damage Causing Earthquakes

Date	Epicenter Location	Maximum Intensity Mag	Magnitude	No. of Deaths	Damage	Repair Cost
03 28 1868	Southern Hawai`i	IX	7.0	0	Extensive-Southern Hawai`i	Unknown
04 02 1868	Southern Hawai`i	XII	7.9	81	>100 houses destroyed in tsunami	Unknown
10 05 1929	Hualālai	VIII	6.5	0	Extensive-Kona	Unknown
08 21 1951	Kona	VIII	6.9	0	Extensive-Kona	Unknown
04 26 1973	North of Hilo	VIII	6.2	0	Extensive-Hilo	$5.6M
11 29 1975	Kalapana	VIII	7.2	2	Extensive-Hilo	$4.1M
11 16 1983	Ka`oiki	IX	6.7	0	Extensive-Southern Hawai`i	>$6M
06 25 1989	Kalapana	VII	6.2	0	Southeast Hawai`i	almost $1M
10 15 2006	Kiholo Bay	VIII	6.7&6.0	0	NW Hawai`i	>$100M

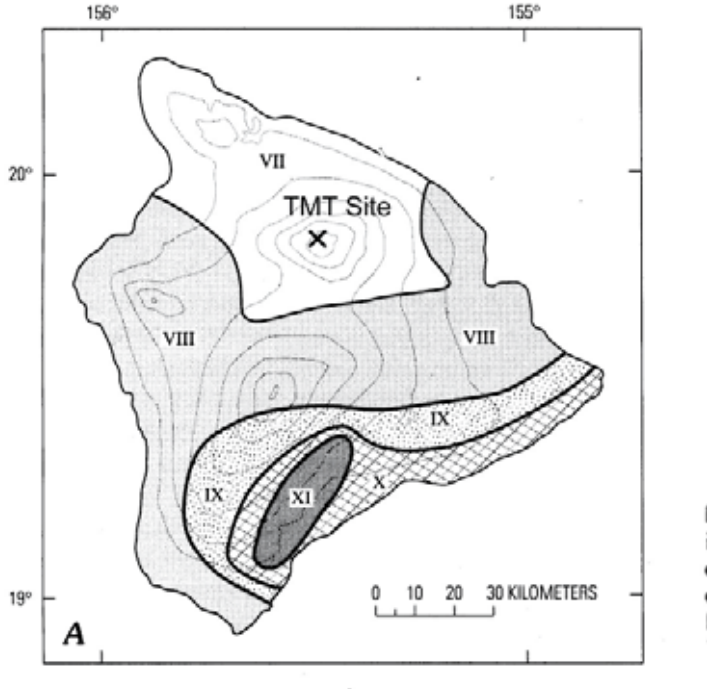

Figure 1: Map showing expected highest Mercalli Intensities for earthquakes expected on the Island of Hawai'i (modified from Wyss and Koyanagi, 1992).

1.2 Geologic Description of Area E

Area E (Figure 2) was designated in the 2000 Master Plan as a location for future facilities development. This area bounds the general limits of sites being considered for the location of the TMT Observatory. It is entirely underlain by a single lava flow, erupted between 30,000 and 40,000 years ago[1] from a vent located on the saddle between Pu‘u Poli‘ahu and Pu‘u Hau‘oki on which the Subaru Telescope is situated (Figure 2). The flow consists of uniformly dense, fine-grained lavas characterized by abundant microcrystalline plagioclase feldspar platelets. These give the rocks a silvery sheen on fresh-broken surfaces. The flow was emplaced as viscous pāhoehoe, although some ‘a‘a fragmental material may have originally overlain the surface. The eruption that produced this overall flow generated multiple flow lobes that overrode one another as the eruption progressed. An older lobe trends to the northwest, and is overlain by a younger lobe that traveled more northerly (Figure 2). It is probable that growth of each of these major lobes was caused by both vertical inflation of ice-quenched surfaces from subsurface injection of molten material, as well as by surface breakouts that fed short flows above solidified crust. Multiple complex flow lobes may be found at depth during excavation.

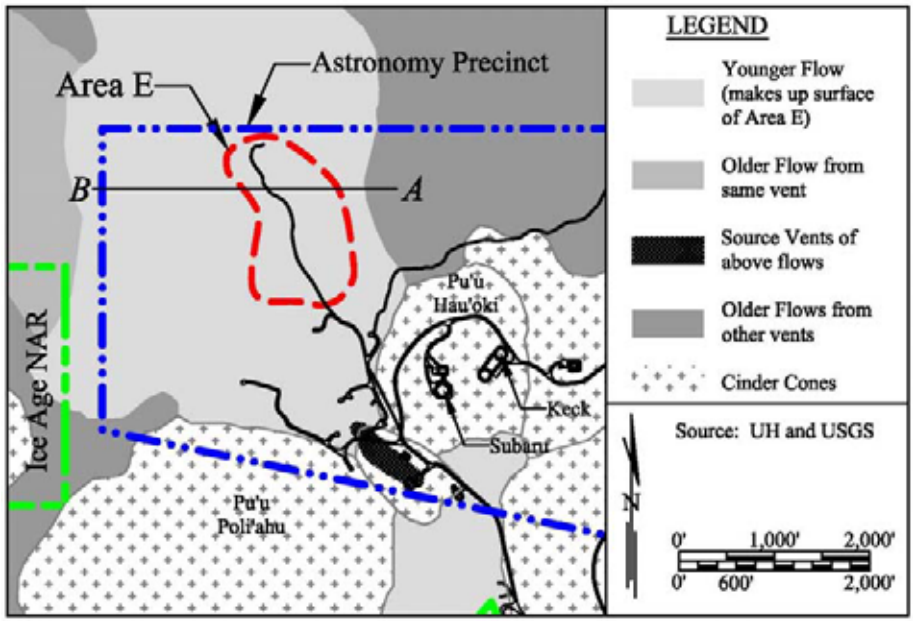

Figure 2: Geologic sketch map of the Area E region. The two flows are of identical composition and have similar surface characteristics. They were both derived from a linear vent system between Pu‘u Poli‘ahu and Hau‘oki.

Although the lavas at the surface in Area E are of a uniformly medium-gray color internally, flow surfaces are everywhere weathered, from yellow-brown to orange ochre colors (Figure 3).

[1] Two K-Ar radiometric ages have been determined for this flow: 33+/- 12 Ka; 41+/-8 Ka (Wolfe and others (1997).



Figure 3: Typical surface of the flow present at surface in Area E. High-standing ground has been eroded by glacial action; low-standing areas are covered by fragmental debris up to a foot thick. Flow surfaces are much more irregular in the northern parts of Area E.

Surficial surface features indicate that most of this flow was emplaced beneath glacial ice or snow. In contrast, the source vent for this flow (Figure 2 and Figure 4) shows no evidence of interaction with water, and fire fountains must have melted through overlying ice during the eruption so that lava fountaining took place and made contact with the air, producing numerous air-cooled volcanic bombs (Figure 5). The flows from this vent traveled down slope to the northwest, beneath a pre-existing thin glacier; the flows preserve many features that document sub-glacial origin. Lava flowage beneath the ice was concentrated in irregular lava channels typically 3-8 feet deep and beneath elongate constructional ridges that are oriented in fan shapes roughly radial to the principal axis of the flow.



Figure 4: Spatter cone at the southern end of the flow present at the surface in Area E. This 20' high structure was formed by fire fountains that projected above surrounding ice and snow.



Figure 5: Aerodynamically-shaped fusiform bomb from the source vent. Such bombs show that the vent erupted into the air.

A single chemical analysis of this lava flow (Table 2) shows the flow to be of typical hawaiite composition, which is a type of alkali-rich basalt. The petrologic evolution of Maunakea, with perspectives on the prospect of future volcanism is given by Frey and others (1990) as well as by Wolfe and others (*ibid.*).

Table 2: Chemical analysis of the lava flow underlying Area E (Sample HR-76 - Wolfe and others, 1997). Values in weight percent.

SiO_2	Al_2O_3	FeO_x	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Total
50.60	17.00	11.50	4.01	6.97	4.68	1.94	2.70	0.95	.22	100.57

1.2.1 Glacial Features

The features described below are unique to glaciated terrains, and are found at no other oceanic volcano in the Pacific. However, the features in Area E are not unique on Maunakea, and better examples are widely distributed in other areas in the summit above the elevation of about 12,000 feet (Lockwood, 2000, Figure 2). The degree of glacial polishing is related to the thickness of the overlying ice that was present; because the glacial ice cap that overlaid Area E was less thick than the glacier overlying lower elevations southeast of the summit, glacial polishing and striations are less developed on the lava flow surface exposed in Area E.

Features associated with sub glacial eruptive activity

Because the flow no present at the surface in Area E was entirely emplaced beneath ice or snow, the actual interface between "fire and ice" was always marked by a zone of melt water, and this water served to very rapidly quench the surface of the flow. Where open channels of molten lava existed at the surface, the margins of those flows repeatedly quenched, narrowing the width of the channels and forming unique structures we term quenching ripples (Figure 6). Such features are common over the top of the flow in most places, within and beyond Area E.



Figure 6: Quenching ripples, formed along the margin of a lava channel in the southern part of Area E. These structures indicate the rapidity of cooling of lava channels overlain by ice.

Most molten lava was supplied by flowage beneath a solidified carapace of frozen lava, but where this carapace was breached, especially at flow margins south and east of Area E, bulbous lava protrusions formed rounded structures, termed mega-pillows after the smaller structures commonly formed by submarine lava flows. These unique structures (Figure 7) consist of especially fine-grained, flinty lava with interstitial glass on marginal surfaces. These flinty rocks are similar in texture to the materials quarried by Hawaiian toolmakers at sites near Puʻu Kokoʻolau on Maunakea's south flank (Cleghorn, 1982; Mills and others, 2008), but were likely obscured by snow during the cooler weather of the past, and would not have been exposed for possible use during the period of active quarrying at lower elevations.



Figure 7: Mega-pillow formed as bulbous protrusions of molten lava grew upward into glacial melt water during flow emplacement. The rapidly quenched lava contains volcanic glass indicative of its rapid cooling.

Features associated with post-eruptive glacial erosion

Following emplacement and cooling of the flow no present on the surface in Area E, ice continued to cover the Maunakea summit, and down slope movement of these glaciers modified lava flow surfaces though the erosive power of entrained rock debris and flowing melt water. Any fragmental material originally at the surface was eroded away by torrents of sub-glacial melt water (Figure 8), leaving typically irregular surfaces that reveal the structures of underlying dense lava. Where moving ice directly overlaid lava, hard surfaces were scoured by entrained rock debris, polishing high-standing areas and leaving glacial striations (Figure 9). Glacial polish is not generally well-developed, and is best seen in low-angle incident sunlight. Some of the lava channels may have been roofed during the eruption to form small pyroducts, or lava tubes, but if once present, these thin roofs have generally been removed by glacial erosion.



Figure 8: Glacially-eroded surface of the flow near the Alternative E2 site. High-standing areas are glacially polished; low-standing areas probably represent weak areas that were eroded by torrents of glacial meltwater.



Figure 9: Glacially-polished rock outcrop near the Project 13N site. The striations are aligned with the direction of ice transport.

As the last glaciers melted in the area 10,000-13,000 years ago, boulders once entrained in the ice were left standing on high places. These boulders, called glacial erratics, give testament to the carrying power of the ice that once flowed above Area E (Figure 10). Such glacial erratics and other debris form extensive deposits of glacial till about a mile down slope, but the glaciers were never extensive enough to form spectacular glacial moraines, of the sorts so well preserved on Maunakea's south flank.



Figure 10: Glacial erratic near the Project 13N site. This boulder, about 2 feet high, was carried by glaciers to its resting spot, and left behind as the glacier melted away about 10,000-13,000 years ago.

1.2.2 Geologic Cross-Section

A geologic cross-section across Area E along the southern edge of the Project 13N site (Figure 11) was constructed to provide an estimate of the thickness of the flow that was emplaced during the eruption event in this area which created the lava no exposed on the surface in Area E, and to show surface terrain variations. From this cross-section it is estimated that the aggregate thickness of all flow layers combined is at least 75 feet; based on the exposed thickness at flow margins. Because lava flows tend to travel along pre-existing depressions, it is likely that most of the flow is thicker than this, especially in the center, and more likely is over 100 feet thick. The pre-existing ground surface in this area evidently sloped locally to the northwest, so that the flow surface slopes in this direction, as well as to the north. Judging from older rocks exposed down slope from Area E, it is possible that this flow overlies a rubbly surface consisting of loose lava fragments and windblown cinders from summit cones, although such material may have been eroded away by glacial activity before the flow was emplaced.

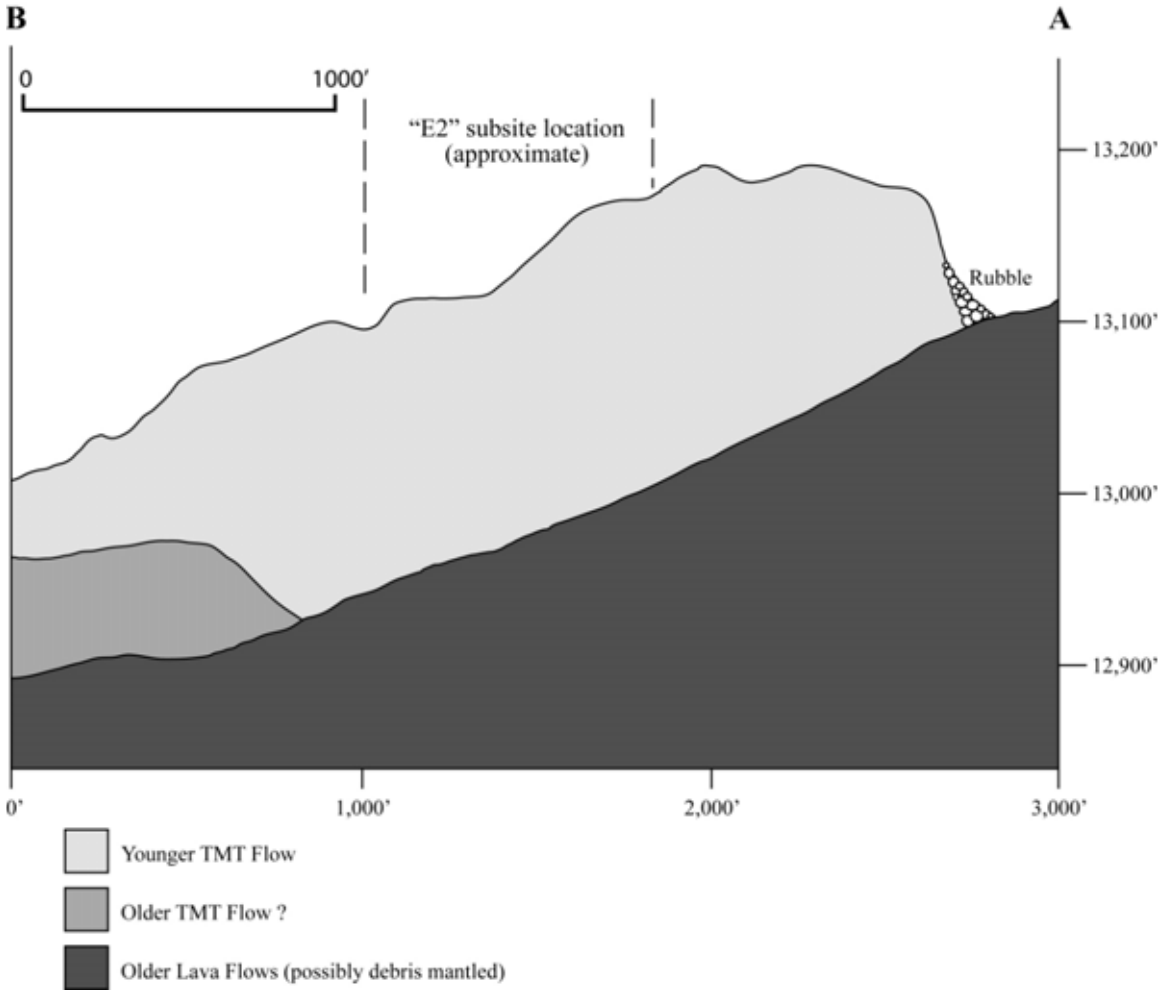

Figure 11: Geological cross-section along line A-B in the area of the Alternative E2 site (location shown on Figure 2). Topographic profile from unpublished University of Hawai'i five foot contour map. The land slopes both to the north and west, and is similar to terrain near the Project 13N site. Vertical exaggeration 5:1.

1.2.3 Soils, Slope Stability, and Construction Perspectives

No soils in a conventional sense are present in Area E as the only fragmental material present has not had sufficient time for soil weathering in this arid, alpine environment. Fragmental material is present in most low-lying areas, however, and could be classified as a non-weathered soil. This material consists of unconsolidated debris derived from glacial erosion and mechanical weathering of the adjacent lavas, and is nowhere more than a foot or two in thickness. This material is subject to down slope movement and internal sorting by the periglacial, or non-glacial alpine, processes known as solifluction (Matsuoka, 2001). Because these materials have no internal strength, they must be removed before being overlain by heavy structures.

The flow present at the surface in Area E is composed of dense, fine-grained lava of exceptional strength, and slope stability will not be a problem for well-anchored structures. There are typically few vesicles (gas bubbles) in these lavas, except in the uppermost sections of flows. During flow emplacement, most lava was supplied by subterranean conduits (pyroducts, or lava

tubes- Figure 12), but these structures appear to have mostly been filled during late eruption stages. Some pyroduct voids might be encountered at depth within the lavas during excavation, but these structures will likely be small and not laterally extensive. Separate individual flow units will likely be encountered at depth, with vesicular sections at their tops, but the probable absence of any loose debris at flow contacts will not cause any excavation problems. The estimated combined thickness of over 100 feet, of these flows should allow basement foundations to rest on solid lava and not on the more fragmental materials that might lie at greater depths.



Figure 12: Subglacial pyroduct (lava tube) opening in central part of Area E. Such structures transported lava beneath glacier cover during emplacement of the flow, but were mostly filled by late-stage lavas.

1.2.4 Descriptions of TMT Observatory Sites

Project 13N Site

The 13N site near the northern boundary of Area E is characterized by irregular terrain, with local relief of 15-20 feet. No geologically unique features were observed within this area, and much of the original surface has been degraded by road-building and site testing activity. The overall slope of the site is about 5-6 degrees to the north.

Alternative E2 Site

The E2 site is characterized by irregular terrain and relatively deep lava channels that trend northerly across the site. The overall ground slopes steeply to the north at 12-15 degrees, which might cause design problems for structures. A strange east-west-oriented lineament crosses Area E directly south of the E2 site (Figure 13). This linear feature, prominent on aerial photographs (Figure 13), is of uncertain origin and is difficult to identify on the ground. It was initially

suspected that this feature might represent a fault or ground fracture, but no indications of any tectonic affinities were observed.

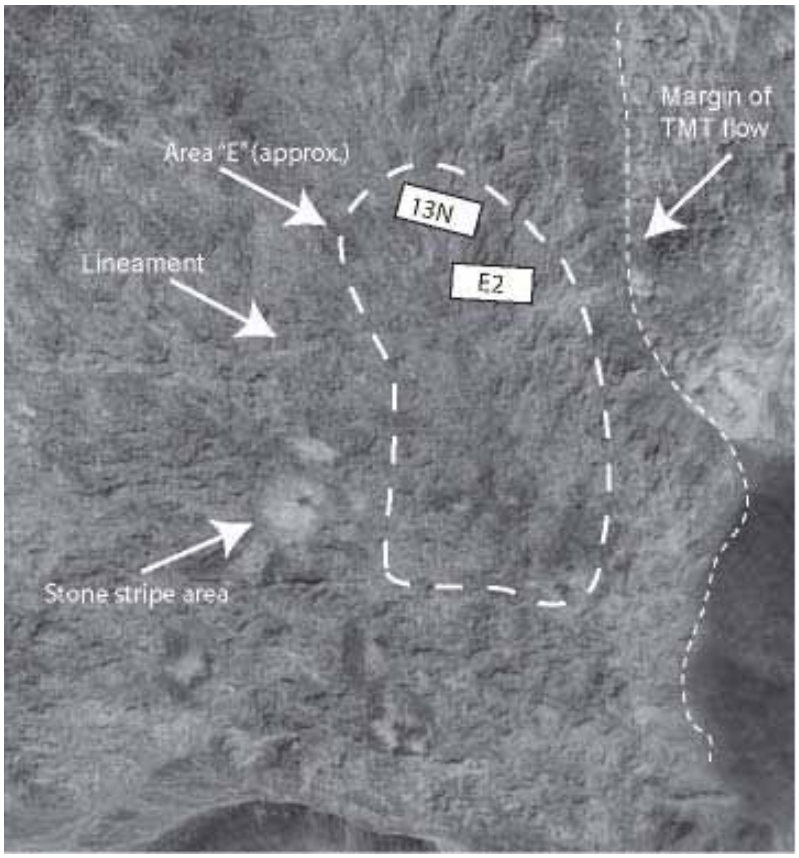

Figure 13: Aerial photo of the flow, showing the flow's irregular surface morphology and an anomalous east-west-trending lineament immediately south of the Alternative E2 site. An area of stone stripes lies west of Area E. USN photo HAI 11 017 (10 October, 1954), obtained before any road development in the Maunakea summit area.

1.2.5 Summary Perspectives on Potential TMT Observatory Construction Sites

The two sites within Area E that are being considered as potential sites for the TMT Observatory are both located on a stable lava flow that would provide a solid substrate for the envisioned construction activities. This lava flow was emplaced during a period of extensive glaciation on Maunakea, and unique geologic features record the interaction with glacial ice, both during and following eruption. Although such features are unique to Maunakea volcano in the Pacific region, they are common and better preserved elsewhere on the mountain. The Alternative E2 site lies in an area of steep regional terrain slope, and perhaps would involve the most difficult construction design factors of the two sites. The Project 13N site has been previously degraded by prior construction activity, and may be the most appropriate for consideration.

1.3 Geologic Description of Area Surrounding Area E

The area in the 500 meter-wide zone surrounding Area E includes numerous geologically unique structures, including portions of the Pu‘u Poli‘ahu and Pu‘u Hau‘oki cinder cones to the south and southeast. The northern and western areas of this border zone are mostly underlain by the same lava flow that is present on the surface in Area E, and are characterized by the same sorts of glacial features described in Area E. None of these features are unique to this area or Maunakea, although a small area of stone stripes located about 300 feet west of Area E (Figure 14) deserves mention. These features, formed by periglacial process and studied elsewhere on Maunakea by Werner and Hallet (1993) are uncommon, although more extensive examples are also found to the south, on the slopes of Pu‘u Poli‘ahu and Pu‘u Waiau. However, because of their rarity care should be taken not to impact this small area, shown on Figure 2.



Figure 14: Well-developed stone stripes about 300 feet west of Area E (location shown on Figure 13). These structures are formed by self-sorting during periglacial solifluction transport.

1.4 Potential Environmental Impact

Any construction activity associated with the construction of the Access Way or clearing of the footprint for the TMT Observatory would unavoidably remove any surface geologic structures present, such as lava flow morphology and glacial features. However, such geologic features are not unique on Maunakea and are better developed at many other areas – especially on the south summit area adjacent to the Maunakea Access Road.

1.5 Mitigation Measures

The areas of glacial polish and striations are highly vulnerable to damage by tracked vehicles, and movement of such construction equipment should be limited to the bounds of the Access Way and the TMT Observatory construction site. Exceptionally noteworthy examples of glacial features near the proposed Access Way would be identified prior to the start of construction, and buffer zones established around them so they would be preserved where alternate routing of the road is feasible. Such features are presently unappreciated, and might be identified along the Access Way to enhance public interpretation efforts.

2.0 Hale Pōhaku TMT Mid-Level Facility Area

2.1 Introduction

Geohazards Consultants International, Inc. was requested to conduct a geologic inspection of proposed sites for the TMT Mid-Level Facility at Hale Pōhaku on the south flank of Maunakea, focusing on the identification and evaluation of any geologically unique features or construction hazards within this area. This brief report summarizes field observations made on 16 February, 2009 at the two separate areas under consideration.

2.2 Site Descriptions

The Hale Pōhaku area is underlain by loose volcanic colluvium (admixed sand, gravel, and cobbles deposited by surface water and wind), extensively impacted by frost action and overlain by soil alteration zones where not disturbed. Because this material is unconsolidated, it is subject to erosion and gullying by flowing surface water during heavy rainfall. The regional geologic structure of the area is shown on a geologic map by Wolfe and others (1997). Note: *All notations of surface slope are given in geometric, not engineering degrees.*

2.2.1 Area within Hale Pōhaku

This 3.2 acre area has been extensively modified by construction around buildings, and is impacted by minor gullying, especially in upper portions where water runoff is concentrated from parking areas and roof drainage. The undisturbed surfaces are covered with loose volcanic cobbles overlying fine grained sand of volcanic origin. Clumps of vegetation have trapped high mounds of aeolian (wind-blown) sand. Slopes are as steep as 8 degrees southward in upper parts, but less than 2 degrees on the south margin of this area. This latter area is presently used as a parking lot for ATV activities.

2.2.2 HELCO Transformer Site

The transformer station is located within a fenced enclosure located in a natural saddle between Pu‘u Kalepeamoa to the south and a cinder cone and crater associated with Pu‘u Kilohana to the north. The enclosure is mostly sited on a thick layer of imported gravel fill, and has had no impact on surrounding geologic structures. The surface underlying this fill consists of unconsolidated colluvial sand and gravel that has been unaffected by surface water runoff as have lower areas in other sites. The adjoining cinder cone slopes are covered with angular pyroclastic debris - principally broken volcanic bombs.

2.3 Summary

The areas being considered for the TMT Mid-Level Facility are entirely underlain by unexceptional volcanic colluvial materials that characterize much of the lower slopes of Maunakea volcano. There are no geologically unique features in these areas. The HELCO transformer site can presumably be expanded to accommodate the increased power needs of the Project without impact on surrounding areas.

The unconsolidated nature of the underlying colluvium at the TMT Mid-Level Facility would require attention during construction to avoid undue erosion. Disturbance of the soil surfaces would expose loose material that is highly vulnerable to erosion by heavy rainfall episodes that can occur very infrequently in this region during thunderstorms. Parking areas should be covered by thick but permeable gravel materials rather than paved in order to reduce water runoff. Permanent facilities should be built above grade on raised foundations to protect against potential flooding.

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Appendix M. Visual Impact Assessment Technical Report

Preface

The Visual Impact Assessment Technical Report has been updated since the Draft EIS was completed. Changes made to this technical report since the Draft EIS was completed are not illustrated as they are within this preface and the body of the Final EIS. Modifications made include adding viewpoint 18 on the north ridge of Kūkahau‘ula and the addition of a visual simulation from within the summit region. Visual and aesthetic resources are discussed in Section 3.5 of the Final EIS.

VISUAL IMPACT ASSESSMENT TECHNICAL REPORT

Thirty Meter Telescope Project

Maunakea Northern Plateau and Hale Pōhaku,
Island of Hawai‘i
TMK 4-4-15: 9 and 12

Proposing Agency:
University of Hawai‘i at Hilo

This document was prepared to support the Environmental Impact Statement for the project, which was prepared pursuant to Hawai‘i Revised Statutes, Chapter 343, Environmental Impact Statement Law and Chapter 200 of Title 11, Hawai‘i Administrative Rules, Department of Health, Environmental Impact Statement Rules

December 2009

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Acronyms and Abbreviations

3D	Three dimensional

AO	Adaptive Optics
BLNR	Board of Land and Natural Resources
CFHT	Canada France Hawai'i Telescope
CMP	Comprehensive Management Plan
CSO	California Institute of Technology Submillimeter Observatory
DEM	Digital Elevation Model
DHHL	Department of Hawaiian Home Lands
EA	Environmental Assessment
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
FEIS	Final Environmental Impact Statement
GIS	Geographic Information Systems
HAR	Hawai‘i Administrative Rules
HRS	Hawai‘i Revised Statutes
IRTF	NASA Infrared Telescope Facility
LUC	Land Use Commission
NED	National Elevation Dataset
NGLT	Next Generation Large Telescope
NPDES	National Pollutant Discharge Elimination System Permit
OMKM	Office of Mauna Kea Management
SMA	Submillimeter Array
TMT	Thirty Meter Telescope
UH	University of Hawai‘i
UHIFA	University of Hawai‘i Institute for Astronomy
UKIRT	United Kingdom Infrared Telescope
USGD	United States Geologic Services

1.0 Introduction and Background

1.1 Introduction

The TMT Observatory project (Project) would consist of the construction and operation of an optical/infrared telescope observatory below the summit of Maunakea[1] and the associated permanent and temporary ancillary facilities. The permanent ancillary facilities would include an Access Way from the Mauna Kea Access Road to the TMT Observatory 13N site, potential housing and support facilities at TMT Mid-Level Facility within and near by the mid-elevation Hale Pōhaku facility, and a Headquarters in the University Park of University of Hawaii (UH) Hilo to support operation of the observatory. Temporary construction facilities would also include potential worker housing at Hale Pōhaku and construction yards near the summit, at Hale Pōhaku, and near the port where the telescope components would be received.

The purpose of this document is to describe the existing visual conditions, discuss and quantify the visual impacts the Project would have, and identify how the Project mitigates its potential visual impact. The information contained in this discipline report will be used to support the Project's Environmental Impact Statement (EIS).

1.2 Policy Documents and Previous Studies

The following is a summary of the discussion of existing visual conditions of Maunakea and the Island of Hawai'i, and the visual impacts and guidance for new projects contained in existing policy documents and recent environmental studies prepared for the Mauna Kea Astronomy Precinct.

1.2.1 Mauna Kea Comprehensive Management Plan, 2009

The Mauna Kea Comprehensive Management Plan (CMP) provides a management framework for the UH to address existing and future activities in the UH Management Areas. The CMP generally discusses the existing views of Maunakea around the Island of Hawai'i and notes "when skies are clear, the summit region and observatories can be seen from Hilo, Honoka'a, Waimea, the summit of Kīlauea, sections of the Mauna Kea Summit Access Road and much of Puna" (UH 2009). The CMP also generally discusses the views available from the summit of Maunakea and the physical characteristics that make it a good location for astronomy viewing.

[1] Maunakea is spelled as one word in this document because it is considered the traditional Hawaiian spelling (Ka Wai Ola, Vos. 25 No. 11). The common "Mauna Kea" spelling is considered an English spelling and is only used in this document where Mauna Kea is used in a proper name, such as the "Mauna Kea Science Reserve."

The CMP also recommends actions to address environmental impacts related to the visual environment. One of the recommended actions is to require new observatories to prepare a site restoration plan upon their decommissioning. In addition, the CMP includes an action that allows the leaving of traditional offerings to continue unrestricted, while implementing culturally appropriate guidelines for removing offerings to protect the visual landscape. The CMP also prohibits off-road vehicle use to protect visual resources by reducing the associated scarring of the landscape. The CMP also recommends developing and implementing consistent interpretive signage for the observatories.

1.2.2 Mauna Kea Science Reserve Master Plan, 2000

The 2000 Mauna Kea Science Reserve Master Plan is an update of the 1983 plan and addresses issues and concerns that have arisen in 30 years of development on Maunakea. The 2000 Master Plan provides guidance relative to the physical development of the summit area, such as the location of facilities, character, size, mass, color, and other physical attributes (UH 2000).

The 2000 Master Plan states that new facilities will be located within the Astronomy Precinct because it would "limit visual impact and scattering of facilities by clustering within the existing development area, recognizing that facilities have already been built in this area" (UH 2000). Within the Astronomy Precinct new areas to locate observatories, because they would have minimal visual impacts, were identified as areas D, E and F. The 2000 Master Plan limits future telescope redevelopment on the summit ridge to a maximum height and diameter of approximately 130 feet.

The 2000 Master Plan includes a discussion of a "Next Generation Large Telescope (NGLT)", which it describes as a telescope with a mirror of 82 to 164 feet (25 to 50 meters) in diameter that may be proposed for the summit of Maunakea. The 2000 Master Plan recognizes that the large scale of a NGLT makes the visual impact considerations very important, and recommends siting such a facility within Area E of the Astronomy Precinct because it would "minimize its visibility" (UH 2000). The 2000 Master Plan also recommends implementing strict design guidelines for the size and color of the NGLT, and recommends that the observatory be built below grade to minimize the apparent height and mass.

1.2.3 Mauna Kea Science Reserve Development Plan, 1983

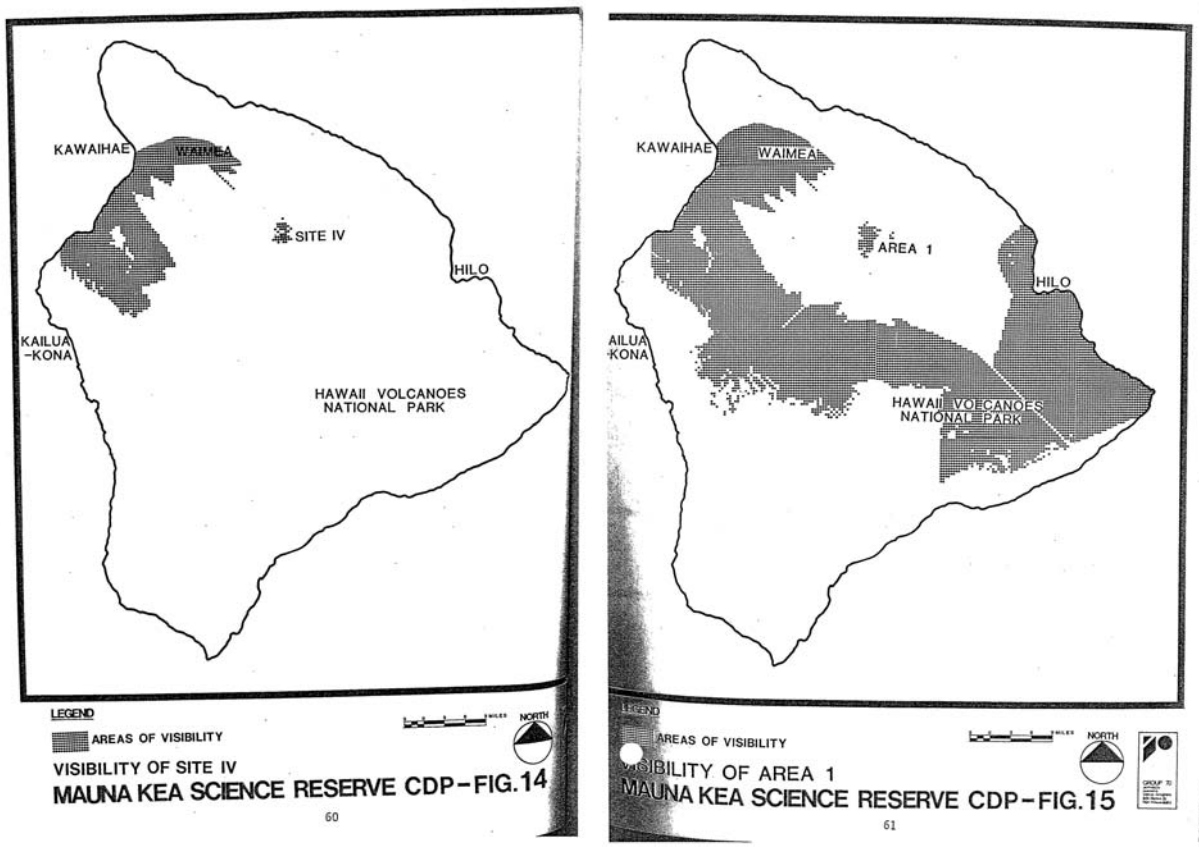
The 1983 Mauna Kea Science Reserve Development Plan included a visibility analysis for two areas on the summit of Maunakea where future observatories may be proposed. This visibility analysis identified areas on the Island of Hawai'i where the future observatories could be seen. These figures are shown in Figure 1-1.

1.2.4 Conservation District, 1961

In 1961 the Hawaiian State Land Use Law (Act 187), granted the State Land Use Commission (LUC) the power to zone all lands in Hawai'i into three districts: Agriculture, Conservation and Urban. The Conservation District has five subzones: Protective, Limited, Resource, General and Special. Maunakea is designated as Conservation District land, within the Resource subzone. Because the UH Management Areas consist of lands owned by the State, land uses within the UH Management Areas are regulated by the Board of Land and Natural Resources (BLNR), and

all activities must be in compliance with the laws and regulations applicable to Conservation District Lands (UH 2009).

Figure 1-1. Visibility Analysis from the 1983 Mauna Kea Science Reserve Development Plan



1.2.5 Outrigger Final EIS, 2005

The EIS prepared for the Outrigger Telescopes provided a brief description of the existing visual conditions within Mauna Kea's Astronomy Precinct and of places on the Island of Hawai'i where the existing observatories are visible. This EIS stated that the proposed Outrigger Telescopes would be visible from within the Astronomy Precinct and from areas below the summit such as Waimea and Honoka'a. The EIS for the Outrigger Telescopes also stated that the visual impact of the proposed telescopes would have a "small impact on visual/aesthetic" resources, but stated that the cumulative visual impact would be substantial (NASA 2005).

2.0 Methods

This section applies to the methods used during the visual analysis of the proposed TMT Observatory on Maunakea.

2.1 Coordination

The following plans were reviewed and consulted:

- Mauna Kea Science Reserve Development Plan, 1983
- Mauna Kea Science Reserve Master Plan, 2000
- Outrigger Final Environmental Impact Statement (FEIS), 2005
- County of Hawai'i General Plan, 2005
- South Kohala Community Development Plan, 2008
- Final Mauna Kea Comprehensive Management Plan (CMP), 2009

Site visits were conducted from October 6 through 9, 2008. The purpose of these visits was to document existing views. Additional visits were made thereafter to take photographs of the summit from various viewpoints.

2.2 Establishing the Affected Environment

2.2.1 Viewer Groups

The potential visual impact of the proposed TMT Observatory at the proposed 13N site and the alternative E2 site depends on the type, or group, of people at a location, their activity and their expectation of their experience. An assessment of the various viewer groups and their expectations was made.

2.2.2 Viewpoints

Eighteen (18) representative viewpoints were selected to analyze the potential visual impact of locating the TMT Observatory on Maunakea. These viewpoints are locations such as population centers, resorts, Department of Hawaiian Home Lands (DHHL) land, and culturally important locations where various activities occur and where the identified viewer groups would visit. The viewpoints are all located in the northern portion of the island because both the proposed 13N site and the alternative E2 site for the TMT Observatory are north of and below the summit of Maunakea, within Area E as designated in the Mauna Kea Science Reserve Master Plan (2000), and would not be visible from the southern portion of the island.

For the purpose of this report the primary view from a viewpoint is the orientation of the most visually prominent feature. The direction of the primary view from a viewpoint was determined by considering the viewer group and the activities at that location. For example, at a beach

viewpoint where the main activity is sightseeing and swimming, the primary view would be toward the ocean. For those viewpoints where the panoramic view is important to the viewer group and the activity at that location, no primary view has been specified.

2.3 Visual Consequences

The analysis of potential visual impacts from the TMT Observatory at the proposed 13N site and the alternative E2 site includes four elements: 1) a viewshed analysis, including quantifying the area of the island and the island's population that could see it; 2) whether it would be visible within the direction of the primary view; 3) whether it would be in silhouette; and 4) photo simulations from select viewpoints where the TMT Observatory would be visible.

2.3.1 Viewshed Analysis

The first step in the analysis of visual consequences is a viewshed analysis. The viewshed of the TMT Observatory was calculated in terms of the percent of the area of the Island of Hawai'i where it could be visible, and the percent of the island's population that could see it.

The viewshed for the TMT Observatory was calculated using specific latitude and longitude points and a height for the facility of 180 feet (55 meters) above grade. Topographic data from the U.S. Geological Survey (USGS) was used; specifically the National Elevation Dataset (NED)[2]. Geographic Information Systems (GIS) software was used to determine areas on the island where at least the top of the TMT Observatory could be visible. The NED is used as a three dimensional (3D) surface in GIS. The topographical changes were calculated using Environmental Science Research Institute's ArcGIS software package and the associated 3D analyst extension. The viewshed analysis does not take into consideration existing vegetation or structures, which may further obstruct views. Therefore, the viewshed analysis can be considered a worst case scenario.

Once the viewshed was established, 2000 U.S. Census data for the County of Hawai'i was used to determine the population within the viewshed. Population data was taken at the block level; the smallest area in which census data is collected.

2.3.2 Primary View

If the viewshed analysis determined that the TMT Observatory would be visible from a viewpoint it was then determined whether it would be visible within the direction of the primary view. This criterion is not applicable to viewpoints where the panoramic view is important to the viewer group and the activity at the location.

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[2] The USGS National Elevation Dataset (NED) has been developed by merging the highest-resolution, best quality elevation data available across the United States into a seamless raster format. NED is the result of the USGS effort to provide 1:24,000-scale Digital Elevation Model (DEM) data for the conterminous US and 1:63,360-scale DEM data for Alaska. The dataset provides seamless coverage of the United States, HI, AK, and the island territories. NED has a consistent projection (Geographic), resolution (1 arc second), and elevation units (meters). The horizontal datum is NAD83, except for AK, which is NAD27. The vertical datum is NAVD88, except for AK, which is NAVD29. NED is a living dataset that is updated bimonthly to incorporate the "best available" DEM data. As more 1/3 arc second (10m) data covers the US, then this will also be a seamless dataset.

2.3.3 Silhouette View

If the viewshed analysis determined that the TMT Observatory could be visible from a viewpoint it was then determined whether the view of the facility would be a prominent silhouette against the sky, or whether it would be seen against the backdrop of Maunakea or one of the existing observatories. The silhouette analysis consists of a profile of the topography between a viewpoint and the TMT Observatory and a line of sight extended from a representative viewer (with a height of 6 feet) at a viewpoint to the top of the proposed TMT Observatory and beyond. If the line of sight extended into the mountainside the view of the TMT Observatory would be against the backdrop of Maunakea; if the line of sight extended into air the view would be either a full or partial silhouette view.

To determine the amount of the TMT Observatory that would be in partial silhouette a line was drawn from the viewer and tangent to the top of the first rise of Maunakea either in front of or behind the TMT Observatory. If the line is tangent to a rise of Maunakea that is behind the TMT Observatory, the portion between the two lines is the amount that would be in silhouette. If the line is tangent to a rise of Maunakea that is in front of the TMT Observatory the portion below that line would not be visible from that viewpoint; the portion between the two lines is the amount that would be visible and in silhouette.

2.3.4 Photo Simulations

In compliance with CMP Management Action FLU-4, visual renderings of the TMT Observatory at the proposed 13N site were done for select viewpoints. These simulations help to evaluate the potential visual impact of the TMT Observatory in the context of its proposed setting. To evaluate the visual impact of the color and material of the dome enclosure simulations of the TMT Observatory were also done with different exterior finishes, and for when the summit is bare and when it is covered in snow.

To create these simulations, photos of the summit of Maunakea were acquired from the Canada–France-Hawai'i Telescope (CFHT) with accompanying information such as camera type, lens and frame size, and the latitude and longitude locations of where the photos were taken. The photos used in the simulation were taken with a 600mm/5.6 telephoto lens that shows the summit of Maunakea and the observatories as if a viewer was looking through binoculars. For a "naked eye" perspective, Project personnel took photos from the representative viewpoints using a 50mm focal length, which best approximates what the human eye sees. While in the field, Project personnel also held a ruler at arms length and measured the distance between the existing observatories. This provided an example of the scale of the existing observatories within the view of a typical viewer. For example, the distance between the Keck and Subaru Observatories is 1 millimeter (mm).

Terrain data or DEM (Digital Elevation Model) was acquired from the USGS Seamless Data Distribution Center. The Project's architect provided a 3D model of the TMT Observatory along with the latitude, longitude and elevation for the location of the proposed structure. Latitude, longitude and elevation data was also acquired for the existing observatories on Maunakea.

Using the above information a 3D model of the summit of Maunakea and the proposed TMT Observatory was created. Within the 3D model a "camera" was created and positioned based on imported location points, and the lens and frame size of the camera used in the original photo.

The 3D camera position was further refined by "camera matching"; a technique where the 3D camera view is slightly modified to allow for the 3D structures to align with coinciding objects seen in the original photograph. 3D lighting was approximated based on the time of day seen in the photograph. Finally, a composite image was created from a 2D rendering of the TMT Observatory and the original photograph.

2.4 Mitigation

The visual impact of the TMT Observatory is due to its proposed size and location on Maunakea. The proposed design and finish of the dome also have a visual impact. These aspects of the TMT Observatory were examined to assess how the Project mitigates its potential visual impacts.

3.0 Affected Environment

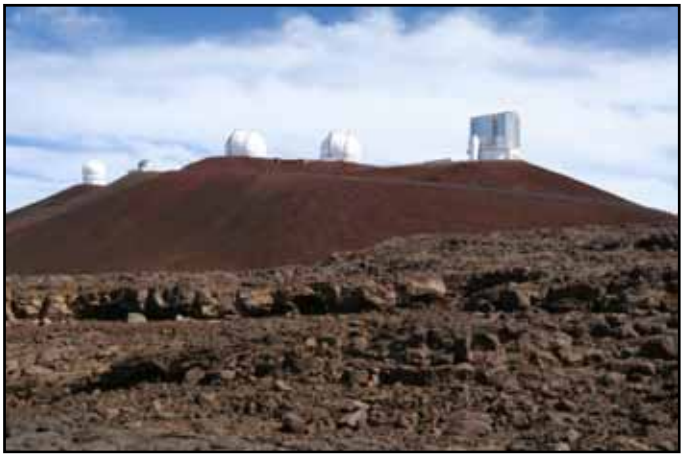
This section describes the existing visual environment related to Maunakea.

3.1 Maunakea

The Island of Hawai'i's landscape and visual resources are varied. On the northern tip the coast is rugged, covered in dense vegetation and dotted with waterfalls and rivers. Inland, around the town of Waimea (at an elevation of 4,000 feet), the landscape is comprised of rolling pastures used for cattle ranching. The west side of the island consists of popular resorts and beaches but lacks vegetation. The southern and southeastern portions of the island receive lots of rainfall and are covered with lush vegetation; Volcanoes National Park is located in this area. The eastern portion of the island consists of steep terrain with dramatic views of the rain forest and cliffs along the coast.

Maunakea is the highest peak on the Island of Hawai'i; with an elevation of 13,796 feet above sea level. In contrast to the lush coastal areas the summit of Maunakea is an alpine ecosystem. Above the tree line, at roughly 9,500 feet there is little more than low shrubs and above 12,800 feet the vegetation consists mainly of lichens, mosses and small ferns that grow in the cracks and crevices of the cinder cones that comprise the mountain's dome (UH 2000). A small alpine lake, Lake Wai'au, is situated on the upper southern flank of the mountain. The summit of Maunakea is often obscured by "vog", volcanic smog formed when sulfur dioxide and other volcanic gases emitting from Kīlauea mix with oxygen, moisture and sunlight. During the daylight hours thermally generated winds can draw the vog ashore and upslope (UH 2009). The vog has been especially thick since February 2008 when gas emissions from Kīlauea dramatically increased.

Maunakea is one of the best locations in the world for ground-based astronomical observations. The first telescope on the summit of Maunakea was constructed in 1964. Today, there are 11 observatories on Maunakea within the designated Astronomy Precinct and a twelfth located at a lower elevation. The existing facilities are visible from locations such as Hilo, Honoka'a and Waimea. On the west coast of the island the existing telescopes appear most visible at sunset, when they are lit by the setting sun; on the east coast the existing telescopes appear most visible at sunrise.



Existing telescopes on Maunakea as seen from Area E.

3.1.1 Scenic Vistas and Viewplanes

The State of Hawai'i Administrative Rules (HAR) Title 11, Chapter 200, § 11-200-12, lists the significance criteria for a State Environmental Impact Statement; the criteria for which an action shall be determined to have a significant effect on the environment. Significance Criteria 12 is if an action:

> *"Substantially affects scenic vistas and viewplanes identified in county or state plans or studies"*

The County of Hawai'i's 2005 General Plan includes a chapter on Natural Beauty that recognizes the importance of preserving the island's natural and scenic beauty. The chapter includes goals, policies and standards to identify and protect scenic vistas and viewplanes. Goal 7.2(b) is to "Protect scenic vistas and view planes from becoming obstructed." Section 7.4, also provides guidelines for designating sites and vistas of extraordinary natural beauty to be protected, and includes the standard "Distinctive and identifiable landforms distinguished as landmarks, e.g. Mauna Kea, Waipio Valley."

Around the Island of Hawai'i the following natural beauty sites have been identified that include Maunakea (County of Hawai'i 2005):

- View of Maunakea and Mauna Loa from Pāhoa-Kea'au, Volcano-Kea'au Roads, and various Puna subdivisions
- Viewpoint of Hilo Bay with Maunakea in background
- Mauna Kea State Park area

In addition, the South Kohala Development Plan includes a policy to preserve Waimea's sense of place. The plan recommends the strategy to "protect the pu'u of Waimea that have cultural, historical and visual importance" and which have "grand views of Mauna Kea" (County of Hawai'i 2008).

3.1.2 Viewer Groups

According to 2000 U.S. Census data, the Island of Hawai'i is home to roughly 148,000 people. The largest cities are Hilo on the east coast (with about 41,000 residents) and Kailua-Kona on the west side (with about 10,000 residents). There are also several smaller towns such as Waimea, Honoka'a and Hāwī.

Tourism is an important industry for all of Hawai'i. The Island of Hawai'i is famous for its volcanoes, such as Kīlauea which has been active for more than two decades. Visitors also visit the Island of Hawai'i for its beaches and recreational opportunities such as snorkeling, scuba diving and golf.

In Hawaiian culture Maunakea is recognized as a sacred place. Similar to other Polynesian cultures, the Hawaiians believed their highest points of land were most sacred; Maunakea being the highest mountain in Pacific Polynesia. Maunakea was host to early Hawaiian traditions including religious practices, study of the heavens, and tool making in the Keanakako'i adze quarry. Lake Wai'au was believed to contain pure water which was used in healing and worship

practices. Today, there are still Hawaiians who go to Maunakea for prayer and restoration. (OMKM 2000).

The people that view the Island of Hawai'i, and more specifically Maunakea, can be categorized into three groups, each with a different expectation of their visual experience:

- *Residents* – Residents place value on the existing condition of the surrounding landscape, particularly as viewed from their homes. Residents would also have views of the island and Maunakea from public places such as commercial centers, beaches and state parks. Residents experience the island's visual resources, including Maunakea, frequently and for a long duration.
- *Sightseers* – Sightseers visit the Island of Hawai'i to view the landscape, including the beaches and volcanoes, and for recreational activities. Sightseers would visit the larger cities of Kailua-Kona and Hilo for shopping, dining, and touring activities, and would take scenic drives along the island stopping at scenic overlooks. Sightseers may also be interested in astronomy and visit the observatories on Maunakea. Sightseers would have a temporary experience of Maunakea and the island's visual resources.



Existing shrine on the summit of Mauna Kea.

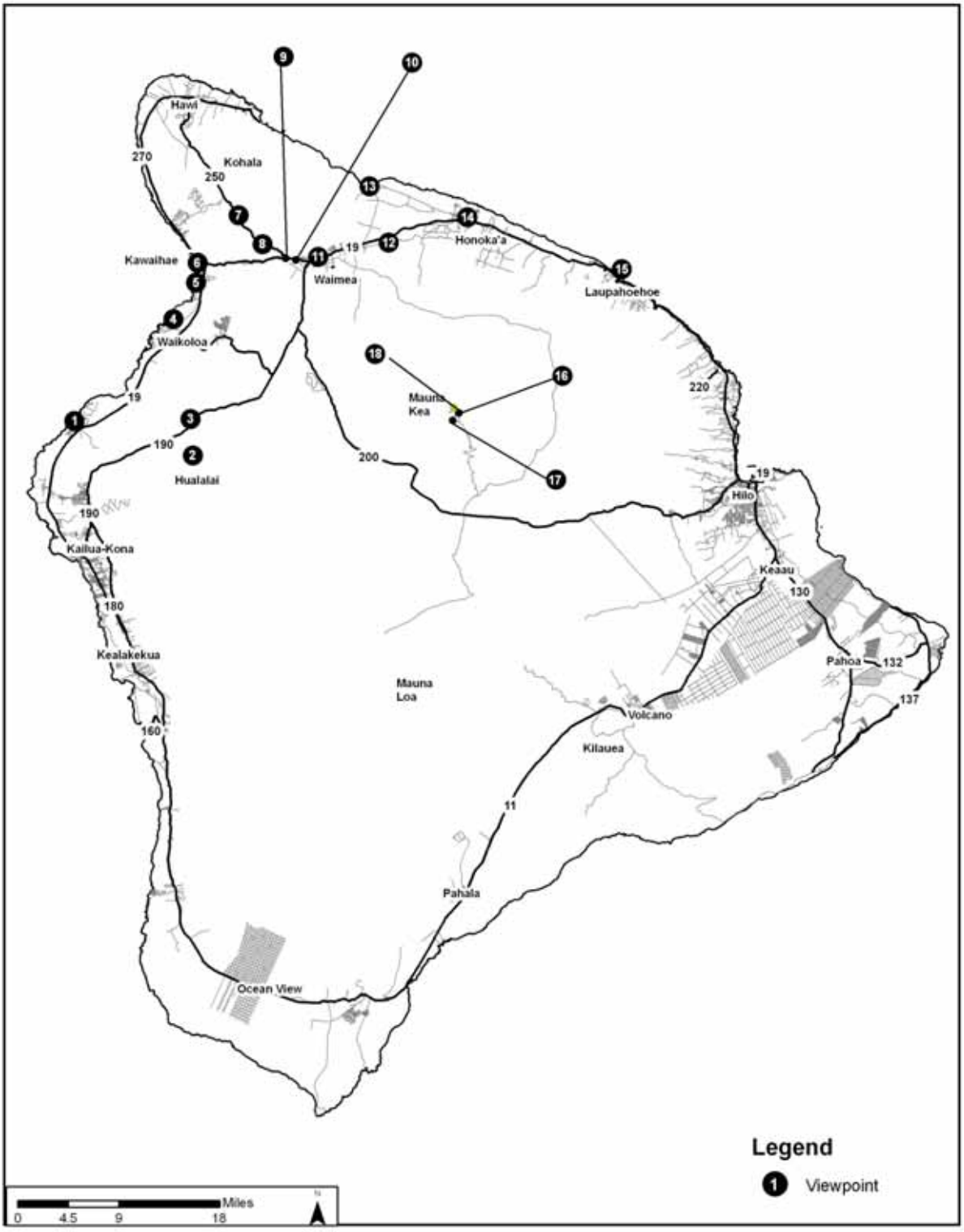
- *Cultural Practitioners*[3] – Cultural Practitioners are native Hawaiians who, as individuals or groups, may visit Maunakea for worship on special occasions or on a regular basis (OMKM 2000). Cultural Practitioners may also visit other important sites on the island with views of Maunakea. Cultural Practitioners place a high value on the island's visual resources, and particularly on pristine views of Maunakea.

3.1.3 Viewpoints

Eighteen (18) representative viewpoints within the northern portion of the island have been identified as places that are of visual significance to the island's three viewer groups. The viewpoints are all located in the northern portion of the island because the proposed 13N site and the alternative E2 site for the TMT Observatory are north of and below the summit of Maunakea and would not be visible from the southern portion of the island. Figure 3-1 maps the locations of the 18 representative viewpoints.

[3] This report only discusses the project's potential visual impact. For more information on impacts to cultural sites or practices please see the *Cultural Impact Assessment, Thirty Meter Telescope*.

Figure 3-1. Viewpoints Used for the Visual Analysis





Primary view from Viewpoint # 13 – Waipio Valley Lookout

Table 3-1 provides the name and description of each viewpoint, including the main activity that occurs at that location, and states the primary viewer group at the viewpoint. For example, at the Waipio Valley Lookout the primary viewer group is Sightseers. For the Hualālai Resort, Big Island Country Club, Hāpuna Beach and Puukohola Heiau State Park, both Residents and Sightseers have been listed as the primary viewer group because of the activities that occur at these locations.

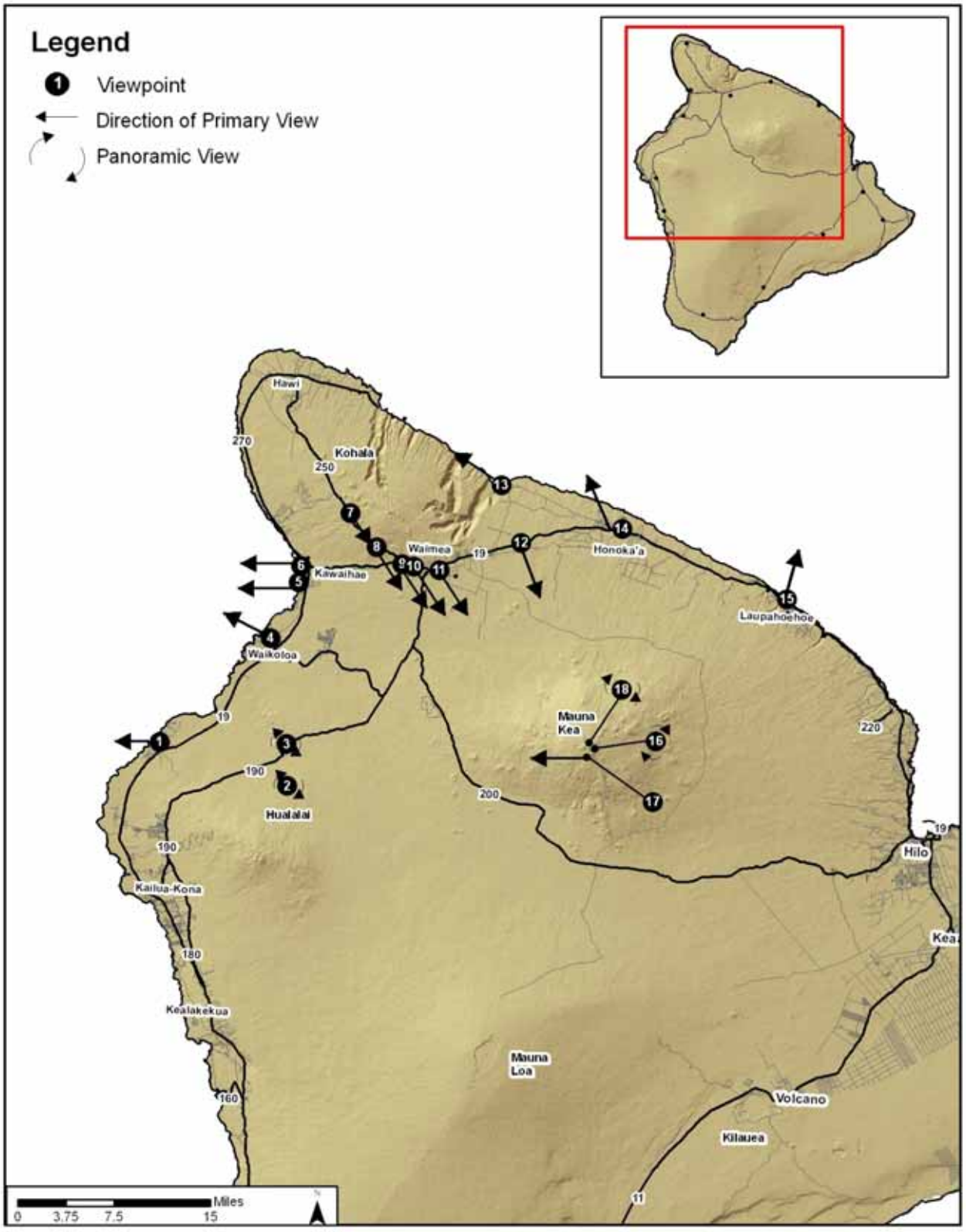
Finally, Table 3-1 states the direction of the primary view from each viewpoint; the orientation of the most visually prominent feature. The primary view has been determined relative to the viewer group and the activities at the viewpoint. The primary view for viewpoints near the coast, such as Hāpuna Beach and Laupāhoehoe Point, is toward the ocean (makai). For viewpoints that are more inland, such as the Route 250 Puu overlook and Waimea Park, the primary view is towards Maunakea (mauka). At the Big Island Country Club, Pu'u Waawaa and the summit of Maunakea, the panoramic view is important to the viewer group and the location's use. The direction of the primary view from each viewpoint is mapped in Figure 3-2.

Appendix A includes a photograph of or from the viewpoints. It has been noted if the photograph is of the primary view from the viewpoint.

Table 3-1. Description of Viewpoint, Viewer Group and Primary View Direction

Viewpoint	Location	Description	Viewer Group	Primary View
1	Hualālai Resort	Exclusive, luxury residential community and hotel.	Residents / Sightseers	West toward the ocean (makai)
2	Pu'u Waawaa	Summit of cinder cone that is of cultural importance to native Hawaiians.	Cultural Practitioners	Panoramic
3	Big Island Country Club	Independent (non-resort affiliated) daily-fee golf course. The club includes views of the coastline and of Maunakea.	Residents / Sightseers	Panoramic
4	Waikoloa/Mauna Lani	Resort development.	Sightseers	West makai
5	Hāpuna Beach	Public beach near a resort.	Sightseers / Residents	West makai
6	Puukohola Heiau	National historic site and Spencer Beach Park, which includes camping and picnic areas along a beach.	Residents / Sightseers	West makai
7	DHHL Kawaihae at Rt. 250	Summit of Hwy 250 between Waimea and Hāwī.	Residents	Southeast toward Maunakea (mauka)
8	Route 250 Pu'u overlook	Gravel shoulder where cars can pull off of the highway and view Maunakea and North Kona/South Kohala.	Sightseers	Southeast mauka
9	DHHL Lalamilo	Residential neighborhood within Waimea.	Residents	Southeast mauka
10	Waimea Park	Athletic facilities for sports such as baseball and tennis. Nearby a school.	Residents	Southeast mauka
11	DHHL Pu'u Kapu	Residential neighborhood within Waimea.	Residents	Southeast mauka
12	DHHL Waikoloa-Waialeale	Along Old Māmahaloa Hwy through ranch lands.	Residents	South mauka
13	Waipio Valley Lookout	Formal lookout with parking lot and trail to scenic view.	Sightseers	Northwest along the coast
14	Honoka'a	Main road into town.	Residents	Northwest up the coast
15	Laupāhoehoe Point	State park with parking lot and picnic facilities along the coast.	Sightseers	Northeast makai
16	Maunakea Summit (Kūkahau'ula)	Highest point on Maunakea. Recognized as a sacred place to native Hawaiians.	Cultural Practitioners	Panoramic
17	Lake Wai'au	Small lake near the summit of Maunakea, accessible by a trail. Waters used for healing and worship practices in Hawaiian culture.	Cultural Practitioners	West over the lake
18	North ridge of Maunakea summit cinder cone (Kūkahau'ula)	North ridge of Kūkalau'ula, near Keck, Subaru, IRTF, or CFHT observatories.	Sightseers	Panoramic

Figure 3-2. Primary View from Viewpoints



3.1.4 Existing Telescopes on Maunakea

There are 11 existing observatories near the summit of Maunakea, eight of which are optical/infrared and three of which are submillimeter/radio observatories. The heights of these existing observatories range from a little over 20-feet to 151-feet. The names, elevation and approximate heights of the existing observatories are listed in Table 3-2. The locations of these observatories within the Astronomy Precinct are shown in Figure 3-3.

Table 3-2. Existing Observatories on Maunakea

Map Number	Observatory	Ground Elevation (feet)	Dome Height from Ground (feet)
Submillimeter/Radio Observatories			
1	California Institute of Technology Submillimeter Observatory (CSO)	13,362	63
2	James Clerk Maxwell Telescope (JCMT)	13,390	100
3	Submillimeter Array (SMA)	13,279-13,400	45
Optical/Infrared Observatories			
4	Subaru Observatory	13,578	141 (Subaru 2008)
5a, 5b	W. M. Keck Observatory (telescopes I and II)	Keck 1: 13,714, Keck 2: 13,659	111 (NASA 2005)
6	NASA Infrared Telescope Facility (IRTF)	13,652	53 (IRTF 2008)
7	Canada-France-Hawai'i Telescope (CFHT)	13,726	125(CFHT 2008)
8	Gemini Northern Observatory	13,764	151 (Gemini 2008)
9	University of Hawai'I (2.2M)	13,784	80
10	United Kingdom Infrared Telescope (UKIRT)	13,762	61 (UH 1975)
11	University of Hawai'i – Hilo (0.9M)	13,727	20.25 (UH 2006)

For each existing observatory, Table 3-3 shows the master plan siting area that they are located within, the percent of the area of the island from which the observatory is potentially visible, and the dome color of the observatory. Figure 3-4 shows the combined visibility of the existing 11 observatories near the summit, where the top of at least one of the existing observatories is visible. Individual viewshed maps are included in Appendix B. Based on this analysis, from approximately 43 percent of the island area a viewer would be able to see at least one existing observatory. According to 2000 U.S. Census data 72 percent of the Island of Hawai'i's population (roughly 107,000 people) is within the viewshed of the existing observatories.

Table 3-3. Existing Observatory Visual and Aesthetic Attributes

Observatory		Master Plan Siting Area	Viewshed (%)	Dome Color
Optical/Infrared Observatories				
UHH 0.9m		A	15	White
UH 2.2m		A	36	White
CFHT		A	35	White
UKIRT		A	26	White
Gemini		A	39	Aluminum
IRTF		B	14	Aluminum
W. M. Keck Observatory	Keck 1	B	17	White
	Keck 2	B	16	White
Subaru		B	20	Metallic
Submillimeter/Radio Observatories				
CSO		C	5	Metallic
JCMT		C	7	White
SMA		C	2	N/A

Figure 3-3. Map of Existing Observatories on Maunakea

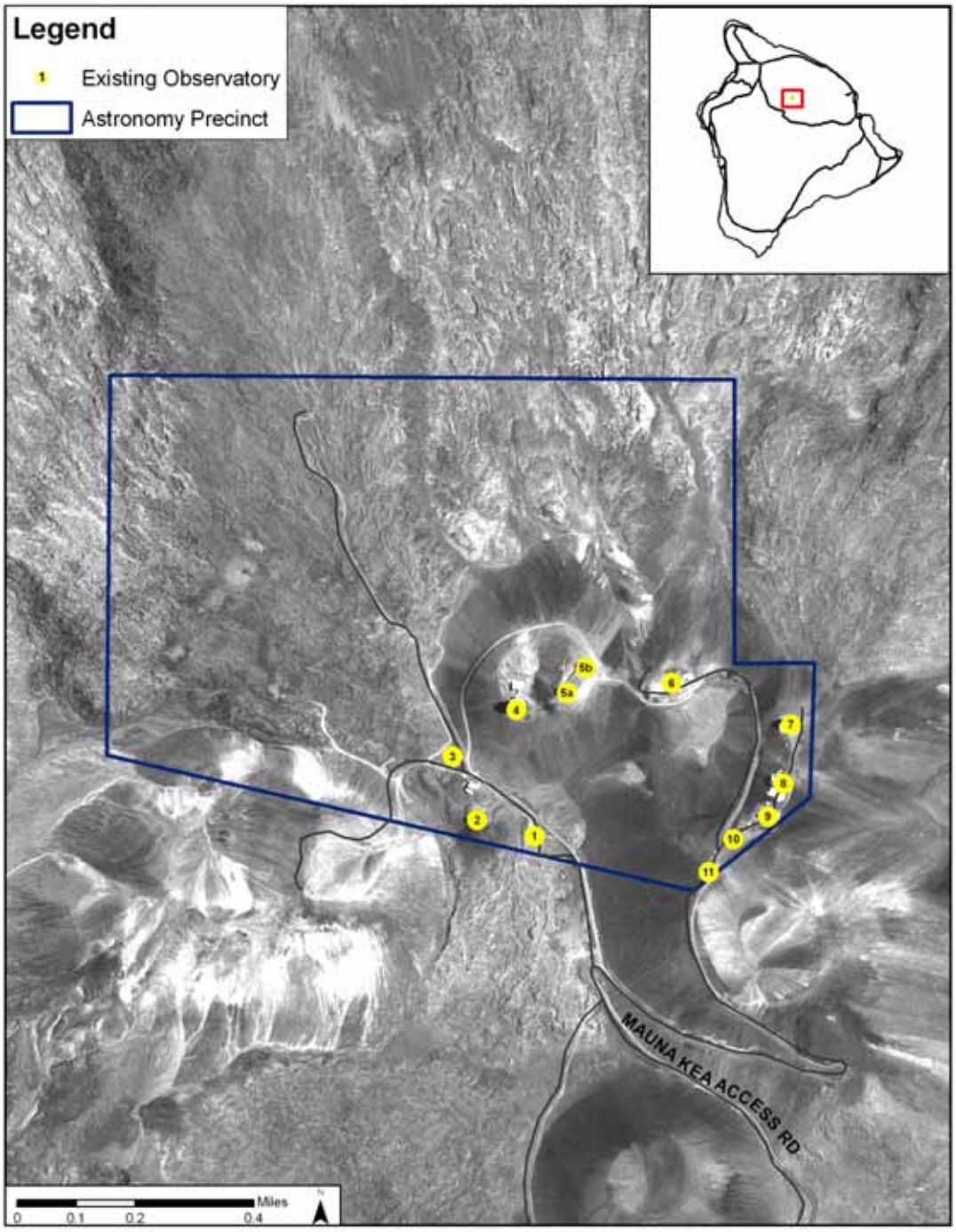
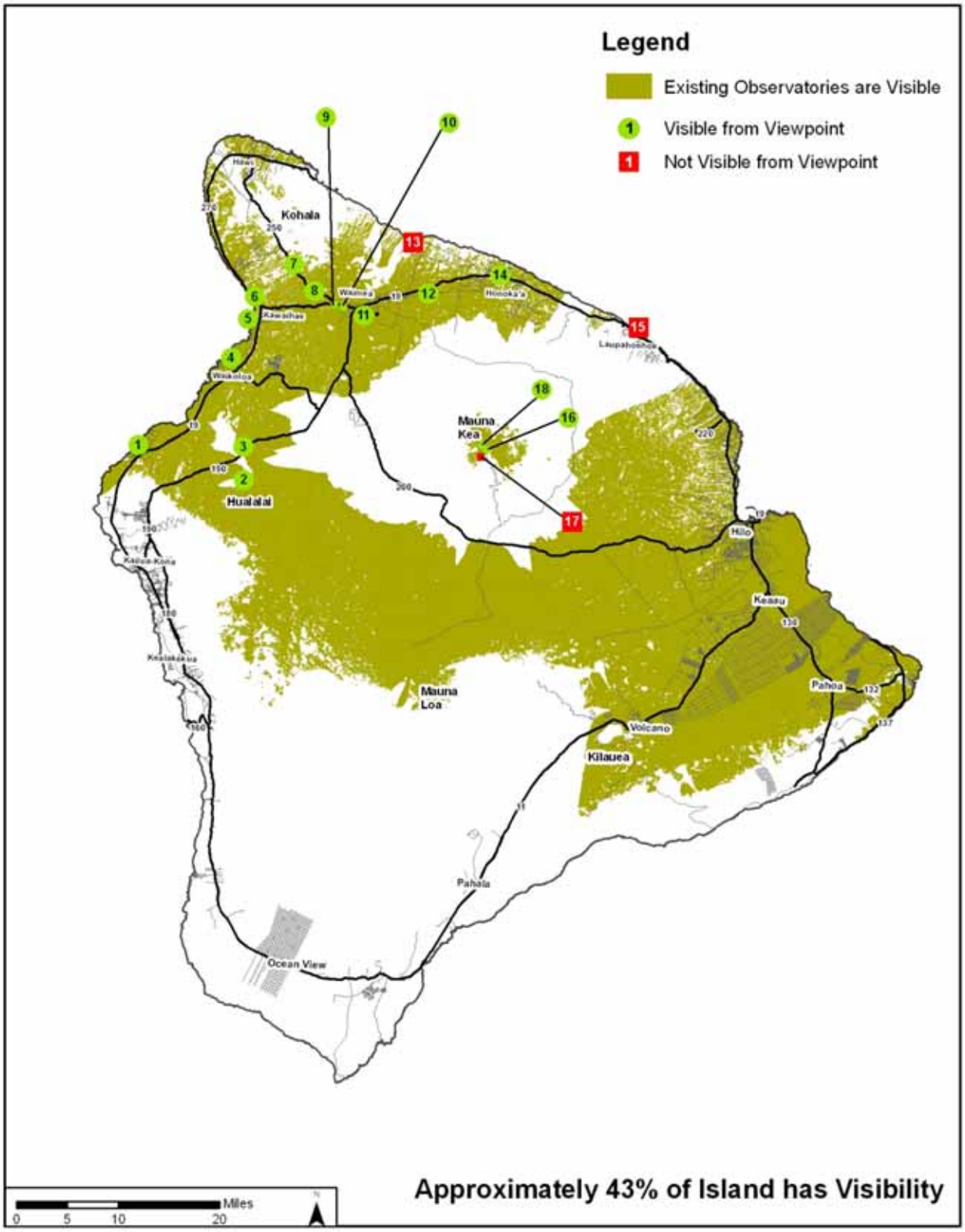


Figure 3-4. Combined Visibility of Existing Observatories on Maunakea



4.0 Consequences

This section presents the potential visual impacts that would occur from locating the TMT Observatory at the proposed 13N site and the alternative E2 site on Maunakea.

4.1 No Action Alternative

The No Action Alternative considers existing conditions and what would be reasonably expected to occur in the foreseeable future, absent the proposed project.

With this alternative the existing CSO Observatory on Maunakea would be decommissioned and the SMA would be expanded from eight to 20 antennas in Area C and D of the Astronomy Precinct. The other existing observatories would remain. These observatories can be seen from 43 percent of the area of the Island of Hawai'i, as shown in Figure 3-4; approximately 72 percent of the population (roughly 106,000 people) is within this existing viewshed.

TMT would not fund construction, installation, or future operation of the TMT Observatory and its supporting facilities at either Maunakea or Cerro Armazonas. The Pan-STARRS project, a telescope consisting of four mirrors each with a diameter of 6 feet (1.8 meters), similar to what is constructed on Haleakala, would occur either at the current location of the UH 2.2 Observatory or the UH 2.2 Observatory would move to Area E and become Pan-STARRS. Also, in the absence of the proposed TMT Observatory, it is likely that in the future another observatory would be developed within Area E pursuant to the CMP.

4.2 Maunakea

The proposed 13N site, and the alternative E2 site, for the TMT Observatory are within the Astronomy Precinct on Maunakea in an area northwest of the summit that was identified in the 2000 Master Plan as Area E. These two sites are shown in Figure 4-1. The 2000 Master Plan for Maunakea identified the Area E location as a potential site for a Next Generation Large Telescope (NGLT), similar to the TMT Observatory, primarily because it minimizes visual impacts (OMKM 2000).

In addition to the observatory within the Mauna Kea Astronomy Precinct the project would also require a Support Facility that would be located at Hale Pōhaku, at an elevation of 9,300 feet, Headquarters in the University Park of UH Hilo, and a satellite office in Waimea. These facilities are not anticipated to have a visual impact due to their limited visibility, because their design would be similar to other developments in these areas, and because there are no designated or recognized visual resources associated with them.

Figure 4-1. Proposed 13N Site and Alternative E2 Site

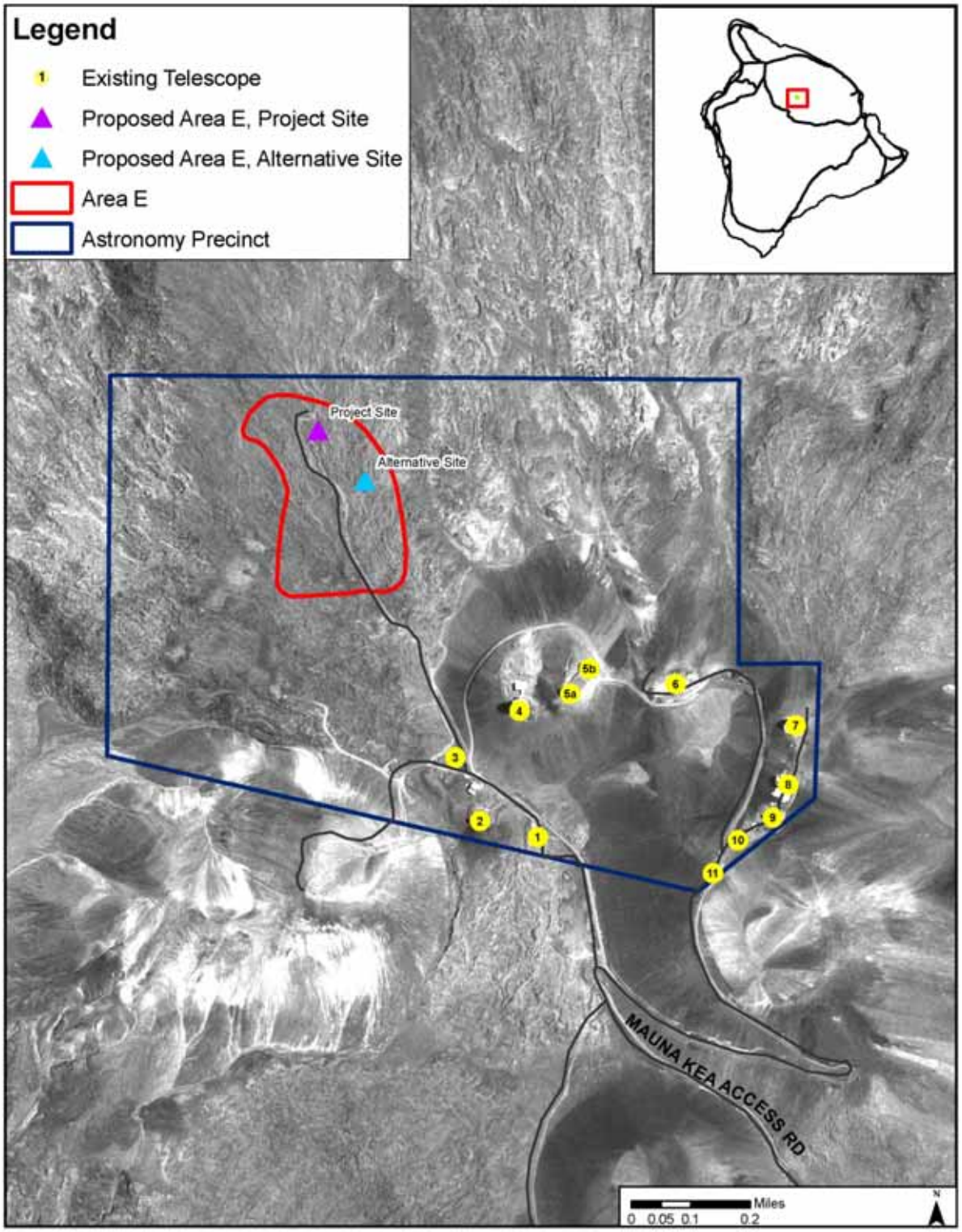


Figure 4-2 provides a simulation and cross section of the proposed design of the TMT Observatory. Figure 4-2 shows both the proposed dome enclosure for the telescope and the administrative facilities. In addition to the 13N and E2 sites being below the summit of Maunakea, the cross section shows that part of the TMT Observatory would be below existing grade, which would further minimize the potential visual impact. The proposed maximum height of the dome enclosure is approximately 180 feet (55 meters) above existing grade. The proposed diameter to the exterior of the structure is 216 feet (66 meters). To put this size into perspective, the area is roughly the size of a football field, which is 160 feet (48.8 meters) wide by 300 feet (91.4 meters) long, without sidelines and stands. For height, the TMT Observatory would be similar to the Ilikai Hotel in Honolulu.

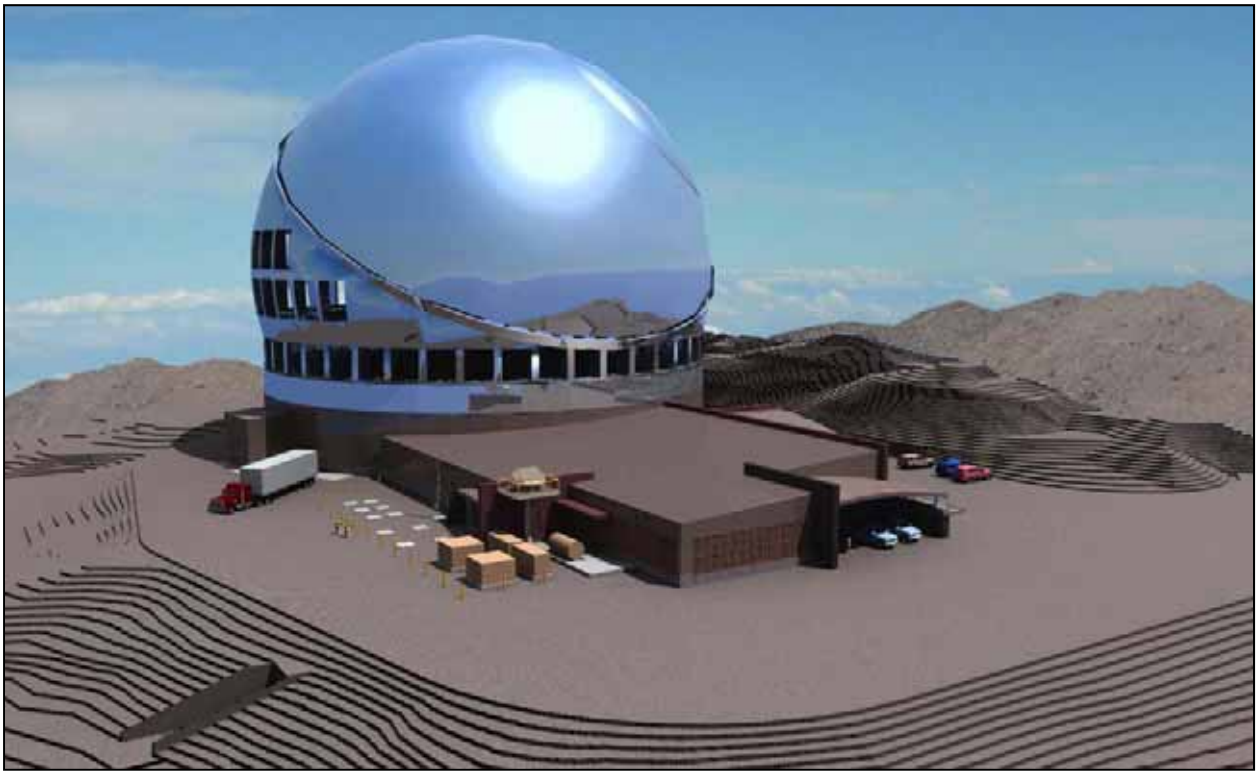
As shown in Figure 4-2, natural colors that blend into the landscape would be used for the exterior of the fixed enclosure and the administrative facilities. The proposed coating of the rotating dome enclosure is a reflective aluminum-like finish similar to the Subaru Observatory. The coating on the outer surface of an observatory dome is important to the function of the telescope. If the telescope and inner structure of the enclosure heat up during the day, or cools below the night air temperature, it will cause local air turbulence inside the enclosure that would degrade the telescope image quality. To maintain a consistent temperature inside the dome the TMT Observatory would be constructed with thick insulation and would require daytime air conditioning. The proposed metallic exterior coating on the dome would reduce the amount of energy needed to regulate the temperature.

In general, the existing observatories on Maunakea with a metallic coating (such as Gemini, IRTF, and Subaru) reflect the morning sunrise and evening sunset light and stand out during this period. However, during majority of the day the metallic coating reflects the sky, which helps reduce the visibility of the observatory.

Visibility of the Adaptive Optics Laser

The proposed TMT Observatory would use an adaptive optics (AO) system on the telescope to correct distortions in the view resulting from atmospheric affects. This greatly improves the image that can be obtained from the telescope. The TMT Observatory would be the first astronomy telescope designed from conception to use adaptive optics. The AO system uses a laser pointed into the sky. The multiple overlapping laser beams could be faintly visible to the naked eye as a single beam on moonless nights for a distance of up to 9 miles from the observatory. Figure 4-3 shows a circle with a 9 mile radius around the proposed location of the TMT Observatory; the maximum potential area where the adaptive optics laser may be visible. The area where the laser may be visible consists primarily of ranchlands and forest reserve which are not populated. Therefore, the laser used in the adaptive optics system is expected to have a less than significant visual impact.

Figure 4-2. Proposed TMT Observatory Design



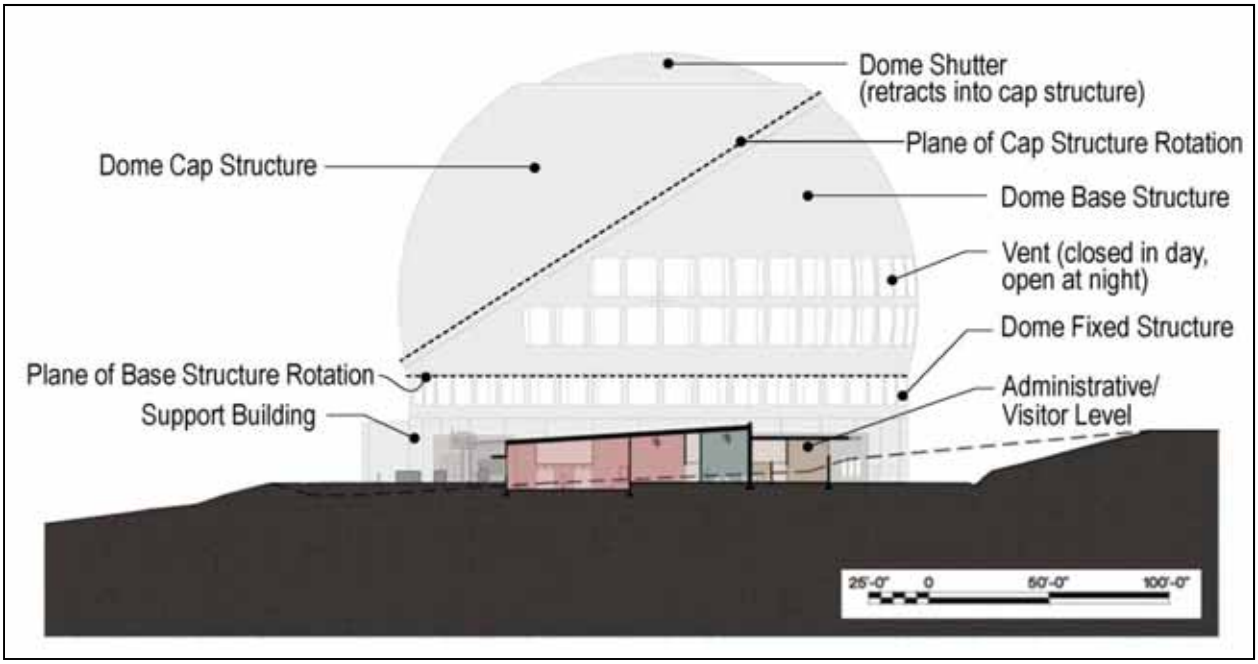
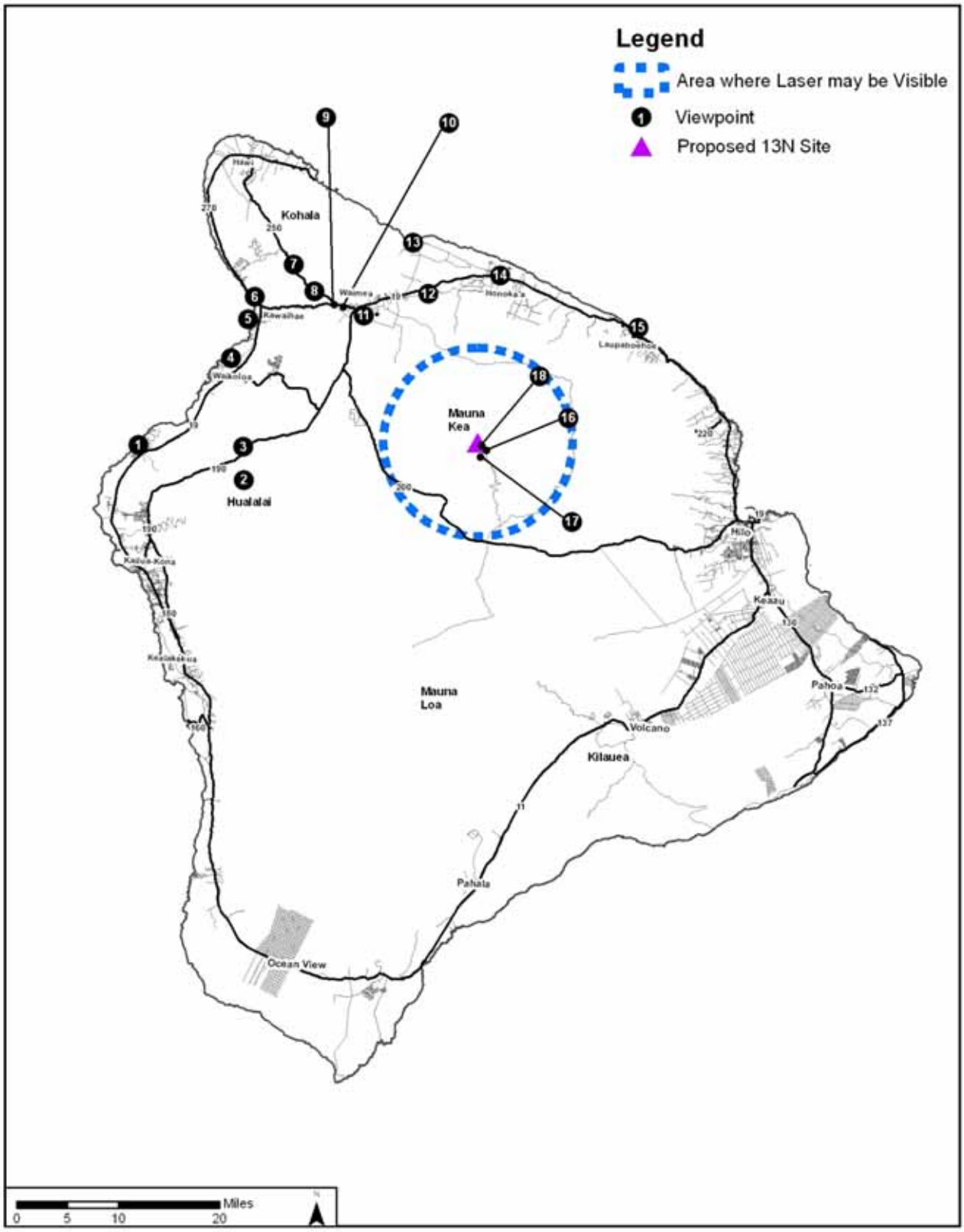


Figure 4-3. Potential Visibility of the TMT Observatory's Adaptive Optics Laser



4.2.1 13N Site

Temporary Impacts

Construction and Decommissioning

Temporary visual impacts from the proposed construction, and the potential future decommissioning, of the TMT Observatory would be associated with the presence of construction equipment and workers, material stockpiles, debris and staging areas. Most of the construction staging and material storage would occur in the area around Hale Pōhaku, at an elevation of 9,300 feet, which would not be visible from other areas of the island. Dust, and light and glare emanating from construction activities would also have a temporary visual impact. These temporary impacts would be less than significant.

Long-Term Impacts

Scenic Vistas and Viewplanes

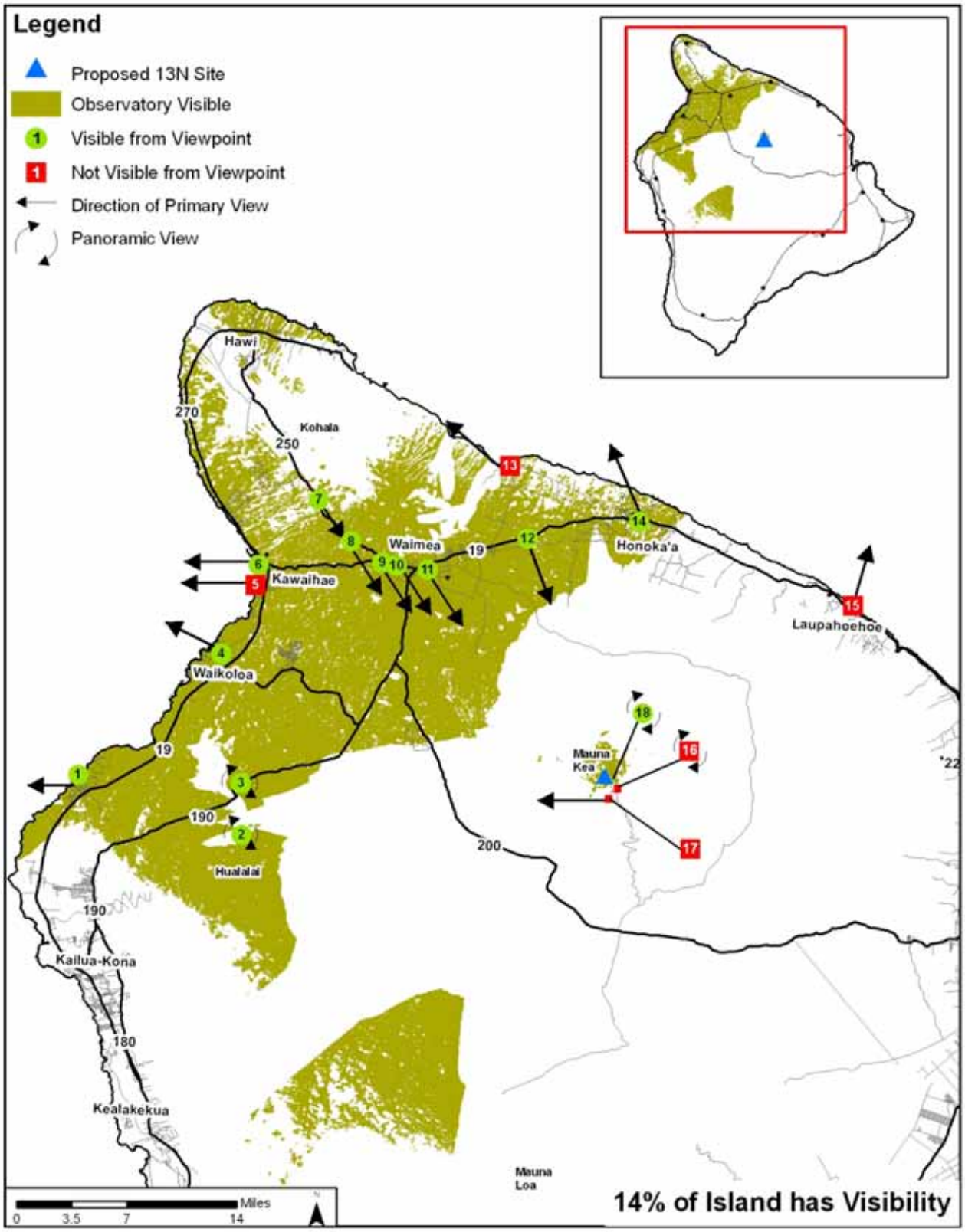
Locating the TMT Observatory at the proposed 13N site would not substantially affect scenic vistas and viewplanes identified in the Hawai'i County General Plan or the South Kohala Development Plan. The TMT Observatory would not be visible in the view from Hilo Bay with Maunakea in the background. The TMT Observatory would not be visible in the view of Maunakea from Pahoa-Kea'au, Volcano-Kea'au Roads, and various Puna subdivisions or from locations where Hilo Bay is visible with Maunakea in the background. Although the TMT Observatory may be visible in the view of Maunakea from portions of the South Kohala district and the area around Waimea, it would not block or substantially obstruct the views and viewplanes of the mountain. Therefore, the Project would not exceed significance criteria 12 as stated in §11-200-12 of the HAR.

Viewshed Analysis

A viewshed analysis was conducted to assess which areas of the Island of Hawai'i may have a view of the TMT Observatory at the proposed 13N site. The viewshed analysis is based on topographic information; it does not include existing vegetation or structures which may further obstruct views of the TMT Observatory. Therefore, the viewshed analysis can be considered a worst case scenario.

The results of this analysis are shown in Figure 4-4. In this figure the shaded portions of the island are areas where at least the top of the TMT Observatory may be visible. For the 18 representative viewpoints, a green circle shows that the TMT Observatory would be visible and a red square means it would not be visible. The TMT Observatory could be visible from viewpoints 1-4, 6-12, 14, and 18. The TMT Observatory would not be visible from viewpoints 5, 13 and 15-17.

Figure 4-4. Proposed 13N Site - Viewshed and Primary View Analysis



The viewshed analysis confirms that, because it would be located north of and below the summit of Maunakea, the TMT Observatory would not be visible in the southern portion of the island; this includes the large cities of Hilo and Kailua-Kona. According to the viewshed analysis the TMT Observatory would be visible from 14 percent of the area of the island (see Table 4-1). According to 2000 U.S. Census data, approximately 15.4 percent of the island of Hawai'i's population (approximately 23,000 people) would live within the viewshed of the TMT Observatory at the proposed 13N site. Others, including visitors and island residents that reside outside of the viewshed, would be able to see the TMT Observatory when they travel through and visit locations within the viewshed.

Table 4-1. Visibility of the Proposed 13N Site

Visibility	Area of Island (%)	Hawai'i's Population	
		%	People
Visible	14%	15.4%	23,000
Not Visible	86%	84.6%	125,000

Table 4-2 divides the viewshed, and the population within the viewshed, into five areas: Waimea, Honoka'a, Hāwī, Waikoloa and Kawaihae, and Hualālai. Of these areas, the TMT Observatory would be visible in the primary view direction only from the area around Waimea. For the other four areas the primary view direction is makai. Of the island's population 5.5 percent (approximately 8,100 people) are within the area around Waimea and may be able to see the TMT Observatory.

Table 4-2. Visibility of the Proposed 13N Site within the Primary View Direction

Location	Hawai'i's Population		Primary View Direction?
	%	People	
Waimea	5.5%	8,100	Yes
Honoka'a	2.8%	4,200	No
Hāwī	2.6%	3,900	No
Waikoloa and Kawaihae	4.3%	6,400	No
Hualālai	0.2%	303	No

Primary View

Of the 13 viewpoints where the TMT Observatory may be visible, it would not be within the primary view of four; the Hualālai Resort (1), Waikoloa/Mauna Lani (4), Puukohola Heiau (6) and Honoka'a (13). At these coastal locations, the primary view is makai.

The TMT Observatory could be visible and in the primary view direction from viewpoints along Highway 250 (7 and 8) and around the town of Waimea (9, 10, 11 and 12). The TMT Observatory could also be visible from the Big Island Country Club (3), from the summit of Pu'u Waawaa (2), and from the North ridge of Maunakea summit cinder cone (18), where the panoramic view of the water, the surrounding area, and Maunakea would be important to the viewer.

Silhouette View

For the 13 representative viewpoints where the TMT Observatory may be visible, an analysis of the line of sight from the viewpoint to the TMT Observatory was conducted to determine

whether the view of the facility would be a full or partial silhouette against the sky, or whether it would be seen against the backdrop of Maunakea. For some of these 13 viewpoints the silhouette analysis showed that the view of the TMT Observatory would be partially obstructed from a rise between the viewer and the viewpoint. Table 4-3 summarizes the silhouette analysis for the TMT Observatory at the proposed 13N site. The results of the silhouette analysis are in Appendix C.

Table 4-3. Proposed 13N Site - Silhouette Analysis

Viewpoint	Location	Portion of TMT Observatory in Silhouette		
		None	Partial	Full
1	Hualālai Resort	--	164 feet (50 m)	--
2	Pu'u Waawaa	--	58 feet (17 m)	--
3	Big Island Country Club	--	82 feet (25 m)	--
4	Waikoloa/Mauna Lani	--	164 feet (50 m)	--
5	Hāpuna Beach	Not Visible		
6	Puukohola Heiau	--	164 feet (50 m)	--
7	DHHL Kawaihae at Rt. 250	X	--	--
8	Route 250 Pu'u overlook	X	--	--
9	DHHL Lalamilo	--	49 feet (15 m)	--
10	Waimea Park	--	89 feet (27 m)	--
11	DHHL Pu'u Kapu	--	98 feet (30 m)	--
12	DHHL Waikoloa-Waialeale	--	164 feet (50 m)	--
13	Waipio Valley Lookout	Not Visible		
14	Honoka'a	--	82 feet (25 m)	--
15	Laupāhoehoe Point	Not Visible		
16	Maunakea Summit	Not Visible		
17	Lake Wai'au	Not Visible		
18	North ridge (Kūkahau'ula)	--		X

From the two viewpoints along Highway 250 (7 and 8) the view of the TMT Observatory would not be in silhouette; it would be visible against the backdrop of Maunakea. This may reduce the prominence of the TMT Observatory in the view from these locations; particularly at sunset, when Maunakea would be back-lit by the setting sun. Only from the northern ridge of Kūkahau'ula (18), which is located on a ridge at an elevation higher than the TMT Observatory, would the full observatory be in silhouette.

From the coastal locations of Hualālai Resort (1), Waikoloa/Mauna Lani (4) and Puukohola Heiau (6), approximately 165 feet (50 meters) of the TMT Observatory would be in silhouette. From the town of Honoka'a (14), approximately 80 feet (25 meters) of the TMT Observatory would be in silhouette. From these viewpoints the TMT Observatory would not be located within the direction of the primary view, which is makai.

In the area around Waimea (viewpoints 9 through 12), where the TMT Observatory would be visible within the direction of the primary view, the amount of the partial silhouette would range from 50 feet (15 meters) to 165 feet (50 meters). The silhouette analysis also showed that from the Big Island Country Club (3) and Pu'u Waawaa (2) the view of the TMT Observatory would be partially obstructed from a rise of Maunakea between the viewer and the observatory. From portions of the Big Island Country Club (2) the top 80 feet (25 meters) of the TMT Observatory

would be visible and in silhouette. From the summit of Pu'u Waawaa (3) the top 55 feet (17 meters) would be visible and in silhouette.

The existing observatories on the summit of Maunakea can also affect the silhouette view. From some areas on Hawai'i, the view of the TMT Observatory would be in front of one of Keck 1, Keck 2 or Subaru. These areas are shown in Figure 4-5.

Figure 4-5. Area where TMT would be Viewed in Front of an Existing Observatory

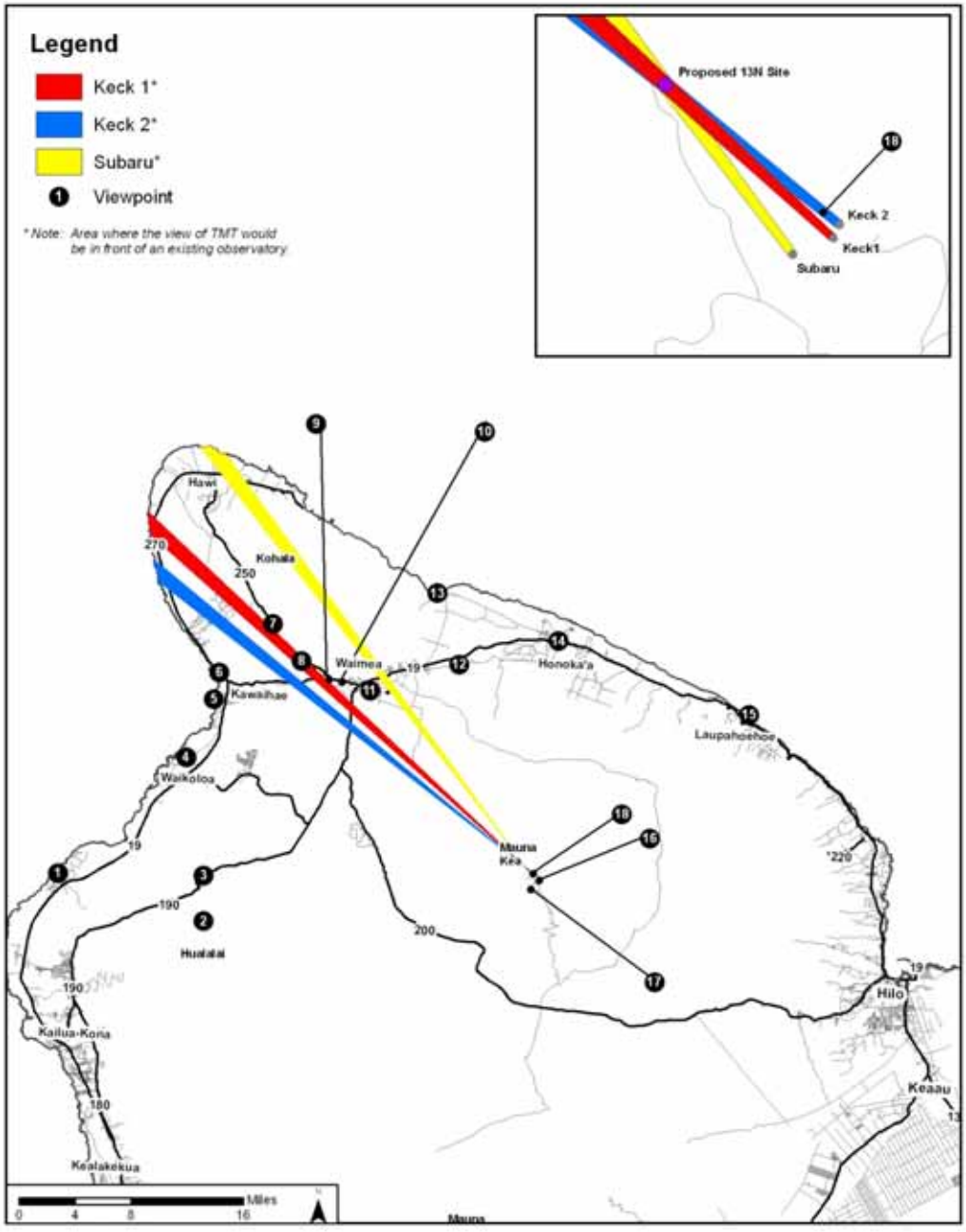


Photo Simulations

Views from Lower Elevation Developed Areas

Photo simulations of the TMT Observatory at the proposed 13N site were created for views from Waimea, near Honoka'a (in the area around viewpoint 12) and Waikoloa. The photos used in these simulations were taken with a 600 mm/5.6 telephoto lens, creating a "binocular view." For comparison purposes a "naked eye view," without the aid of binoculars or a telephoto lens, from Waimea, Honoka'a and Waikoloa are provided. These naked eye photos show how, from these locations that are a distance of approximately 19 miles from the summit of Maunakea, the existing observatories appear quite small and do not occupy much of the total view. The naked eye view of the TMT Observatory on Maunakea would be similar. Because the size and design of the TMT Observatory would not be discernable from the naked eye perspective, simulations at this scale were not prepared.

An example of the naked eye view of Maunakea from Waimea is shown in Figure 4-6. Figure 4-7 is a binocular view simulation of the TMT Observatory in the proposed 13N site from Waimea. This simulation shows how the location of the TMT Observatory would be below the summit of Maunakea and the existing observatories. In this view the lower portion of the TMT Observatory would be obscured behind a rise of Maunakea and it would be located in front of one of the existing domes of the Keck Observatory.

In Figure 4-7 the TMT Observatory is shown with a reflective aluminum-like finish on the dome enclosure. In Figure 4-8 the TMT Observatory is shown with a white exterior finish and in Figure 4-9 it is shown in a brown finish. The visual impact of the dome's exterior finish partly depends on the colors in the landscape of the summit of Maunakea. For much of the year the summit of Maunakea has a reddish-brown color from the volcanic rock. From November through March the summit of Maunakea is white from varying amounts of snow cover. Figure 4-10 through Figure 4-12 provide a photo simulation of the TMT Observatory, as viewed from Waimea, with the three exterior finishes when Maunakea is covered with snow.

Figure 4-13 shows the naked eye view from Honoka'a. Figure 4-14 through Figure 4-16 are binocular view simulations of the TMT Observatory, in the proposed 13N site, near Honoka'a (in the area around Waikoloa-Waialeale, viewpoint 12) with the reflective aluminum-like finish, and the white and brown exterior finish when Maunakea is covered in snow.

Figure 4-17 shows the naked eye view from Waikoloa in the northwest portion of the island. Figure 4-18 shows a binocular view simulation of the TMT Observatory, in the proposed 13N site with a reflective aluminum-like finish, as seen from Waikoloa. Figure 4-19 through Figure 4-21 are binocular view simulations of the TMT Observatory, as seen from Waikoloa when Maunakea is covered in snow, with the reflective aluminum-like, white and brown exterior finish.

As shown in these simulations while the white finish visually blends in with Maunakea when it is snow covered, it would be more visually prominent when the summit is bare. Conversely, the brown finish may blend better with the bare volcanic rock at the summit, but it would stand out more during the snow covered months. The reflective aluminum-like exterior finish reflects the colors of the sky and ground, which would better reflect its setting and have a reduced visual impact year round.

Figure 4-6. Naked Eye View of Maunakea from Waimea



Figure 4-7. Simulation of TMT Observatory, Aluminum-Like Finish – Binocular View from Waimea



Photo Credit: CFHT

Figure 4-8. Simulation of the TMT Observatory, White Finish – Binocular View from Waimea



Photo Credit: CFHT

Figure 4-9. Simulation of the TMT Observatory, Brown Finish – Binocular View from Waimea



Photo Credit: CFHT

Figure 4-10. Simulation of the TMT Observatory, Aluminum-Like Finish – Binocular View from Waimea with Snow



Photo Credit: Charles R. West Photography

Figure 4-11. Simulation of the TMT Observatory, White Finish – Binocular View from Waimea with Snow



Photo Credit: Charles R. West Photography

Figure 4-12. Simulation of the TMT Observatory, Brown Finish – Binocular View from Waimea with Snow



Photo Credit: Charles R. West Photography

Figure 4-13. Naked Eye View of Maunakea near Honoka'a



Figure 4-14. Simulation of the TMT Observatory, Aluminum-Like Finish – Binocular View from Honoka'a with Snow



Figure 4-15. Simulation of the TMT Observatory, White Finish – Binocular view from Honoka'a with Snow



Figure 4-16. Simulation of the TMT Observatory, Brown Finish – Binocular view from Honoka'a with Snow



Figure 4-17. Naked Eye View of Maunakea from Waikoloa



Figure 4-18. Simulation of the TMT Observatory, Aluminum-Like Finish – Binocular View from Waikoloa



Photo credit: CFHT

Figure 4-19. Simulation of the TMT Observatory, Aluminum-Like Finish – Binocular view from Waikoloa with Snow



Photo Credit: Charles R. West Photography

Figure 4-20. Simulation of the TMT Observatory, White Finish – Binocular view from Waikoloa with Snow



Photo Credit: Charles R. West Photography

Figure 4-21. Simulation of the TMT Observatory, Brown Finish – Binocular view from Waikoloa with Snow



Photo Credit: Charles R. West Photography

Views within the Summit Region

Although the TMT Observatory will not be visible from the summit of Maunakea, viewpoint 16, or Lake Waiau, viewpoint 17, it will be visible from other locations within the summit region; primarily, the northern plateau and the northern ridge of Kūkahau‘ula, viewpoint 18, where the Subaru, Keck, IRTF, and CFHT observatories are located. Figure 4-22 shows the current view from near the Keck Observatory, viewpoint 18, looking to the northwest over the northern plateau and the TMT Observatory 13N site. Figure 4-23 is a simulation of the TMT Observatory with an aluminum-like finish from the same viewpoint.

As the simulation in Figure 4-23 shows, the TMT Observatory will add a substantial new visual element in the landscape that will be visible from viewpoints along the northern ridge of Kūkahau‘ula and by people as they travel within the northern portion of the summit region. Views from the northern ridge of Kūkahau‘ula are now dominated by views of observatories, including Subaru, Keck, IRTF, and CFHT, which are located on this ridge. The majority of visitors/sightseers to the summit region and cultural practitioners visit the Kūkahau‘ula summit, not the northern ridge of Kūkahau‘ula. In addition, TMT’s lower elevation and minimal size and height mean it will not block the view of Maui from the ridge. Nevertheless, the TMT Observatory will add a substantial new visual element to a currently, relatively undeveloped portion of the summit region.

Figure 4-22. Naked Eye View from Near Keck Observatory, Viewing Northwest



Figure 4-23. Simulation of the TMT Observatory, Aluminum-Like Finish – from Near Keck Observatory, Viewing Northwest



Summary

The potential long-term visual impacts from the proposed 13N site for the TMT Observatory are summarized in Table 4-4.

Table 4-4. Proposed 13N Site - Summary of Potential Visual Impacts

Viewpoint	Location	Visual Impact				
		Is the TMT visible?	Visible in primary view?	Visible in silhouette?		
				No	Partial	Full
1	Hualālai Resort	Yes	No	--	164 feet (50 m)	--
2	Pu'u Waawaa	Yes	N/A[1]	--	58 feet (17 m)	--
3	Big Island Country Club	Yes	N/A[1]	--	82 feet (25 m)	--
4	Waikoloa/Mauna Lani	Yes	No	--	164 feet (50 m)	--
5	Hāpuna Beach	No	No	N/A		
6	Puukohola Heiau	Yes	No	--	164 feet (50 m)	--
7	DHHL Kawaihae at Route 250	Yes	Yes	X	--	--
8	Route 250 Pu'u Overlook	Yes	Yes	X	--	--
9	DHHL Lalamilo	Yes	Yes	--	49 feet (15 m)	--
10	Waimea Park	Yes	Yes	--	89 feet (27 m)	--
11	DHHL Pu'u Kapu	Yes	Yes	--	98 feet (30 m)	--
12	DHHL Waikoloa-Waialeale	Yes	Yes	--	164 feet (50 m)	--
13	Waipio Valley Lookout	No	N/A	N/A		
14	Honoka'a	Yes	No	--	82 feet (25 m)	--
15	Laupāhoehoe Point	No	N/A	N/A		
16	Maunakea Summit	No	N/A	N/A		
17	Lake Waiau	No	N/A	N/A		
18	North ridge of Kūkahau'ula	Yes	N/A1	--	--	X

[1] The primary view criterion is not applicable because at these viewpoints the panoramic view is important.

Visual Impact on Viewer Groups

Based on the above analysis, the following is a summary of the potential visual impacts on the three viewer groups from locating the TMT Observatory at the proposed 13N site.

Residents

Most residents of Hawai'i, such as in the cities of Hilo and Kailua-Kona, would not be able to see the TMT Observatory from their homes or public gathering places. From the viewshed analysis approximately 15 percent of the population (23,000 people) would be able to see at least the top of the TMT Observatory. Of these, it would only be within the direction of the primary view of 5.5 percent of the population (8,100 people) in the area around Waimea. However, residents that live outside of the viewshed would be able to see the TMT Observatory when they travel through and visit locations within the viewshed.

The TMT Observatory would also have a visual impact on residents in towns such as Waimea, Waikoloa and the area around Honoka'a. Within these towns the views of Maunakea that residents may have from their homes or gathering places, such as the Waimea Park (10), may be altered. The views from these viewpoints would be in partial silhouette (ranging from 15 meters at DHHL Lalamilo (9) to 50 meters at DHHL Waikoloa-Waialeale (12)), which could make the view more prominent, particularly in the morning when the facility would be back lit by the sun. The extent of the visual impact would be somewhat reduced by the times when the summit of Maunakea would be obscured by vog, clouds, or other causes of limited visibility. In general, the visual impact to the resident viewer group of Hawai'i would be less than significant. The impact to residents of Waimea, while slightly higher, would still be less than significant.

Sightseers

The visual experience for the sightseer viewer group would not be impacted by the TMT Observatory. This is because it would not be visible from the majority of the island including: the larger cities of Kona and Hilo; Volcanoes National Park; or from scenic viewpoints such as Waipio Valley Lookout (13) and Laupāhoehoe Point (15). From viewpoints, such as the Hualālai Resort (1), where the TMT Observatory could be visible, it would not be within the primary view and would not be expected to impact the visual experience. In addition, sightseers may be interested in astronomy, may plan on visiting the astronomy precinct and enjoy views of the TMT Observatory. The visual impact to sightseers on the island of Hawai'i would be less than significant.

Cultural Practitioners

Finally, as stated in Section 3.1.2, cultural practitioners on the Island of Hawai'i place a high value on pristine views of Maunakea. Of the three representative viewpoints that are from culturally important locations, the TMT Observatory would not be visible from two; the summit of Maunakea (16) and Lake Wai'au (17). The TMT Observatory could be visible from the summit of Pu'u Waawaa, where cultural practitioners may experience a visual impact. The silhouette analysis showed that from Pu'u Waawaa (2) the view of the TMT Observatory would be partially obstructed from a rise of Maunakea between the viewer and the observatory and that only the top 56 feet (17 meters) would be visible and in silhouette. The extent of the visual impact would be somewhat reduced at the times when the summit of Maunakea would be obscured by vog, clouds, or other causes of limited visibility.

Visual impacts are only a component of the Project's potential cultural impact. For information on the project's impacts to cultural practices see the *Cultural Impact Assessment, Thirty Meter Telescope*.

Overall Visual Impact

As discussed above, while the TMT Observatory would be a new visual element within the views of Maunakea (for approximately 14 percent of the island area and could be seen by approximately 15.4 percent of the population, or roughly 23,000 people) it would not obstruct or block existing views of Maunakea from around the Island of Hawai'i. Therefore, the Project would not exceed the applicable significance criteria in §11-200-12 of the HAR and would be expected to have a less than significant visual impact.

4.2.2 E2 Site

Temporary Impacts

Construction and Decommissioning

At the alternative E2 site the temporary visual impacts, from the proposed construction of the TMT Observatory and the potential future decommissioning of the TMT Observatory, would be the same as described in Section 4.2.1 for the proposed 13N site. These include the presence of construction equipment and workers, dust, and light and glare. These temporary impacts would be less than significant.

Long-Term Impacts

The long-term impacts from the alternative E2 site would be similar to the long-term impacts of the proposed 13N site.

Scenic Vistas and Viewplanes

Locating the TMT Observatory at the alternative E2 site would not substantially affect scenic vistas and viewplanes identified in the Hawai'i County General Plan or the South Kohala Development Plan. The TMT Observatory would not be visible in the view from Hilo Bay with Maunakea in the background. The TMT Observatory would not be visible in the view of Maunakea from Pahoa-Kea'au, Volcano-Kea'au Roads, and various Puna subdivisions or from locations where Hilo Bay is visible with Maunakea in the background. Although the TMT Observatory may be visible in the view of Maunakea from portions of the South Kohala district and the area around Waimea, it would not block the views and viewplanes of the mountain. Therefore, the project would not exceed significance criteria 12 as stated in §11-200-12 of the HAR.

Viewshed Analysis

The results of the viewshed analysis for the alternative E2 site are shown in Figure 4-24. The viewshed analysis confirms that, because it would be located north of and below the summit of Maunakea, the TMT Observatory would not be visible in the southern portion of the island; this includes the large cities of Hilo and Kailua-Kona. According to the viewshed analysis the TMT Observatory would be visible from about 13 percent of the area of the island (see Table 4-5). According to U.S. Census data, approximately 15.1 percent of the Island of Hawai'i's population (approximately 22,500 people) would be within the viewshed of the TMT Observatory at the alternative E2 site. Others, including visitors and island residents that reside outside the viewshed, would be able to see the TMT Observatory when they travel through and visit locations within the viewshed. Of the representative viewpoints, the TMT Observatory could be visible from viewpoints 1 through 12 and viewpoint 18. The TMT Observatory would not be visible from viewpoints 13 through 17.

Figure 4-24. E2 Alternative Site – Viewshed and Primary View Analysis

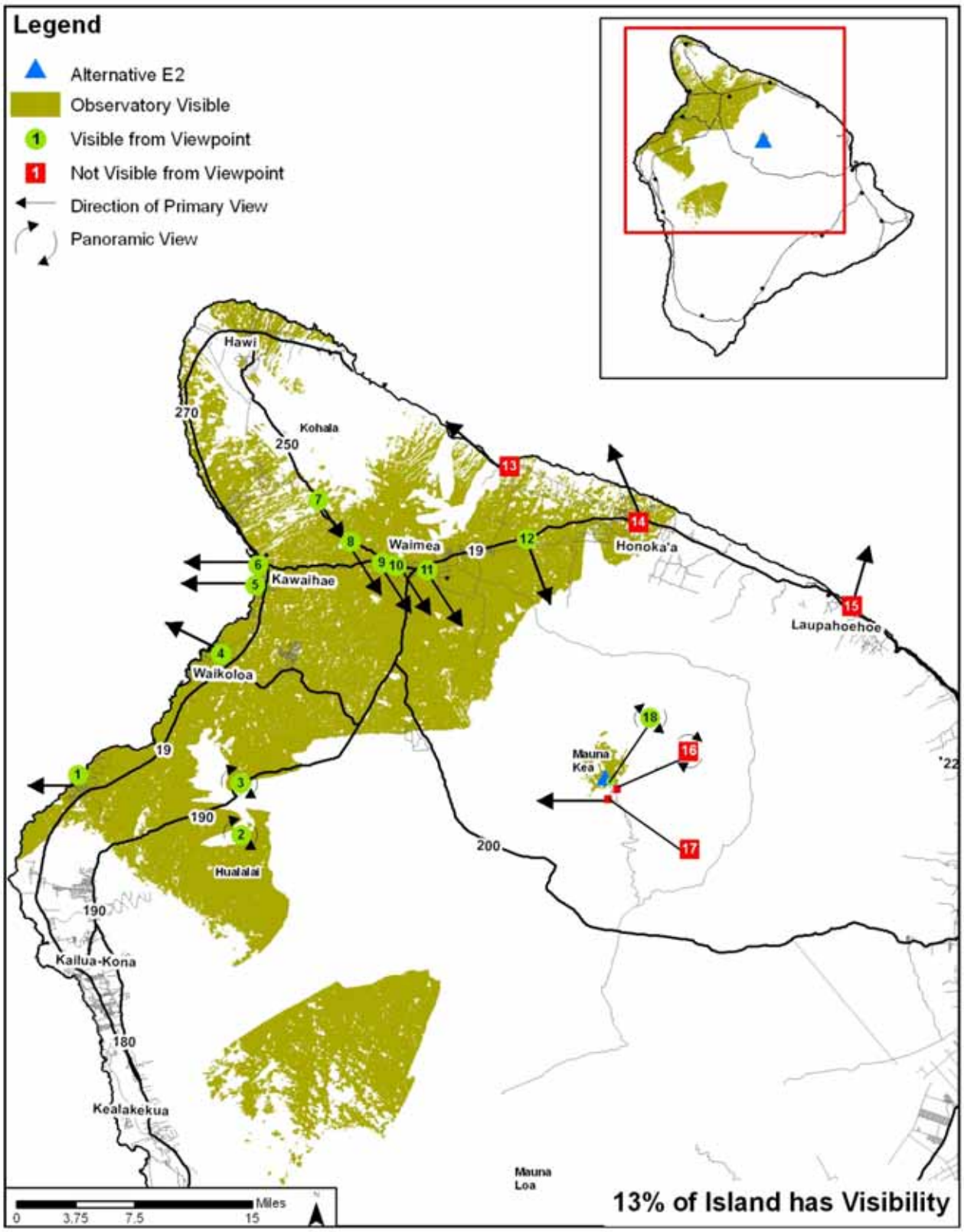


Table 4-5. Visibility of Alternative E2 Site

Visibility	Area of Island (%)	Hawai'i's Population	
		%	People
Visible	13%	15.1%	22,500
Not Visible	87%	84.9%	126,200

Table 4-6 divides the viewshed, and the population within the viewshed, into five areas: Waimea, Honoka'a, Hāwī, Waikoloa and Kawaihae, and Hualālai. Of these areas, the TMT Observatory would be visible in the primary view direction only from the area around Waimea. For the other four areas the primary view direction is toward the ocean. Of the island's population 5.4 percent (approximately 8,000 people) are within the area around Waimea and may be able to see the TMT Observatory.

Table 4-6. Visibility of the Alternative E2 Site within the Primary View Direction

Location	Hawai'i's Population		Primary View Direction?
	%	People	
Waimea	5.4%	8,000	Yes
Honoka'a	2.8%	4,200	No
Hāwī	2.6%	3,900	No
Waikoloa and Kawaihae	4.3%	6,400	No
Hualālai	0.04%	66	No

Primary View

Of the 13 viewpoints where the TMT Observatory may be visible, it would not be within the primary view of four; the Hualālai Resort (1), Waikoloa/Mauna Lani (4), Hāpuna Beach (5) and Puukohola Heiau (6). At these coastal locations, the primary view is westward makai.

The TMT Observatory could be visible and in the primary view direction from viewpoints along Highway 250 (7 and 8) and around the town of Waimea (9, 10, 11 and 12). The TMT Observatory could also be visible from the Big Island Country Club (3), from the summit of Pu'u Waawaa (2), and from the North ridge of Maunakea summit cinder cone (Kūkahau'ula) (18) where the panoramic view of the water, the surrounding area, and Maunakea would be important to the viewer.

Silhouette View

With the alternative E2 site the TMT Observatory would be in partial silhouette from all 13 of the viewpoints where it would be visible. Table 4-7 summarizes the silhouette analysis for the TMT Observatory at the alternative E2 site. The results of the silhouette analysis are shown in Appendix C.

Table 4-7. Alternative E2 Site - Silhouette Analysis

Viewpoint	Location	Portion of TMT Observatory in Silhouette		
		None	Partial	Full
1	Hualālai Resort	--	141 feet (43 m)	--
2	Pu'u Waawaa	--	43 feet (13 m)	--
3	Big Island Country Club	--	17 feet (5 m)	--
4	Waikoloa/Mauna Lani	--	148 feet (45 m)	--
5	Hāpuna Beach	--	144 feet (44 m)	--
6	Puukohola Heiau	--	105 feet (32 m)	--
7	DHHL Kawaihae at Route 250	X	--	--
8	Route 250 Pu'u Overlook	X	--	--
9	DHHL Lalamilo	--	40 feet (12 m)	--
10	Waimea Park	--	62 feet (19 m)	--
11	DHHL Pu'u Kapu	--	105 feet (32 m)	--
12	DHHL Waikoloa-Waialeale	--	128 feet (39 m)	--
13	Waipio Valley Lookout	Not Visible		
14	Honoka'a	Not Visible		
15	Laupāhoehoe Point	Not Visible		
16	Maunakea Summit	Not Visible		
17	Lake Wai'au	Not Visible		
18	North ridge of Maunakea summit cinder cone (Kūkahau'ula)	--	17 feet (5 m)	--

From the two viewpoints along Highway 250 (7 and 8) the view of the TMT Observatory would not be in silhouette; the observatory would be visible against the backdrop of Maunakea. This may reduce the prominence of the TMT Observatory in the view from these locations; particularly at sunset, when Maunakea would be back-lit by the setting sun. From the coastal locations of Hualālai Resort (1), Waikoloa/Mauna Lani (4), Hāpuna Beach (5), and Puukohola Heiau (6) between 105 feet (32 meters) and 148 feet (45 meters) of the TMT Observatory would be in silhouette. From these viewpoints the TMT Observatory would not be located within the direction of the primary view, which is toward the water.

In the area around Waimea (viewpoints 9 through 12), where the TMT Observatory would be visible within the direction of the primary view, the amount of the partial silhouette would range from 40 feet (12 meters) to 128 feet (39 meters). The silhouette analysis showed that from the Big Island Country Club (3) and Pu'u Waawaa (2) the view of the TMT Observatory would be partially obstructed from a rise of Maunakea between the viewer and the observatory. From portions of the Big Island Country Club only the top 16 feet (5 meters) of the TMT Observatory would be visible and in silhouette. From the summit of Pu'u Waawaa the top 43 feet (13 meters) would be visible and in silhouette.

In addition to the topography of Maunakea limiting the silhouette of the TMT Observatory, the existing observatories can also affect the silhouette view. The areas where the view of the TMT Observatory would be in front of one of the existing observatories would be similar to what is shown in Figure 4-5.

Photo Simulations

Photo simulations specific to the alternative E2 site were not created. Because the E2 site is located less than 1,000 feet south of the proposed 13N site the visual representations of the TMT Observatory shown in Figure 4-7 through Figure 4-21 for the 13N site would be very similar for the alternative E2 site.

Summary

The potential long term visual impacts of the alternative E2 site for the TMT Observatory are summarized in Table 4-8.

Table 4-8. E2 Alternative Site - Summary of Potential Visual Impacts

Viewpoint	Location	Visual Impact				
		Is the TMT visible?	Visible in primary view?	Visible in silhouette?		
				No	Partial	Full
1	Hualālai Resort	Yes	No	--	141 feet (43 m)	--
2	Pu'u Waawaa	Yes	N/A[1]	--	43 feet (13 m)	--
3	Big Island Country Club	Yes	N/A[1]	--	17 feet (5 m)	--
4	Waikoloa/Mauna Lani	Yes	No	--	148 feet (45 m)	--
5	Hāpuna Beach	Yes	No	--	144 feet (44 m)	--
6	Puukohola Heiau	Yes	No	--	105 feet (32 m)	--
7	DHHL Kawaihae at Route 250	Yes	Yes	X	--	--
8	Route 250 Pu'u Overlook	Yes	Yes	X	--	--
9	DHHL Lalamilo	Yes	Yes	--	40 feet (12 m)	--
10	Waimea Park	Yes	Yes	--	62 feet (19 m)	--
11	DHHL Pu'u Kapu	Yes	Yes	--	105 feet (32 m)	--
12	DHHL Waikoloa-Waialeale	Yes	Yes	--	128 feet (39 m)	--
13	Waipio Valley Lookout	No	N/A	N/A		
14	Honoka'a	No[2]	N/A	N/A		
15	Laupāhoehoe Point	No	N/A	N/A		
16	Maunakea Summit	No	N/A	N/A		
17	Lake Wai'au	No	N/A	N/A		
18	North ridge of Maunakea summit cinder cone (Kūkuhau'ula)	Yes	N/A1	--	17 feet (5 m)	--

[1] The primary view criterion is not applicable because at these viewpoints the panoramic view is important.
[2] At the specific location for Honoka'a used in the visual analysis the TMT Observatory was not visible. However, there are portions of Honoka'a where the TMT Observatory would be visible.

Visual Impact on Viewer Groups

Based on the above analysis, the following is a summary of the potential visual impacts on the three viewer groups from locating the TMT Observatory at the proposed alternative E2 site.

Residents

Most residents of the Island of Hawai'i would not be able to see the TMT Observatory in the alternative E2 site. From the viewshed analysis 15.1 percent of the population (approximately 22,500 residents) would be able to see at least the top of the TMT Observatory. Of these, it would only be within the primary view direction of 5.4 percent of the population (approximately 8,000 residents). However, residents that live outside of the viewshed would be able to see the TMT Observatory when they travel through and visit locations within the viewshed.

The TMT Observatory could also have a visual impact on residents in towns such as Waimea, Waikoloa and the area around Honoka'a. These residents may have their views of Maunakea from their homes, or gathering places, altered by the facility. The views from these viewpoints would be in partial silhouette (ranging from 40 feet (12 meters) (10) to 130 feet (39 meters) (12)), which could make the view more prominent, particularly in the morning when the facility would be back lit by the sun. The extent of the visual impact would be somewhat reduced by the times when the summit of Maunakea would be obscured by vog, clouds, or other causes of limited visibility. In general, the visual impact to the resident viewer group would be less than significant. The impact to residents of Waimea, while slightly higher, would still be less than significant.

Sightseers

The visual experience for the sightseer viewer group would not be impacted by the TMT Observatory. This is because it would not be visible from the majority of the island. From viewpoints, such as Hāpuna Beach (5), where the TMT Observatory could be visible, it would not be within the primary view and would not be expected to impact their visual experience. In addition, some sightseers may be interested in astronomy, may plan on visiting the astronomy precinct and enjoy views of the facility. The visual impact to sightseers would be less than significant.

Cultural Practitioners

Finally, as stated in 3.1.2, cultural practitioners on the Island of Hawai'i place a high value on pristine views of Maunakea. Of the three representative viewpoints that are from culturally important locations, the TMT Observatory would not be visible from two; the summit of Maunakea (17) and Lake Wai'au (18). The TMT Observatory could be visible from the summit of Pu'u Waawaa, where cultural practitioners may experience a visual impact. The silhouette analysis showed that from Pu'u Waawaa (2) the view of the TMT Observatory would be partially obstructed from a rise of Maunakea between the viewer and the observatory and that only the top 43 feet (13 meters) would be visible and in silhouette. The extent of the visual impact would be somewhat reduced by the times when the summit of Maunakea would be obscured by vog, clouds, or other causes of limited visibility.

Visual impacts are only a component of the Project's potential cultural impact. For information on the Project's impacts to cultural practices see the *Cultural Impact Assessment, Thirty Meter Telescope*.

Overall Visual Impact

As discussed above, while the TMT Observatory would be a new visual element within the views of Maunakea (for approximately 13 percent of the island area and could be seen by approximately 15.1 percent of the population, or roughly 22,500 people) it would not obstruct or block existing views of Maunakea from around the Island of Hawai'i. Therefore, the Project would not exceed the applicable significance criteria in §11-200-12 of the HAR and would be expected to have a less than significant visual impact.

4.2.3 Indirect and Cumulative

Indirect Impacts

The TMT Observatory is not expected to have any indirect visual impacts.

Cumulative Impacts

A cumulative impact is the incremental impact of a proposed project together with other past, present and reasonably foreseeable future actions. For cumulative visual impacts, the analysis for the TMT Observatory looks at the following two components:

- Would the TMT Observatory be visible in an area of the island where currently no telescopes are visible?
- Which areas of the island would the TMT Observatory be visible in addition to the existing telescopes?

Proposed 13N Site

Table 4-9 summarizes the cumulative visual impact of the TMT Observatory at the proposed 13N site.

Table 4-9. Cumulative Visibility of Proposed 13N Site

Visibility	Area of Island (%)	Hawai'i's Population	
		%	People
Existing	43%	72%	107,000
New (TMT)	1.2%	Less than 1%	72

Figure 4-25 shows the visibility/viewshed of the existing summit observatories on Maunakea (see Section 3.1.4) combined with the viewshed of the TMT Observatory at the proposed 13N site. The green shaded area indicates where the existing summit observatories on Maunakea are visible. This area is approximately 43 percent of the island and is home to approximately 72 percent of the Island of Hawai'i's population. The portions of the island that are shaded in red are areas where the TMT Observatory would be visible where currently none of the existing telescopes can be seen. The new area where a telescope would be visible is roughly 1.2 percent of the area of the Island of Hawai'i. The majority of this new area is ranch land south of Waimea. Off of Saddle Road there is a residential area, Waikii Ranch, which would be within the area where the TMT Observatory would be the only visible observatory. Using the 2000 U.S. Census average household size of 2.75 people for the County of Hawai'i, the estimated

number of people living in this area is 72 (substantially less than 1 percent of the island's population).

Figure 4-25. Proposed 13N Site – Cumulative Visibility Analysis

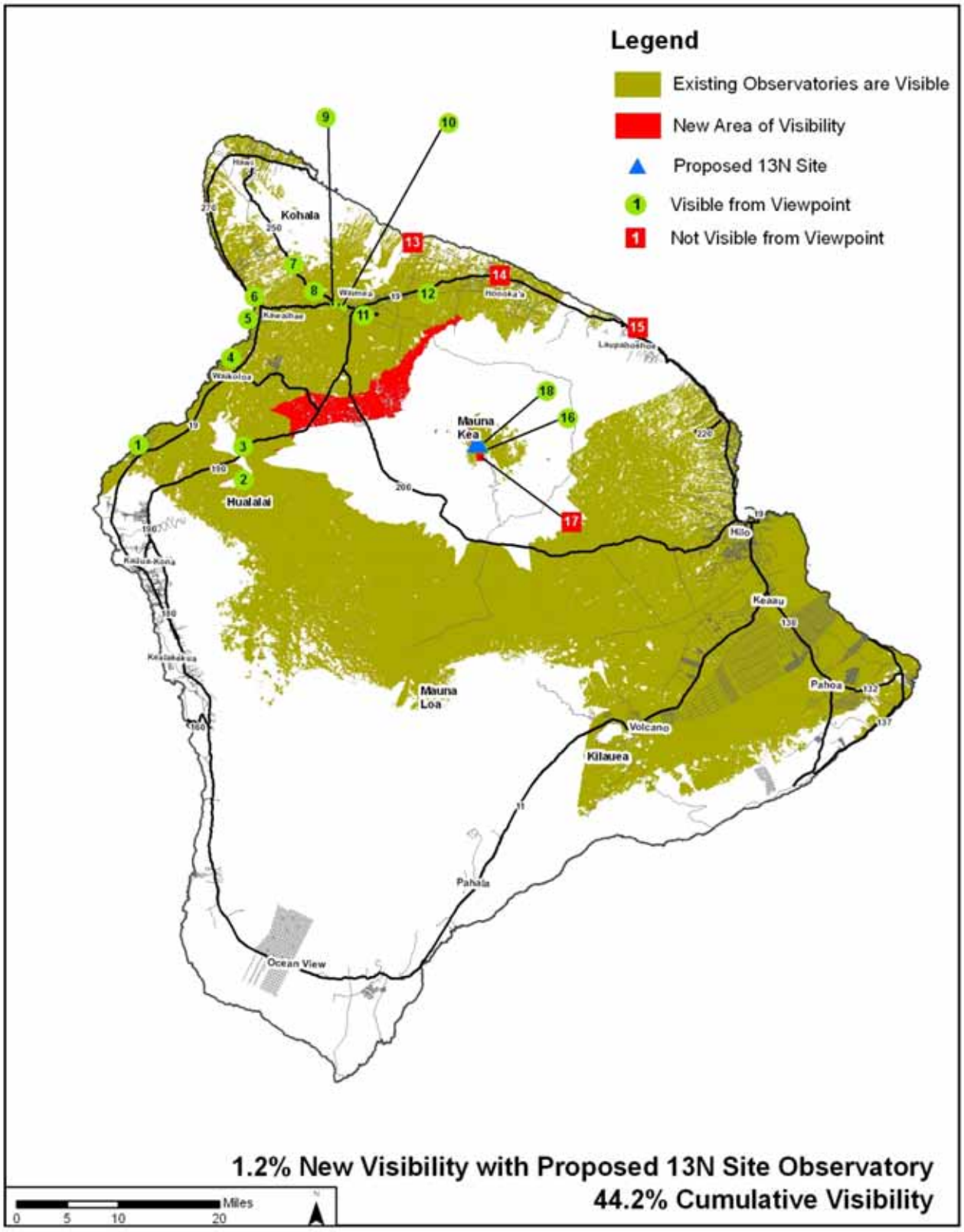


Table B-1, in Appendix B, shows which of the existing observatories are visible at the 18 representative viewpoints. At the viewpoints where the TMT Observatory would be visible, six to eight of the existing 11 summit observatories are currently visible.

The visual impact of the existing observatories on Maunakea is significant; particularly considering the visual sensitivity of the cultural practitioner viewer group. The visual impact of the TMT Observatory at the proposed 13N site would be less than significant. Nonetheless, when combined with the past, present (existing conditions) and reasonably foreseeable future actions the cumulative visual impact of development on and near the summit of Maunakea, including the proposed TMT Observatory, would continue to be significant.

E2 Alternative Site

The cumulative visual impact of the TMT Observatory at the alternative E2 site would be similar to the proposed 13N site.

Table 4-10 summarizes the cumulative visual impact. Figure 4-26 shows the visibility/viewshed of the existing observatories combined with the viewshed of the TMT Observatory at the alternative E2 site. The new area where a telescope would be visible is roughly 0.9 percent of the area of the Island of Hawai'i. The majority of this new area is ranch land south of Waimea. Off of Saddle Road there is a residential area that would be within the area where the TMT Observatory would be the only telescope visible. Using the 2000 U.S. Census average household size of 2.75 people for the County of Hawai'i, the estimated number of people living in this area is 28 (substantially less than 1 percent of the Island of Hawai'i's population).

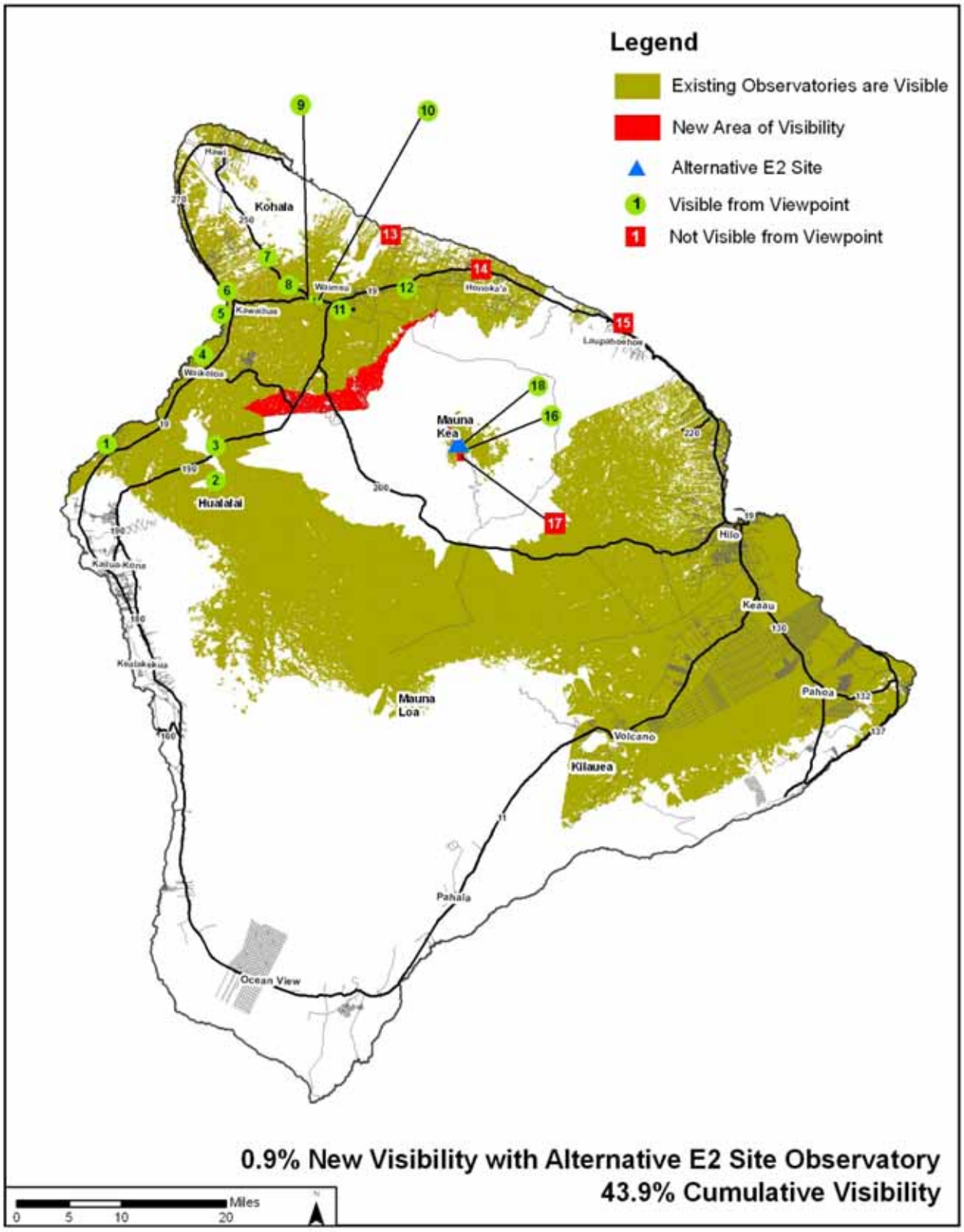
Table 4-10. Cumulative Visibility of Alternative E2 Site

Visibility	Area of Island (%)	Hawai'i's Population	
		%	People
Existing	43%	72%	107,000
New (TMT)	0.9%	Less than 1%	28

Table B-1, in Appendix B, shows which of the existing observatories are visible at the 18 representative viewpoints. At the viewpoints where the TMT Observatory would be visible, six to eight of the existing 11 summit observatories are currently visible.

The visual impact of the existing observatories on Maunakea is significant; particularly considering the visual sensitivity of the cultural practitioner viewer group. The visual impact of the TMT Observatory at the alternative E2 site would be less than significant. Nonetheless, when combined with the past, present (existing conditions) and reasonably foreseeable future actions the cumulative visual impact of development on and near the summit of Maunakea, including the proposed TMT Observatory, would continue to be significant.

Figure 4-26. E2 Alternative Site – Cumulative Visibility Analysis



5.0 Mitigation

5.1 No Build Alternative

There are no Project visual impacts from the No Build Alternative, therefore mitigation is not proposed.

5.2 Maunakea

The proposed location for the TMT Observatory is the primary mitigation for the Project's potential visual impacts. As shown in Section 4.2 because the proposed location of the TMT Observatory is north of and below the summit of Maunakea it would be visible in roughly 14 percent of the Island of Hawai'i and to approximately 15 percent of the population (23,000 people). This is significantly different than if the TMT Observatory were to be placed in a more visible location, such as the summit ridge or pu'u.

The visual impacts of the TMT Observatory, which would house a telescope with a mirror 98 feet (30 meters) in diameter, are also due to the size of the dome enclosure. The proposed diameter of the TMT dome is 216 feet (66 meters). Because the center of the dome would be placed only 36 feet (11 meters) off the ground surface the TMT Observatory would have a height of approximately 180 feet (55 meters) above grade level. This would be the tallest observatory on Maunakea. However, the TMT telescope and the dome enclosure have been designed to minimize the height of the structure, which in turn minimizes the visual impacts (Figure 5-1). The TMT telescope itself has been designed to be much shorter to allow for a much smaller dome. In addition, the enclosure has been designed to fit very tightly around the telescope, leaving only about 20 inches between the telescope and the dome; just enough room for a person.

For comparison purposes, the Keck Observatory consists of two telescopes each with mirrors 33 feet (10 meters) in diameter. The diameter of each Keck dome is 121 feet (37 meters); the height of the Keck dome and other observatories on Maunakea are listed in Table 3-2. Using this ratio of mirror to dome size the TMT telescope would result in a dome with a diameter of 364 feet (111 meters); almost twice what is proposed (Figure 5-2).

Finally, the color, or coating, of the dome enclosure has substantial visual implications. As discussed in Section 4.2 the fixed enclosure and support facilities would be painted with colors that would blend into the landscape. The coating of the dome enclosure would be a reflective aluminum-like finish, similar to the Subaru Observatory. In general, the visual impacts of the existing observatories on Maunakea with an aluminum-like finish (such as Gemini, IRTF and Subaru) are that they reflect the morning sunrise and evening sunset light and stand out during this period. However, during most of the day the coating can reflect the sky, which helps reduce the visibility of the observatory.

Figure 5-1: Overview of TMT Telescope and Dome Design

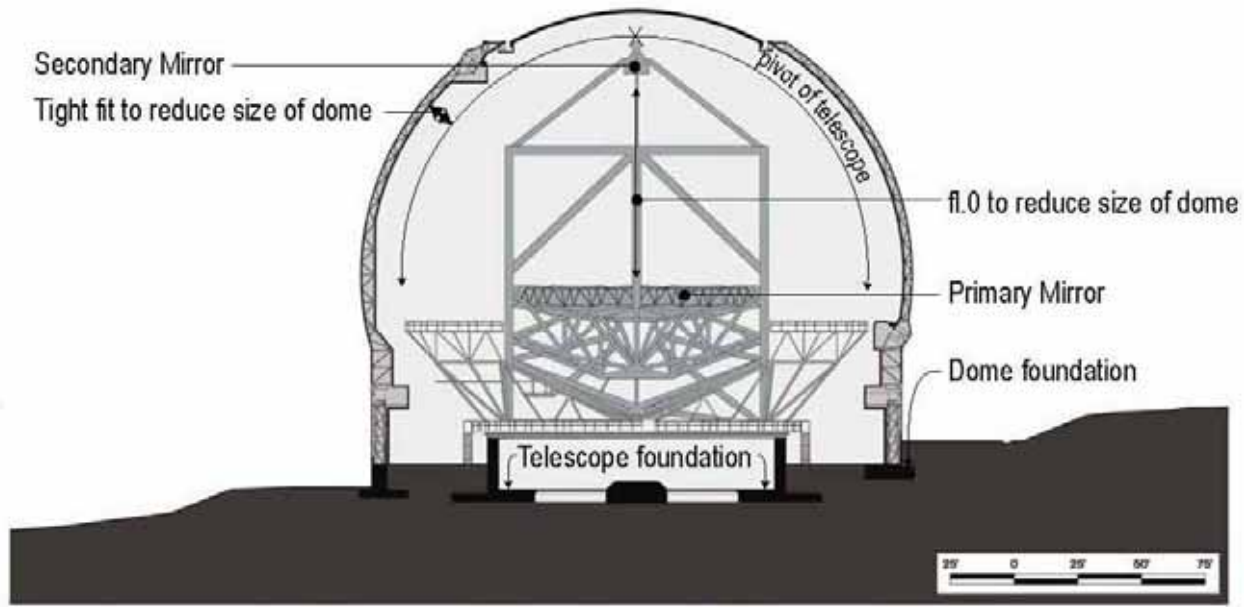
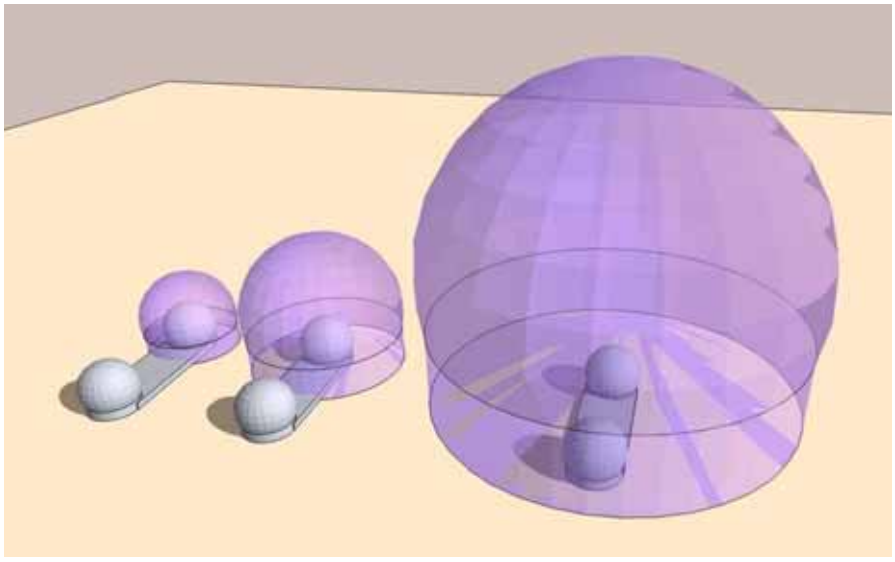


Figure 5-2: Comparison of Observatory Dome Sizes to Telescope Focal Ratios



In summary, the location and design of the TMT Observatory incorporate measures that mitigate for the potential visual impacts. No further visual mitigation measures are proposed.

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Appendix A. Photographs of or from the Representative Viewpoints

Viewpoint 1: Hualālai Resort

Photo not available.

Viewpoint 2: Pu'u Waawaa

Photo not available.

Viewpoint 3: Big Island Country Club



Viewpoint 4: Waikoloa/Mauna Lani (View toward Maunakea)



Viewpoint 5: Hāpuna Beach (Primary View)



Viewpoint 6: Puukohola Heiau (Primary View)





Viewpoint 7: DHHL Kawaihae at Rt. 250 (In the direction of Maunakea)



Viewpoint 8: Route 250 Pu'u Overlook (Primary View)



Viewpoint 9: DHHL Lalamilo (Primary View)



Viewpoint 10: Waimea Park (Primary View)



Viewpoint 11: DHHL Pu'u Kapu (Primary View)



Viewpoint 12: DHHL Waikoloa-Waialeale (Primary View)



Viewpoint 13: Waipio Valley Lookout (Primary View)



Viewpoint 14: Honoka'a (Primary View)



Viewpoint 15: Laupāhoehoe Point (Primary View, Top Photo)





Viewpoint 16: Maunakea Summit





Viewpoint 17: Lake Wai'au (Primary View)



Viewpoint 18: North ridge of Maunakea summit cinder cone (Kūkuhau'ula)



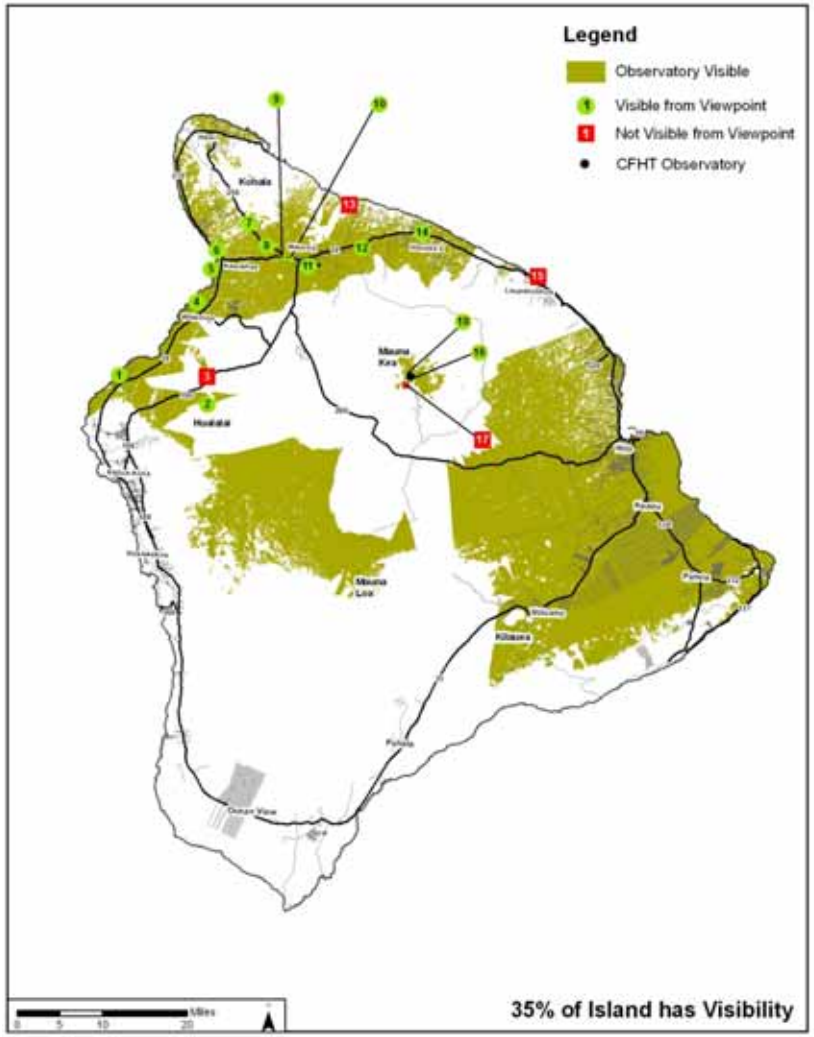
Appendix B. Viewsheds of Existing Observatories

Table B-1. Visibility of the TMT Observatory and the Existing Observatories from the Representative Viewpoints

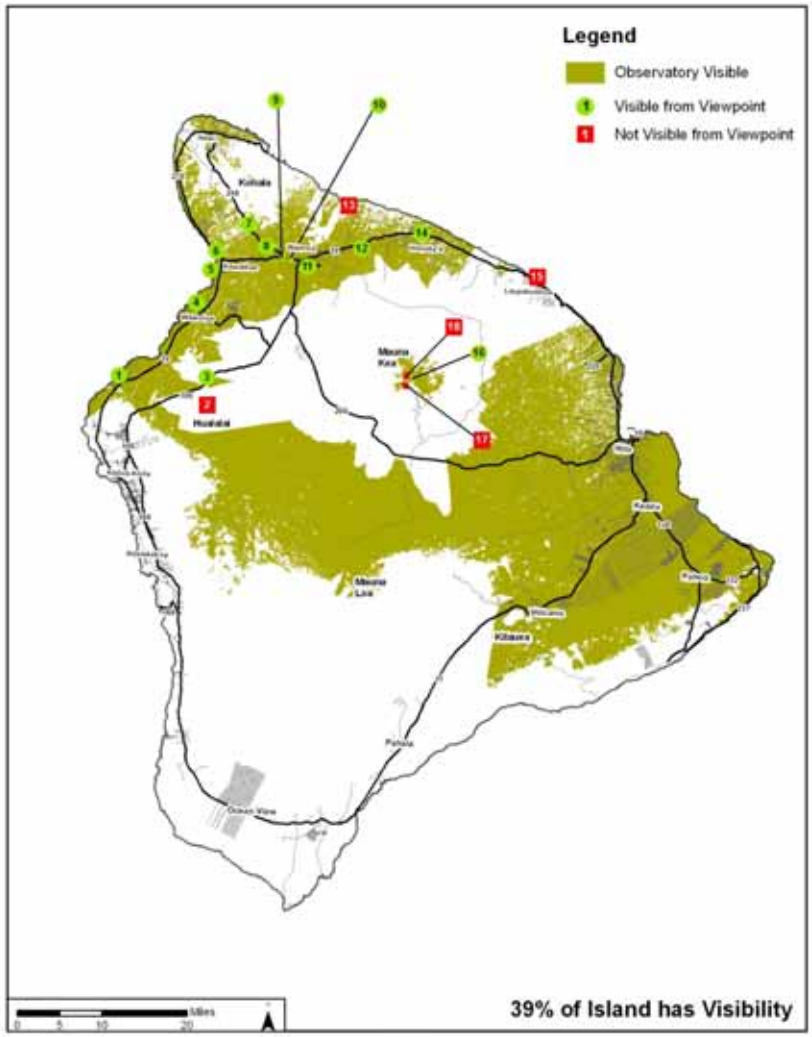
Viewpoint Number	Viewpoint Name	TMT Proposed 13N Site	TMT Alternative E2 Site	CFHT	Gemini	UH 2.2 M	IRTF	Keck	UKIRT	Subaru	Hilo	CSO	JCMT	SMA
1	Hualālai Resort	X	X	X	X	X	X	X		X				
2	Pu'u Waawaa	X	X	X			X	X		X				
3	Big Island Country Club	X	X		X			X		X				
4	Waikoloa/Mauna Lani	X	X	X	X	X	X	X	X	X				
5	Hāpuna Beach		X	X	X	X	X	X	X	X	X			
6	Puukohola Heiau	X	X	X	X	X	X	X	X	X	X			
7	DHHL Kawaihae at Route 250	X	X	X	X	X	X	X	X	X	X		X	X
8	Route 250 Pu'u Overlook	X	X	X	X	X	X	X	X	X				X
9	DHHL Lalamilo	X	X	X	X	X	X	X		X				
10	Waimea Park	X	X	X	X	X	X	X		X				
11	DHHL Pu'u Kapu	X	X	X	X	X	X	X		X				
12	DHHL Waikoloa-Waialeale	X	X	X	X	X	X	X	X	X				
13	Waipio Valley Lookout													
14	Honoka'a	X		X	X	X	X	X	X					
15	Laupāhoehoe Point													
16	Maunakea Summit			X	X	X			X	X	X			
17	Lake Wai'au													
18	North ridge of Kūkahau'ula	X	X	X			X	X						

CFHT = Canada France Hawai'i Telescope Gemini = Gemini Northern Observatory UH 2.2M = University of Hawai'i 2.2 m IRTF = NASA Infrared Telescope Facility Keck = W.M. Keck Observatory UKIRT = United Kingdom Infrared Telescope Subaru = Subaru Observatory CSO = California Institute of Technology Submillimeter Observatory Hilo = University of Hawi'i 0.9 m JCMT = James Clerk Maxwell Telescope SMA = Submillimeter Array

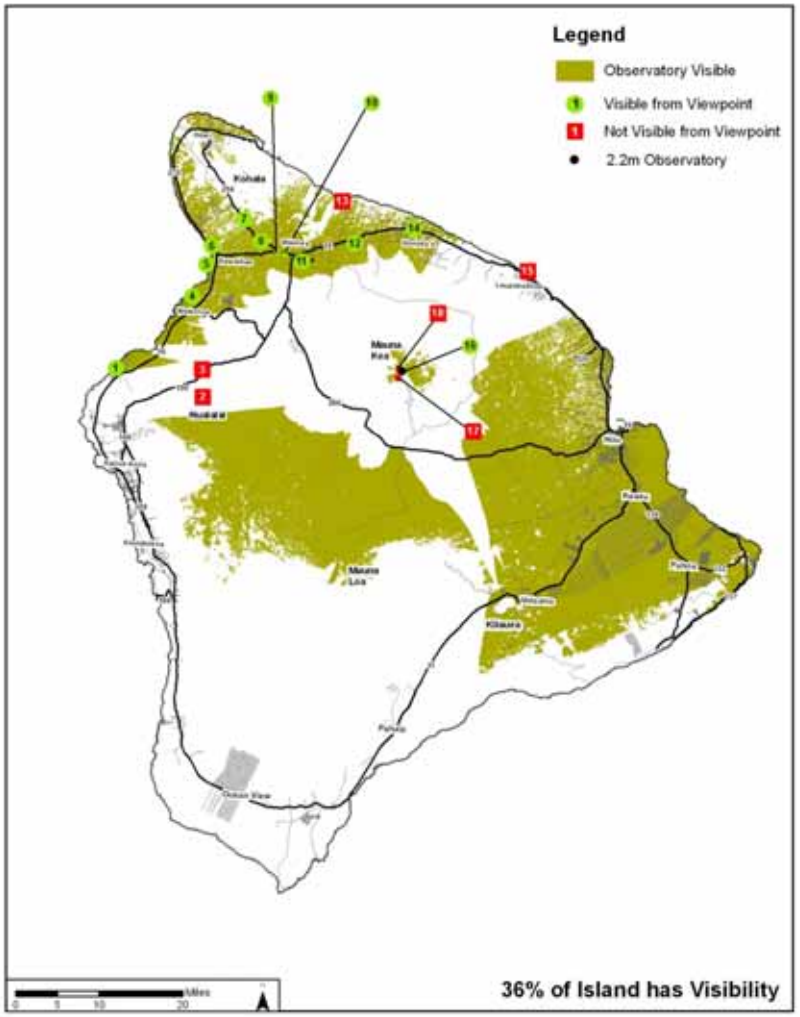
1) Canada-France-Hawaii Telescope (CFHT)



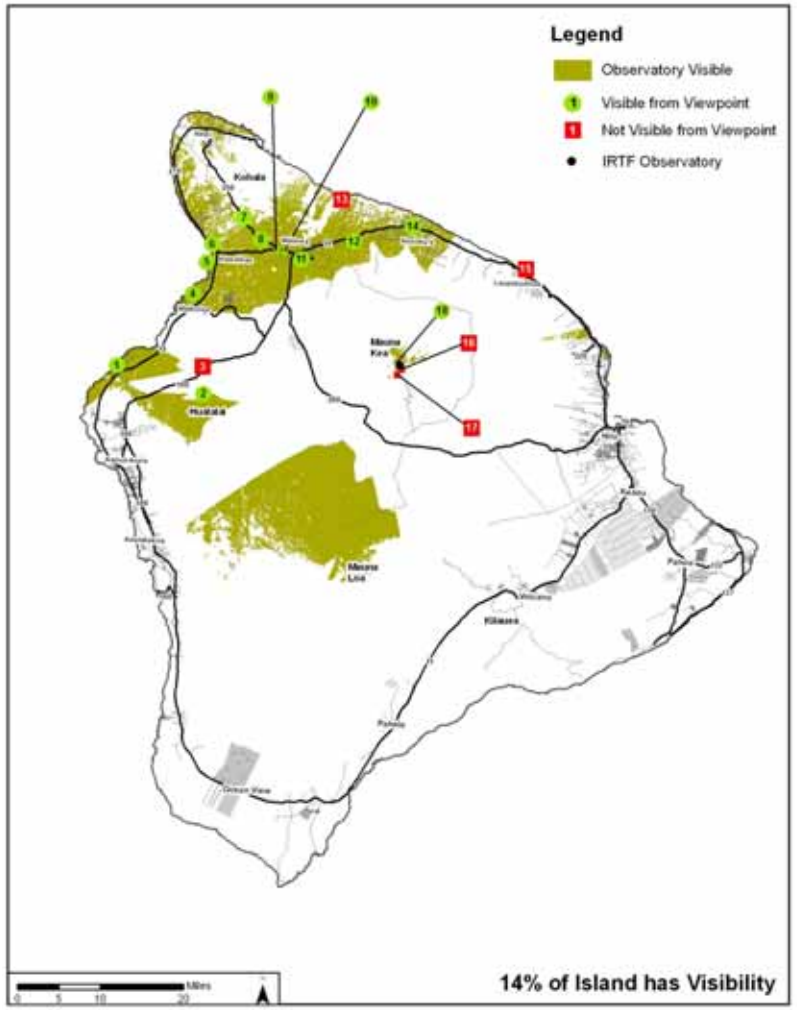
2) Gemini Northern Observatory



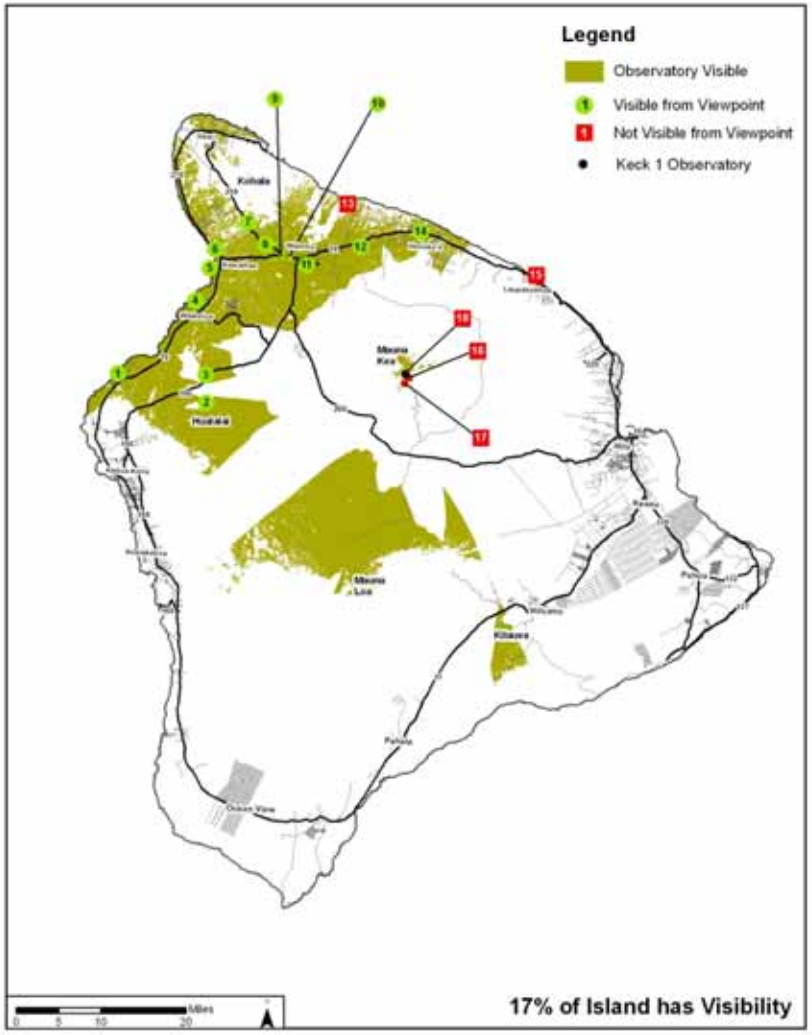
3) University of Hawaii 2.2 m Observatory

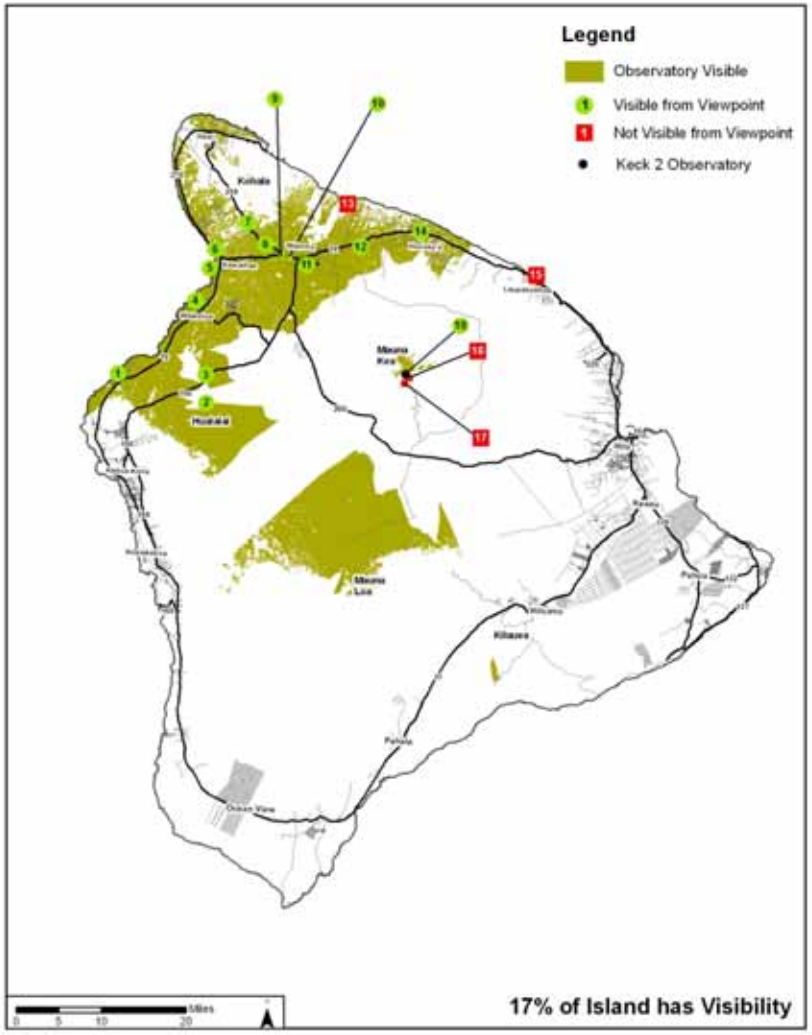


4) NASA Infrared Telescope (IRTF)

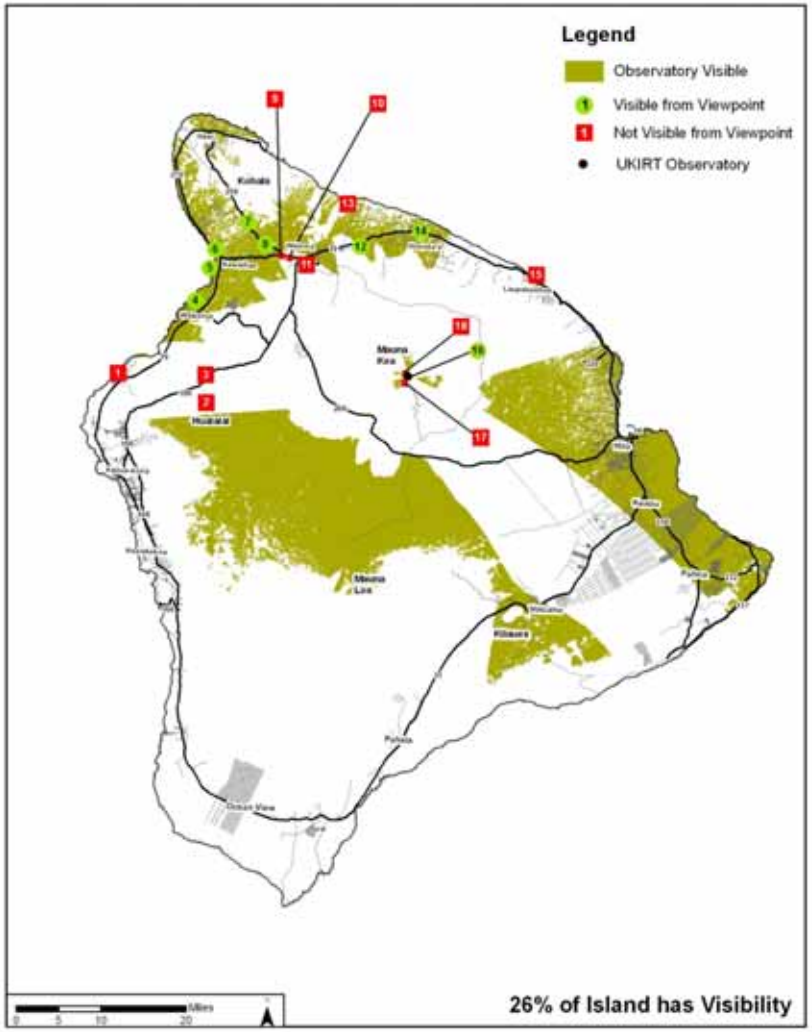


5) Keck 1 and Keck 2

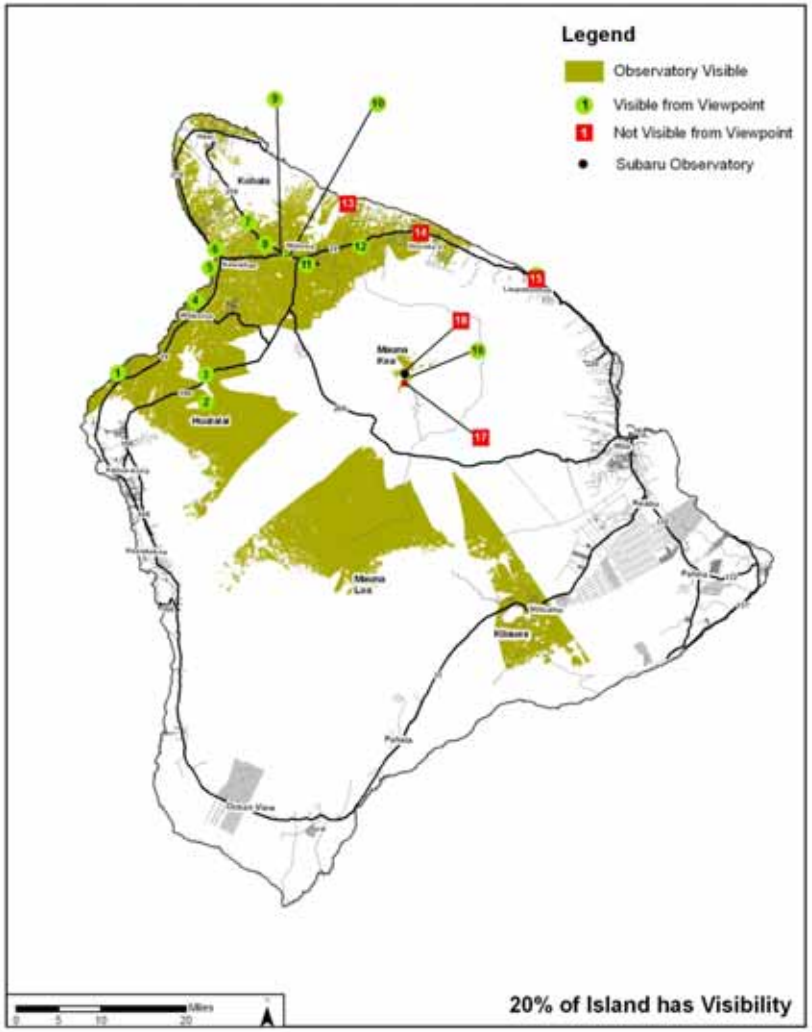




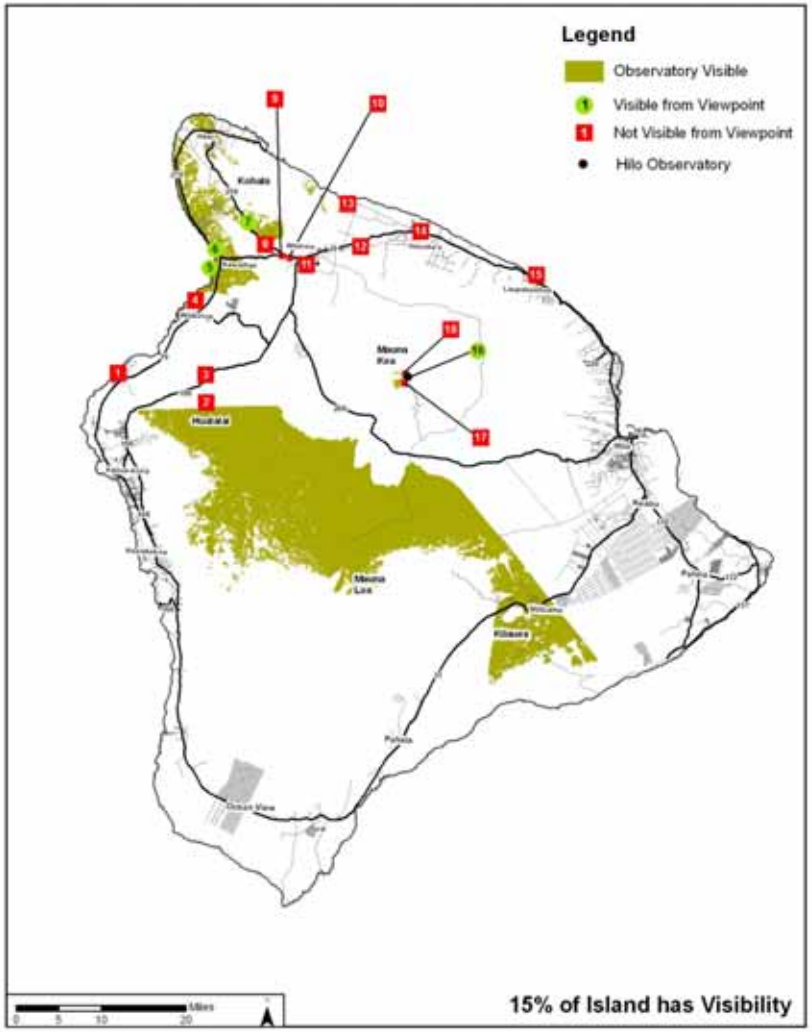
6) United Kingdom Infrared Telescope (UKIRT)



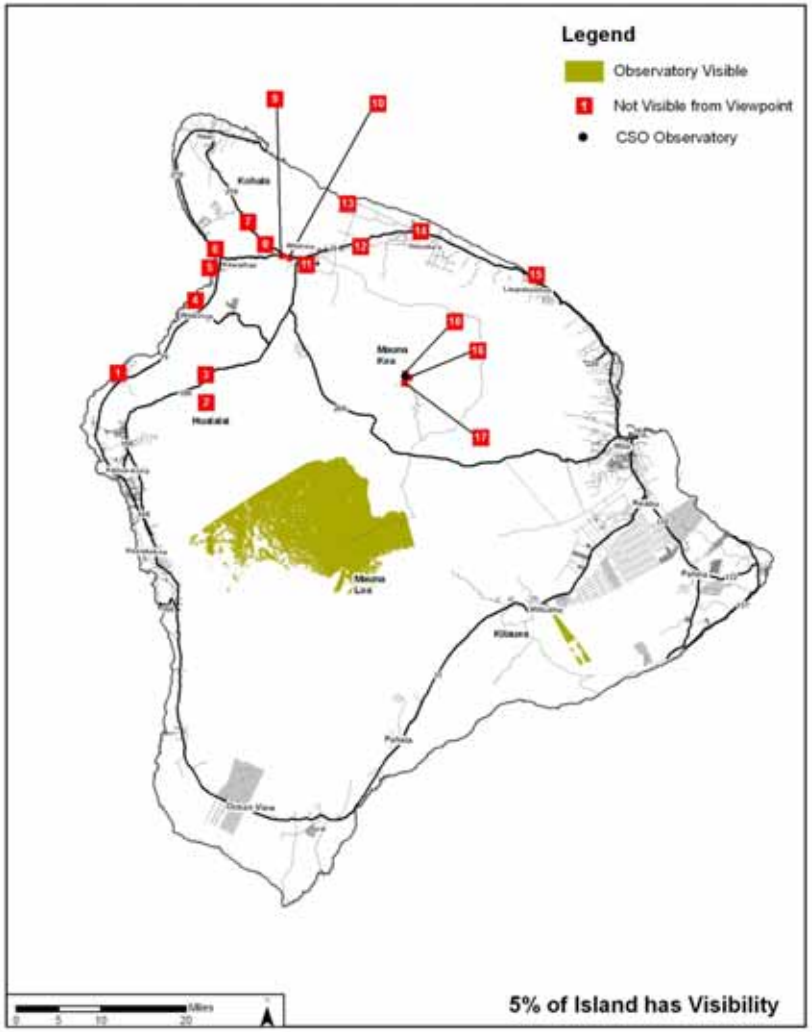
7) Subaru Observatory



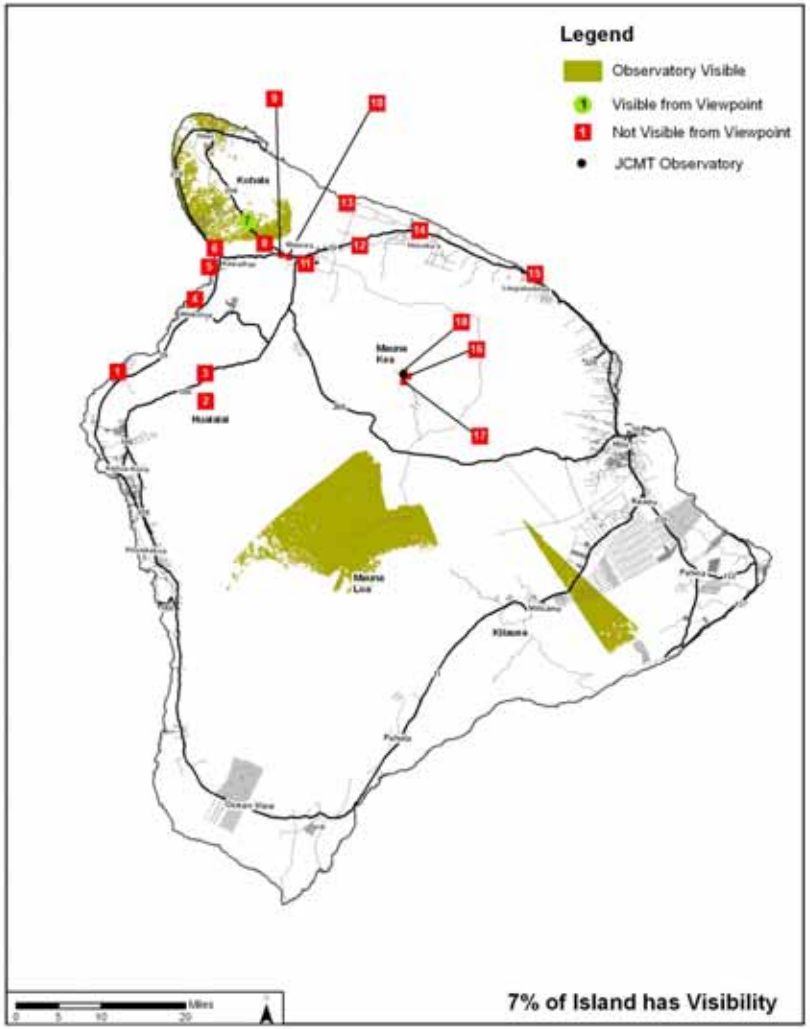
8) University of Hawaii 0.9 m Telescope (Hilo)



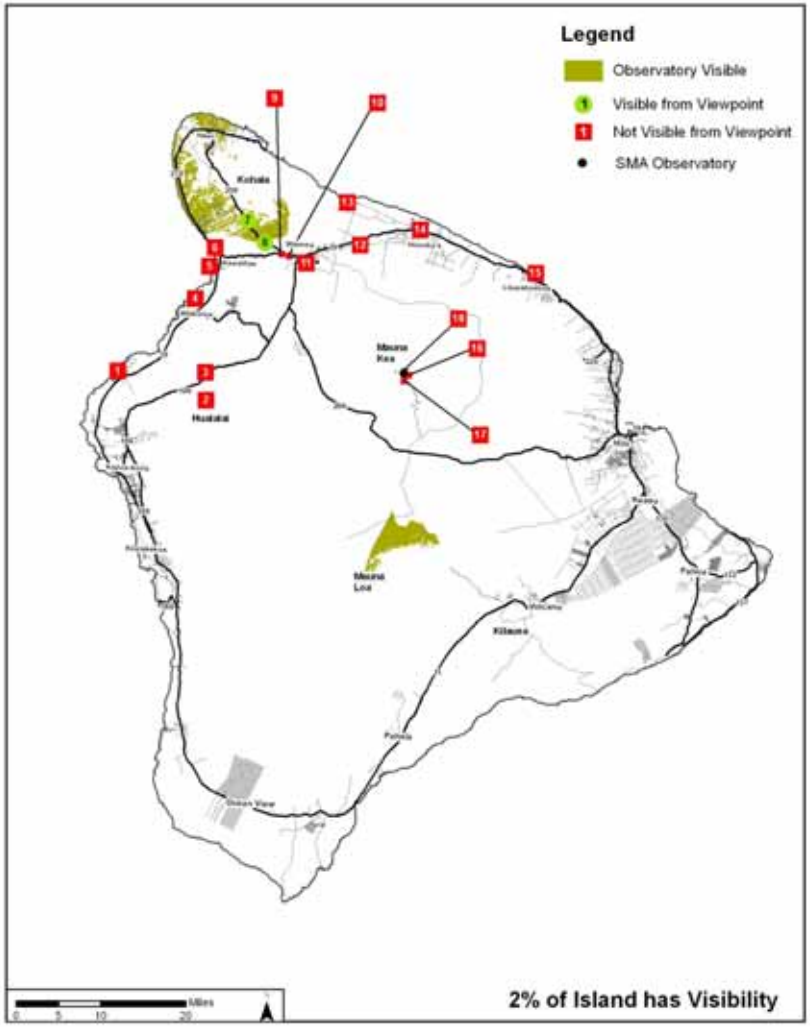
9) Caltech Submillimeter Telescope (CSO)



10) James Clerk Maxwell Telescope (JCMT)

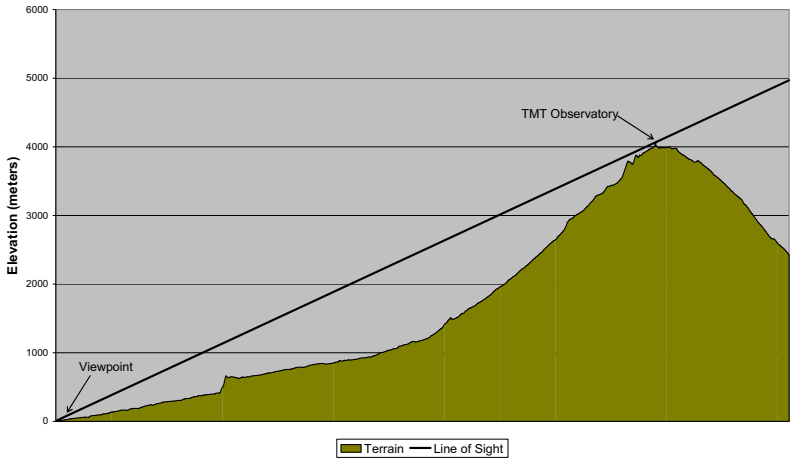


11) Submillimeter Array (SMA)

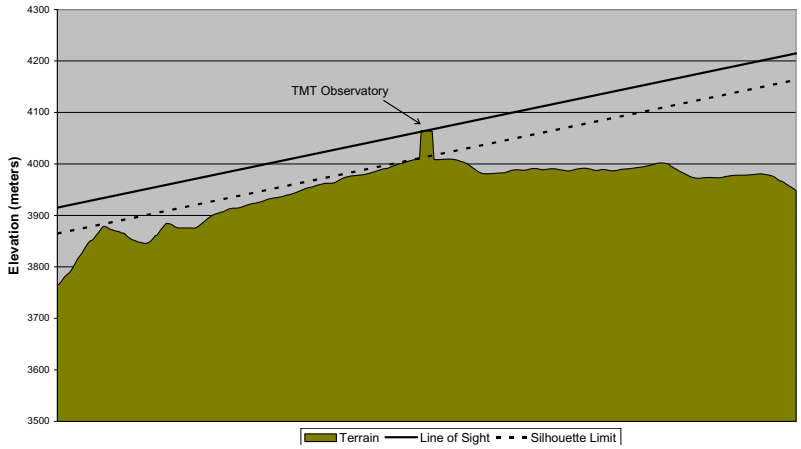


Appendix C. Silhouette Analysis by Viewpoint

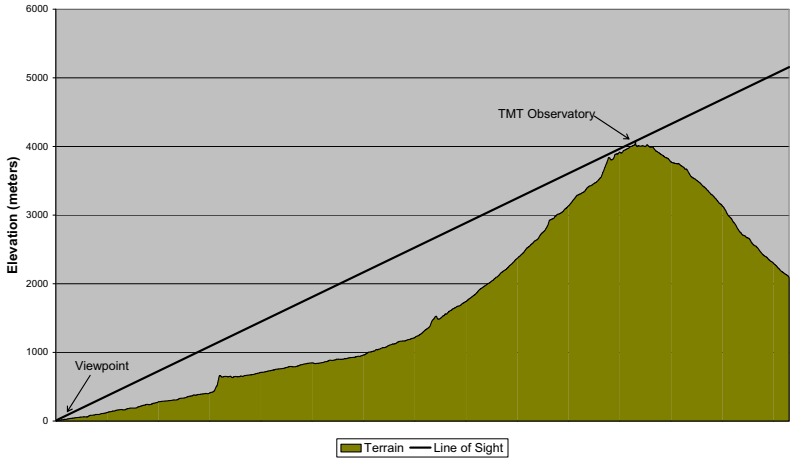
Hualalai Resort - TMT Proposed 13N Site



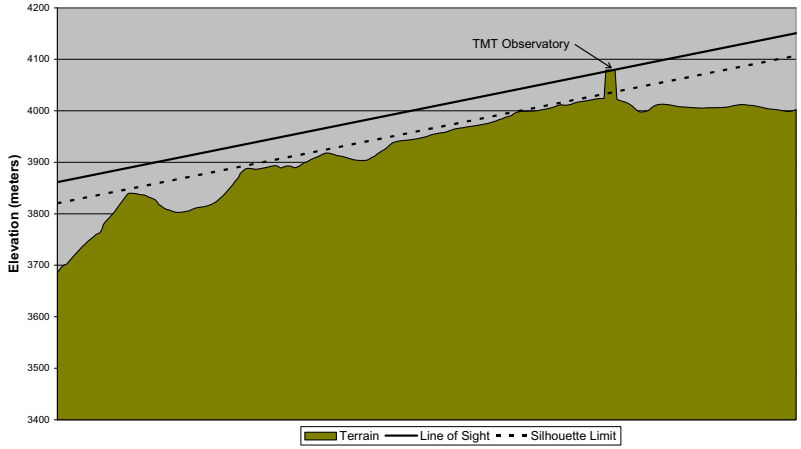
Hualalai Resort - Near TMT Proposed 13N Site



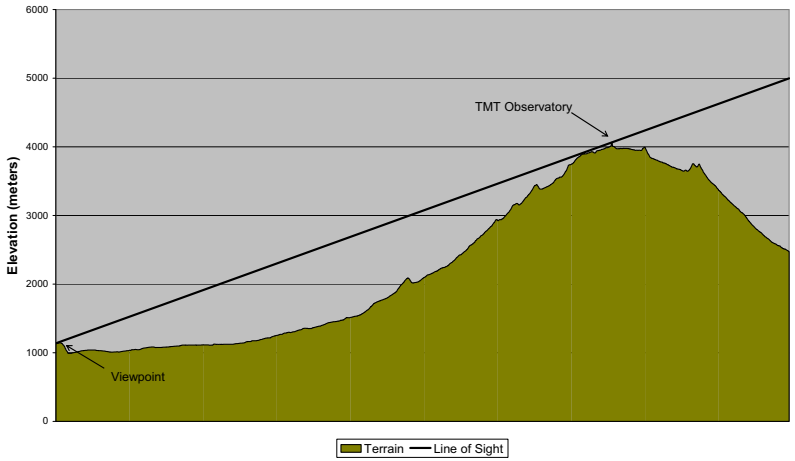
Hualalai Resort - TMT Alternative E2 Site



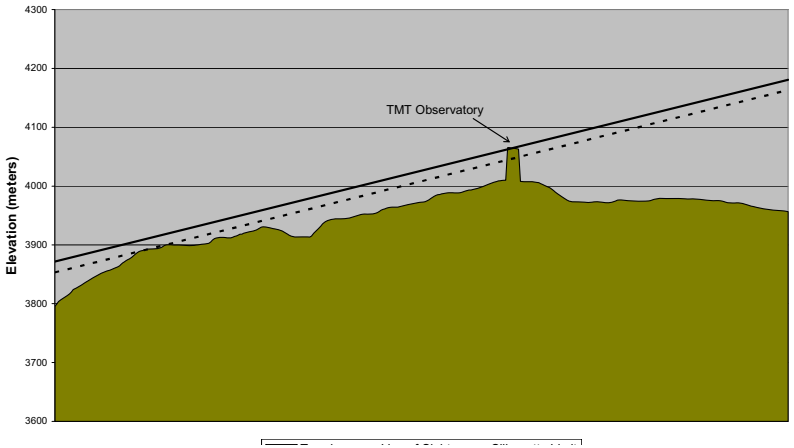
Hualalai Resort - Near TMT Alternative E2 Site



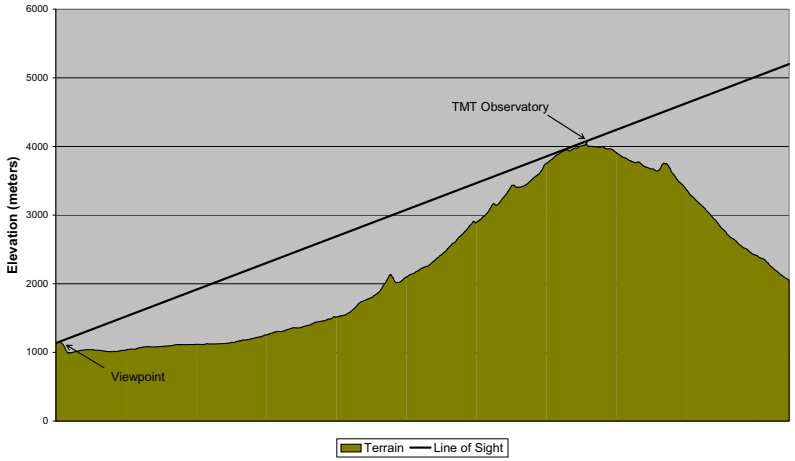
Puu Waawaa - TMT Proposed 13N Site



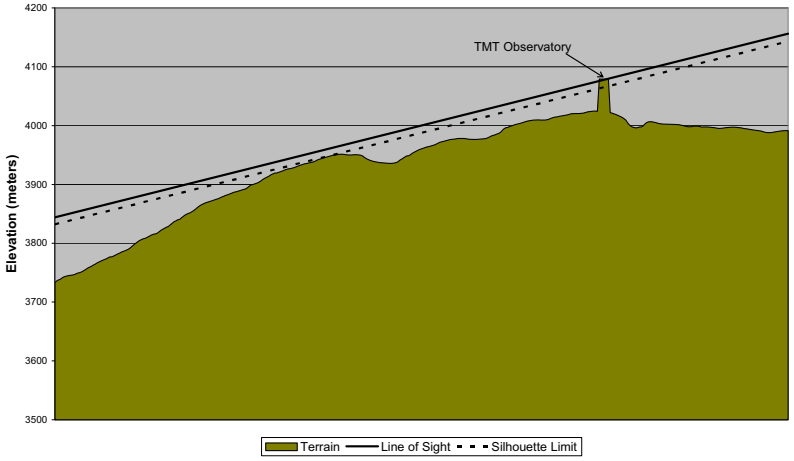
Puu Waawaa - Near TMT Proposed 13N Site



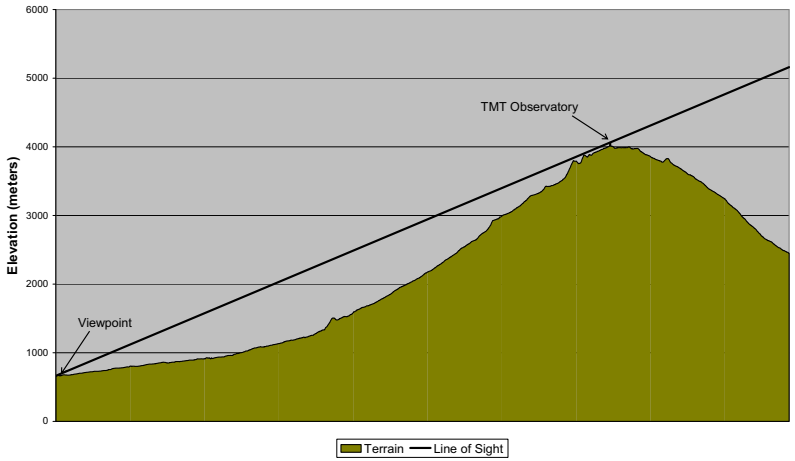
Puu Waawaa - TMT Alternative E2 Site



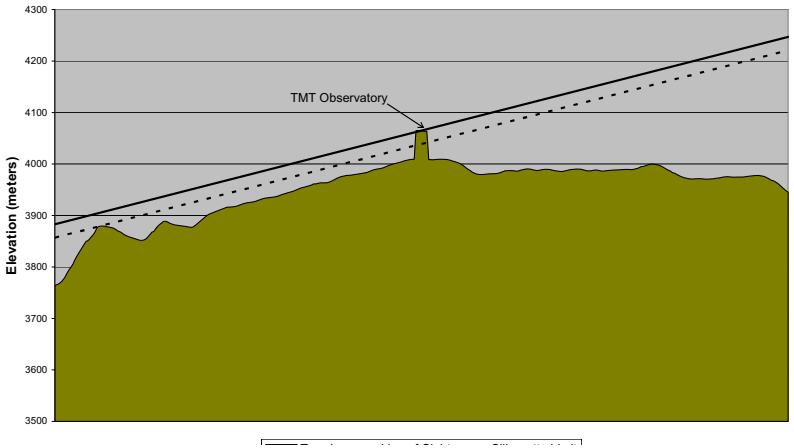
Puu Waawaa - Near TMT Alternative E2 Site



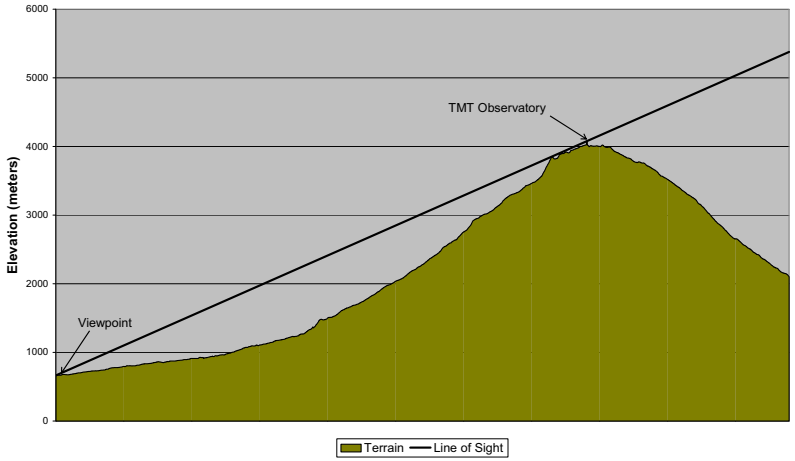
Big Island Country Club - TMT Proposed 13N Site



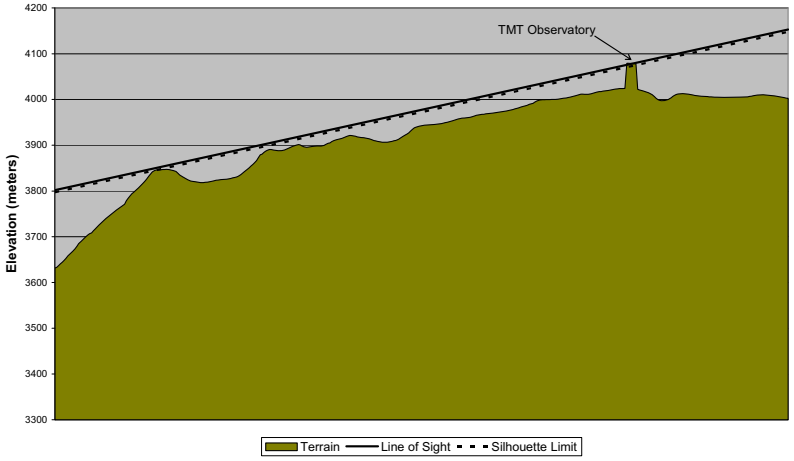
Big Island Country Club - Near TMT Proposed 13N Site



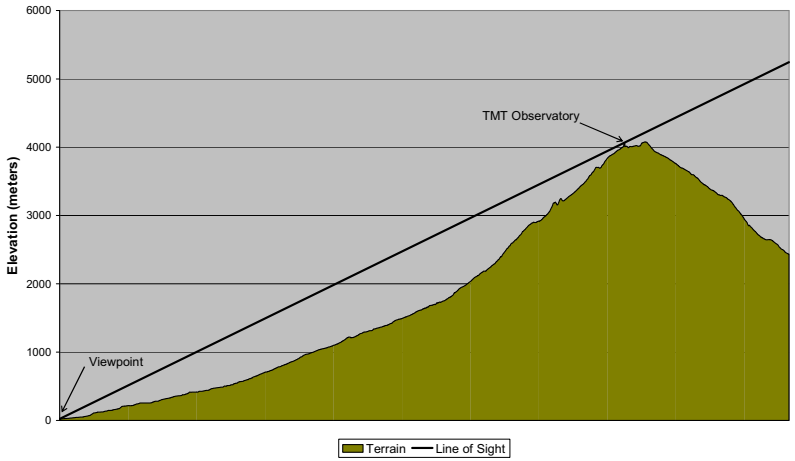
Big Island Country Club - TMT Alternative E2 Site



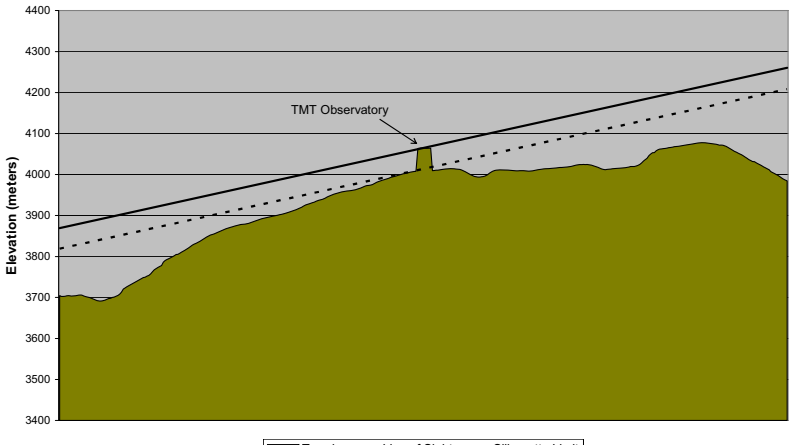
Big Island Country Club - Near TMT Alternative E2 Site



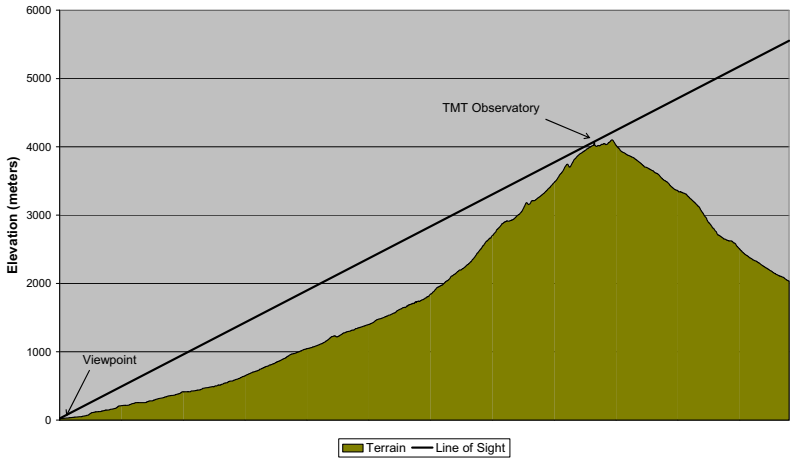
Waikoloa/Mauna Lani - TMT Proposed 13N Site



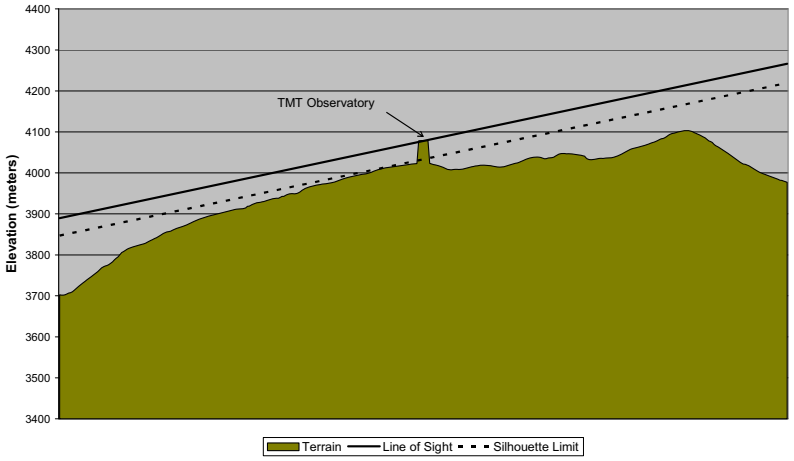
Waikoloa/Mauna Lani - Near TMT Proposed 13N Site



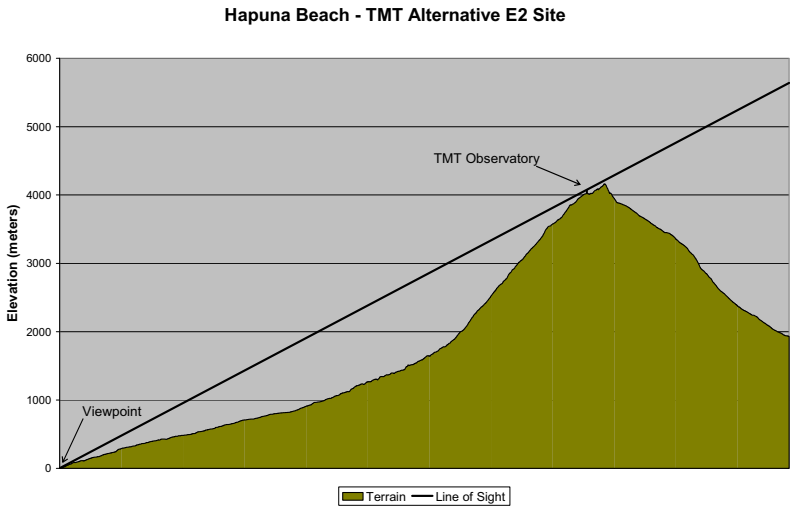
Waikoloa/Mauna Lani - TMT Alternative E2 Site

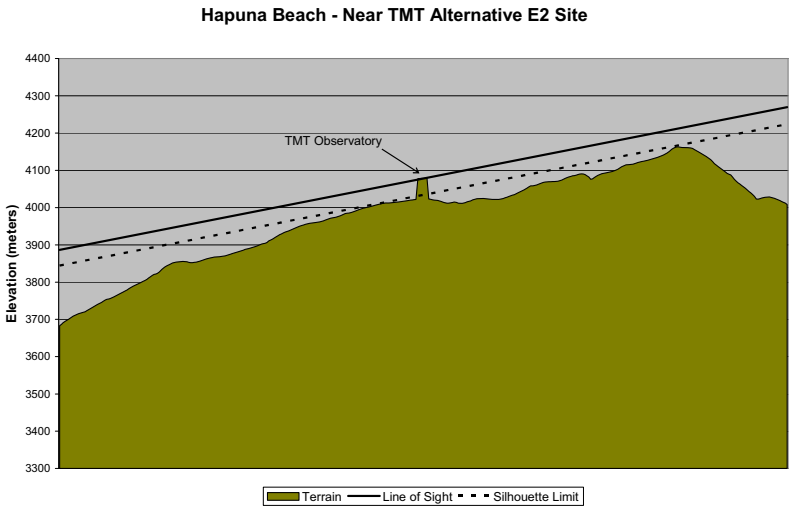


Waikoloa/Mauna Lani - Near TMT Alternative E2 Site

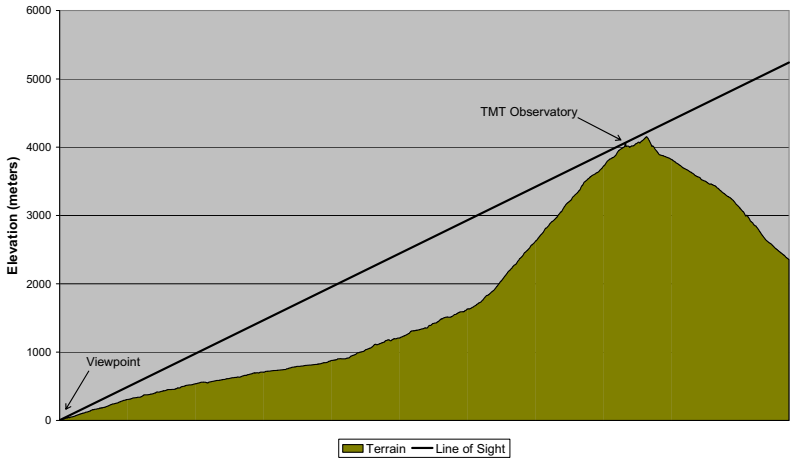


At site 13N the TMT Observatory would not be visible from Hapuna Beach.

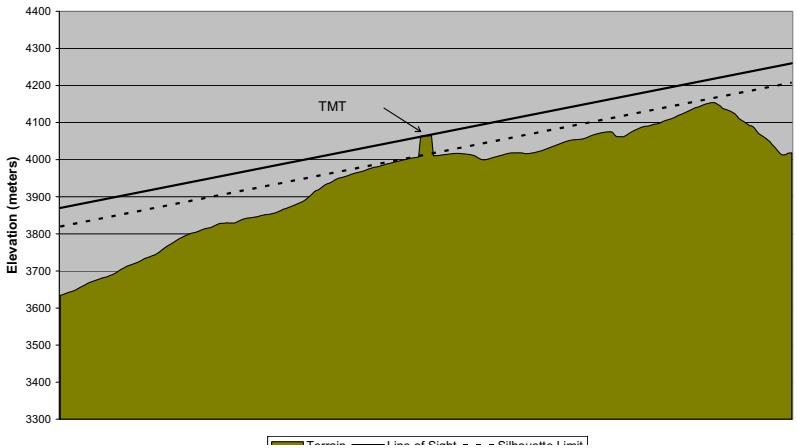




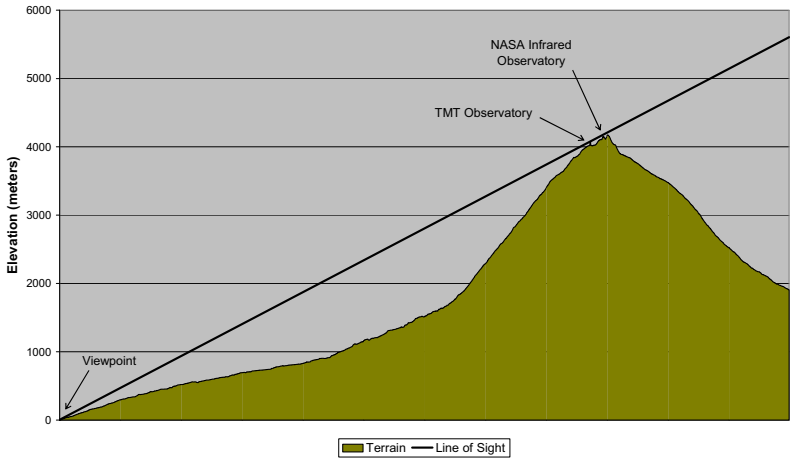
Puukohola Heiau - TMT Proposed 13N Site



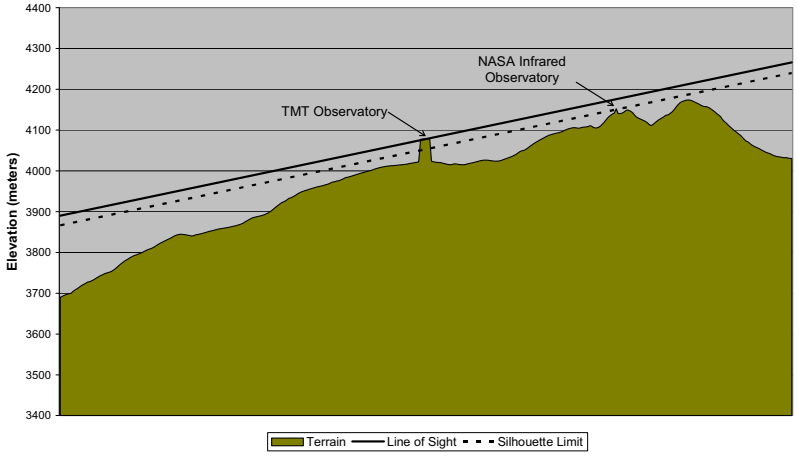
Puukohola Heiau - Near TMT Proposed 13N Site



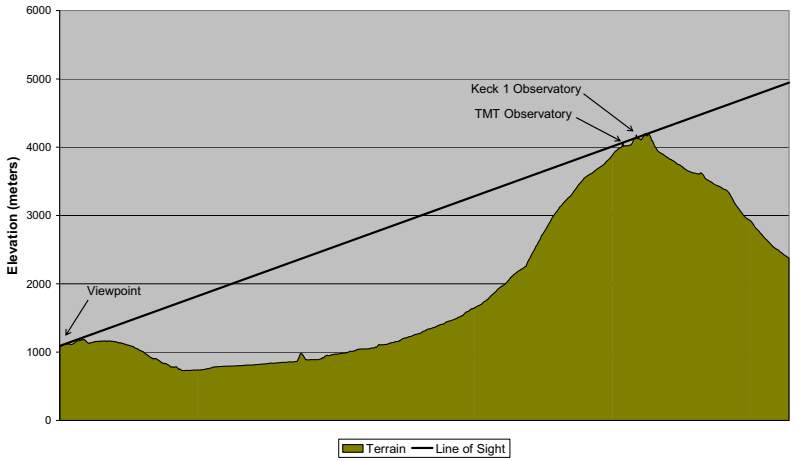
Puukohola Heiau - TMT Alternative E2 Site



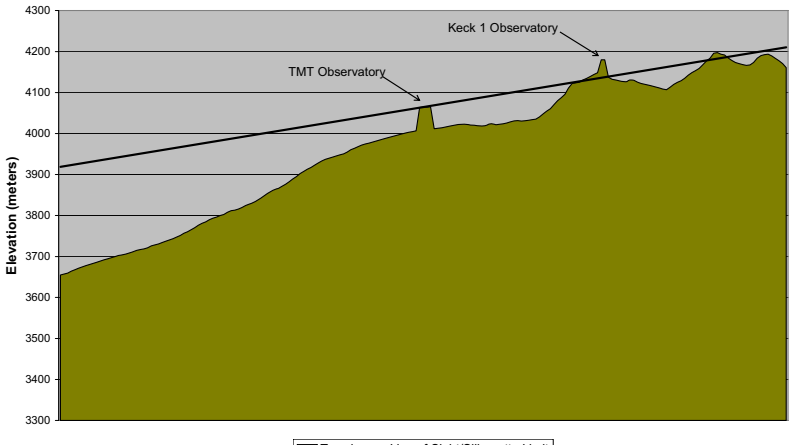
Puukohola Heiau - Near TMT Alternative E2 Site



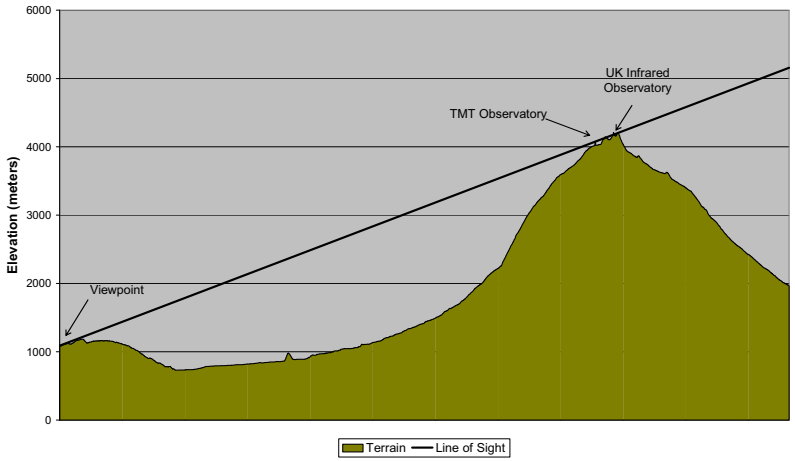
DHHL Kawaihae at Rt. 250 - TMT Proposed 13N Site



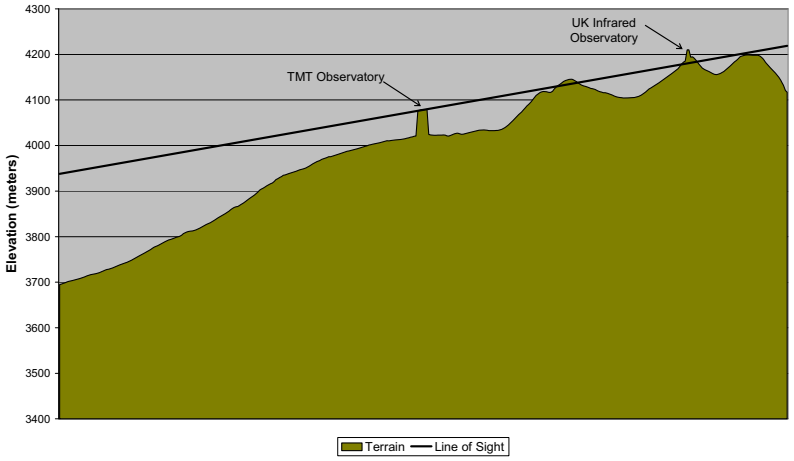
DHHL Kawaihae at Rt. 250 - Near TMT Proposed 13N Site



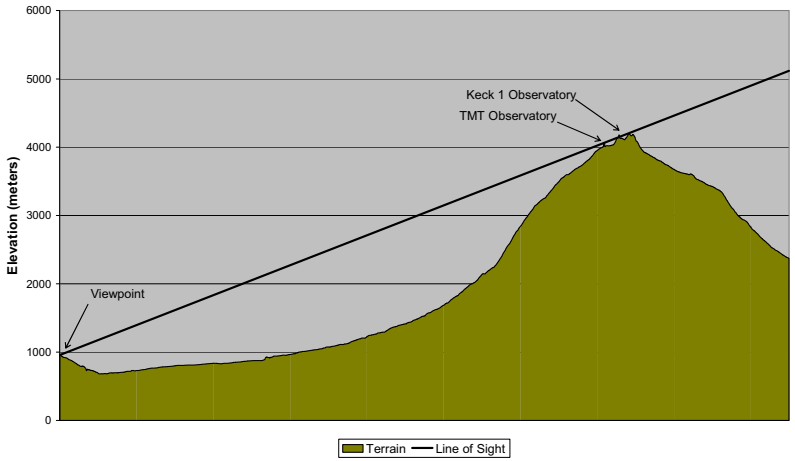
DHHL Kawaihae at Rt. 250 - TMT Alternative E2 Site



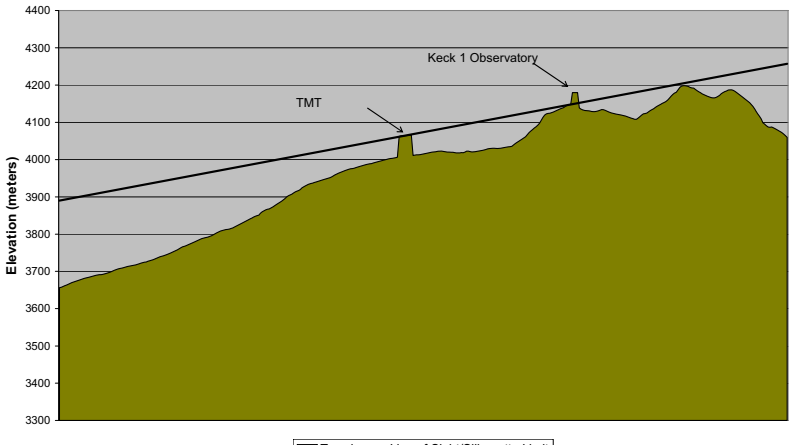
DHHL Kawaihae at Rt. 250 - Near TMT Alternative E2 Site



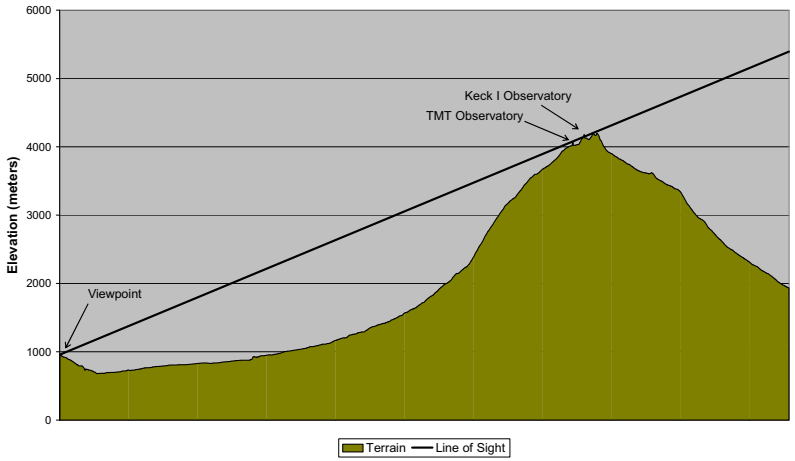
Route 250 Puu overlook - TMT Proposed 13N Site



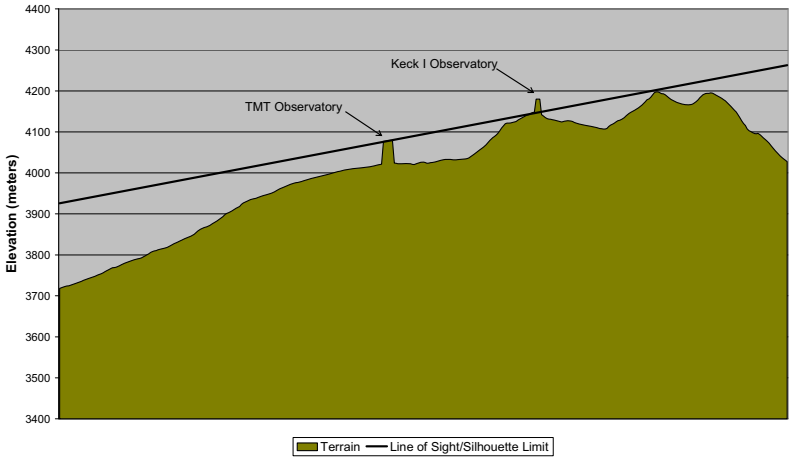
Route 250 Puu overlook - Near TMT Proposed 13N Site



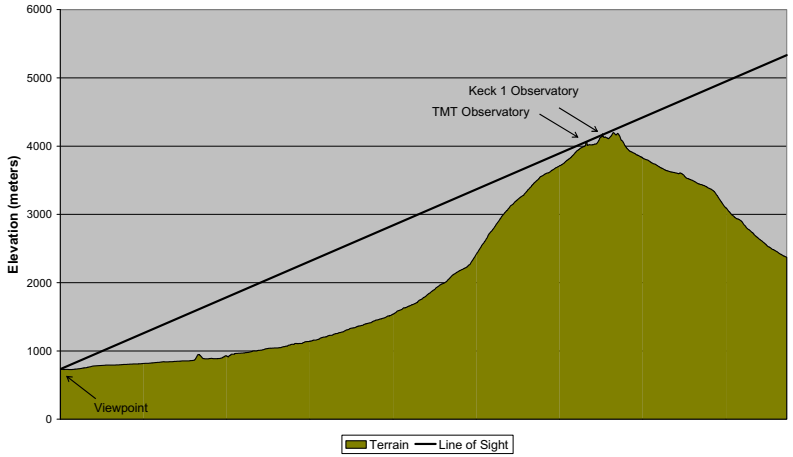
Route 250 Puu overlook - TMT Alternative E2 Site



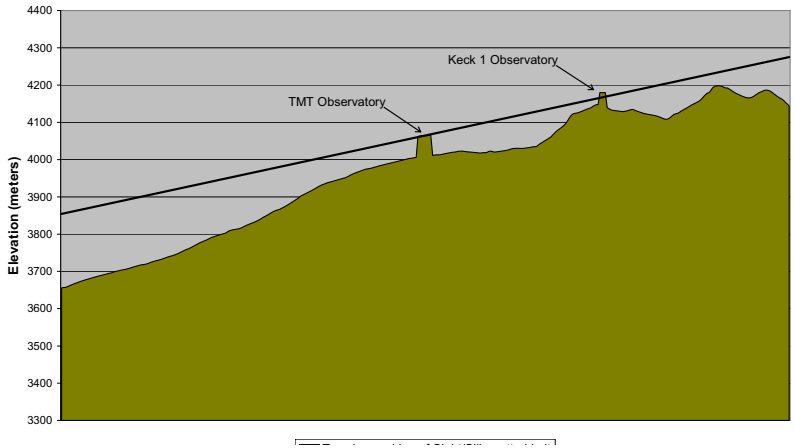
Route 250 Puu overlook - Near TMT Alternative E2 Site



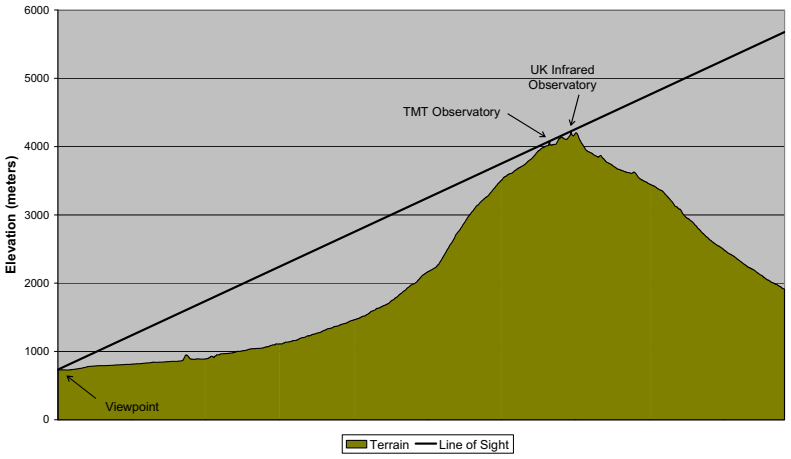
DHHL Lalamilo - TMT Proposed 13N Site



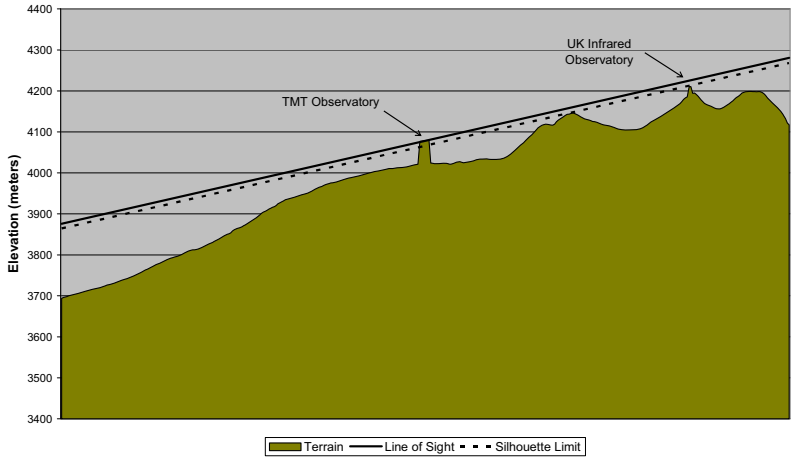
DHHL Lalamilo - Near TMT Proposed 13N Site



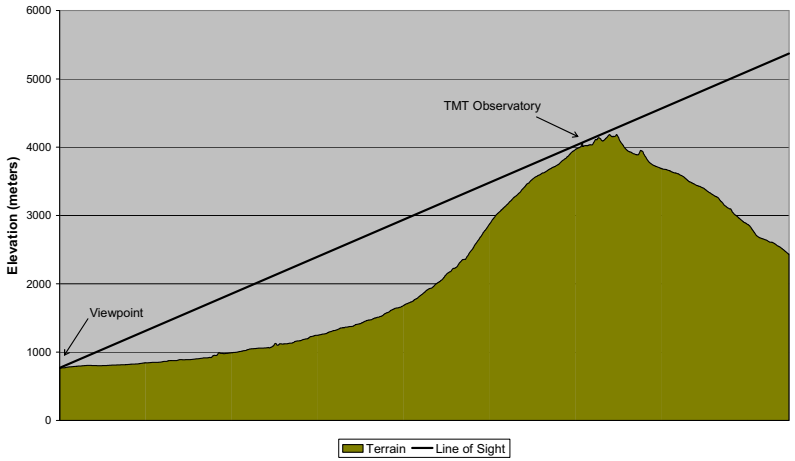
DHHL Lalamilo - TMT Alternative E2 Site



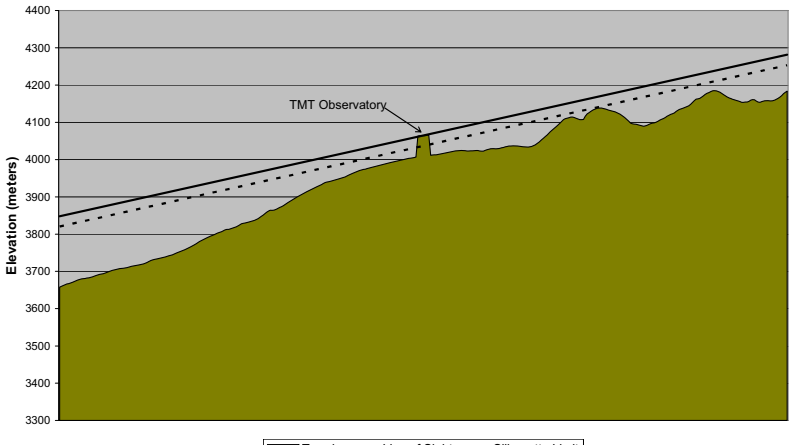
DHHL Lalamilo - Near TMT Alternative E2 Site



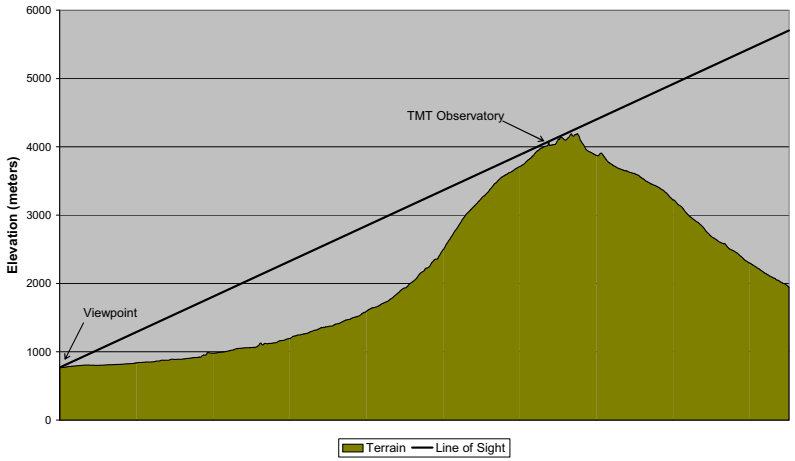
Waimea Park - TMT Proposed 13N Site



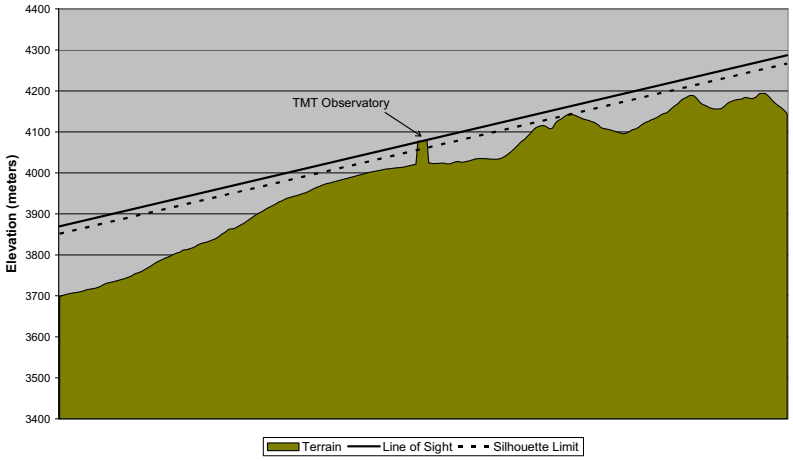
Waimea Park - Near TMT Proposed 13N Site



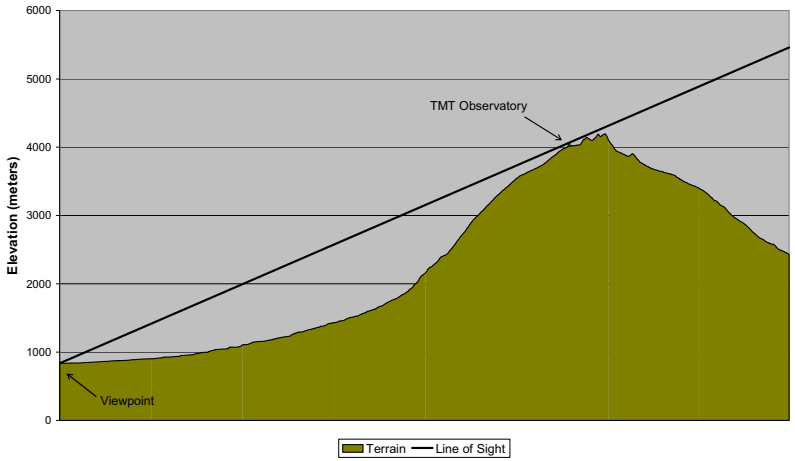
Waimea Park - TMT Alternative E2 Site



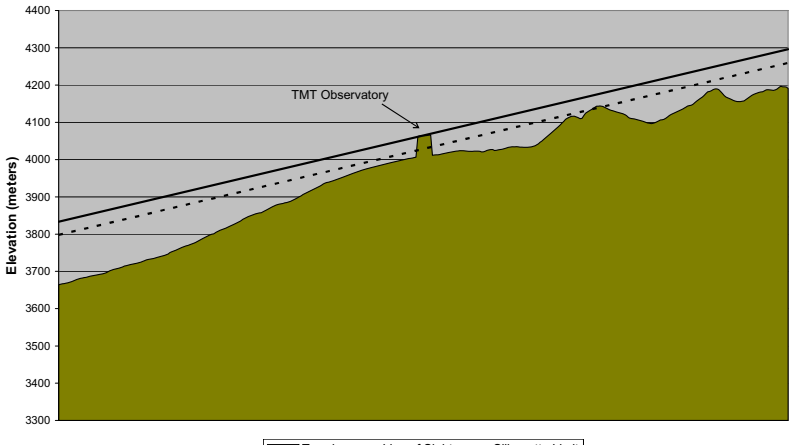
Waimea Park - Near TMT Alternative 13N Site



DHHL Puu Kapu - TMT Proposed 13N Site



DHHL Puu Kapu - Near TMT Proposed 13N Site



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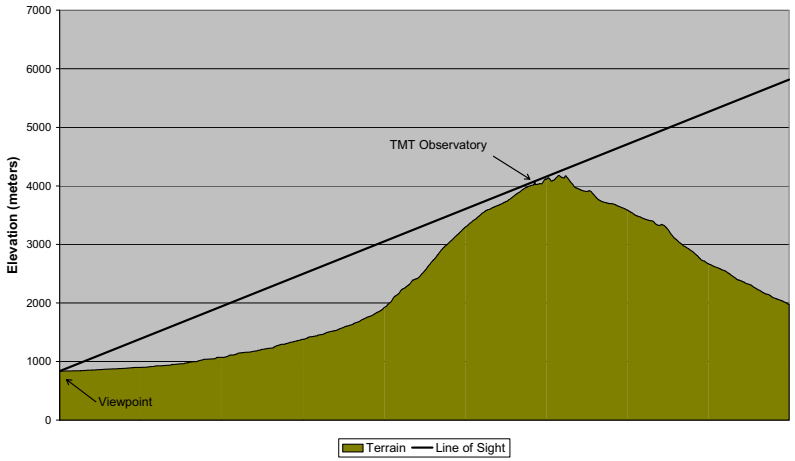
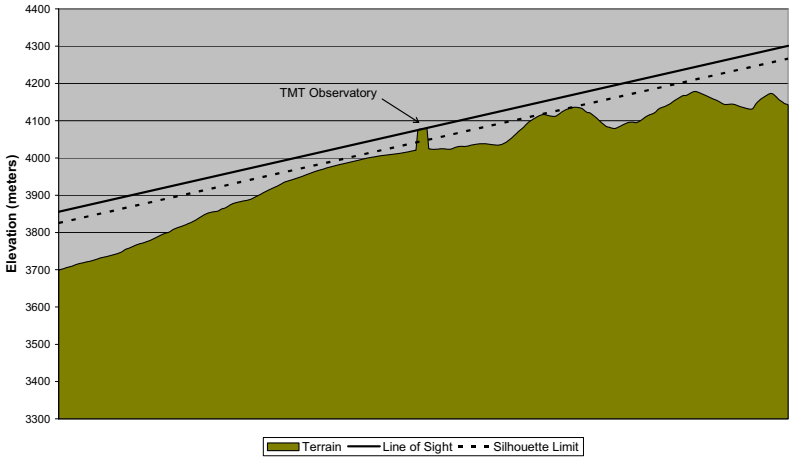
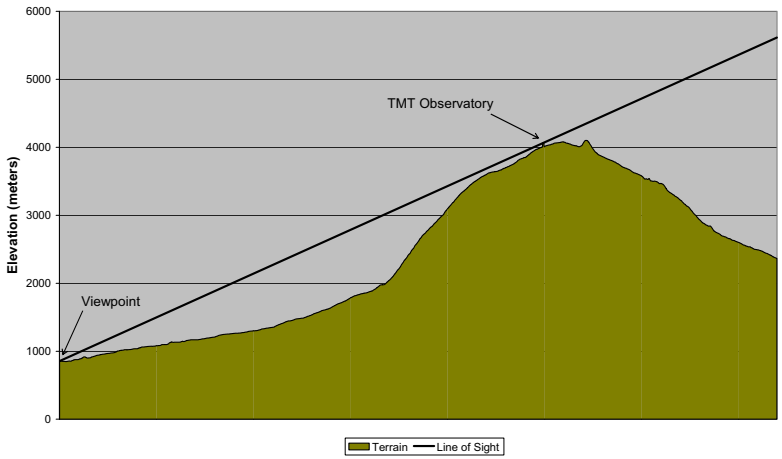


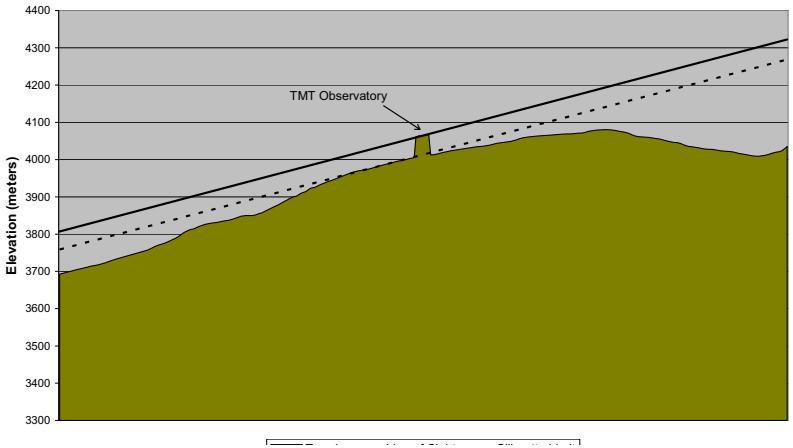
DHHL Puu Kapu - Near TMT Alternative E2 Site



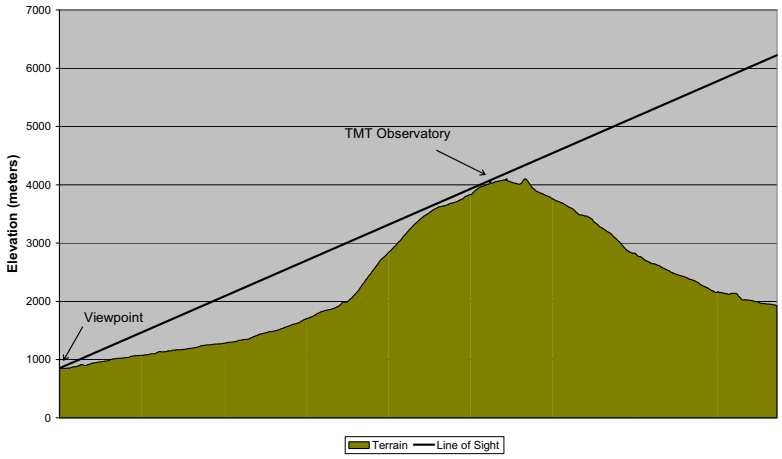
DHHL Waikoloa-Waialeale - TMT Proposed 13N Site



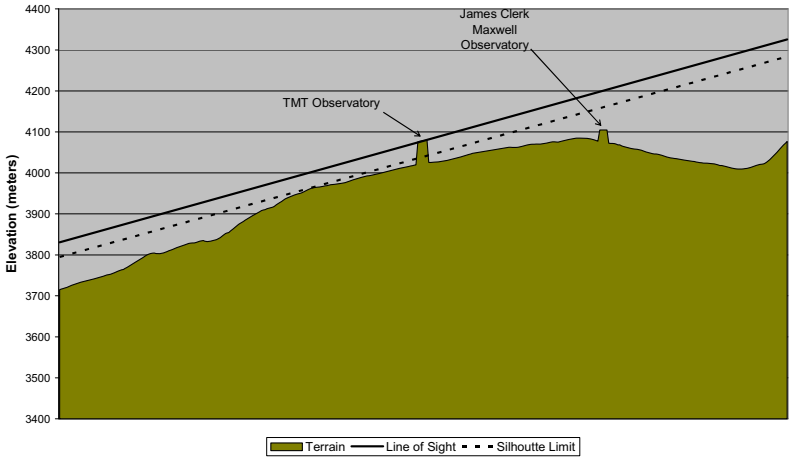
DHHL Waikoloa-Waialeale - Near TMT Proposed 13N Site

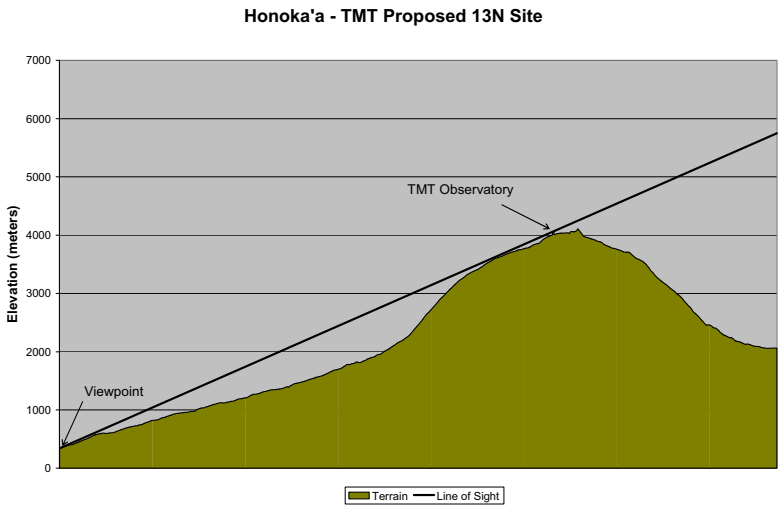


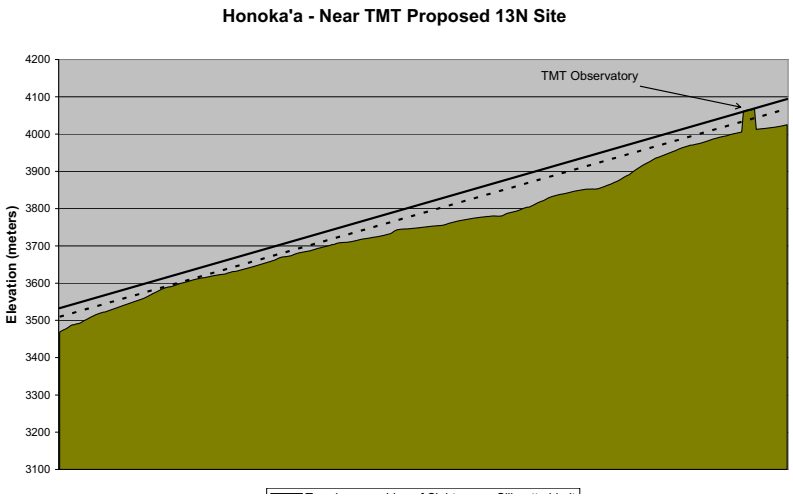
DHHL Waikoloa-Waialeale - TMT Alternative E2 Site



DHHL Waikoloa-Waialeale - Near TMT Alternative E2 Site

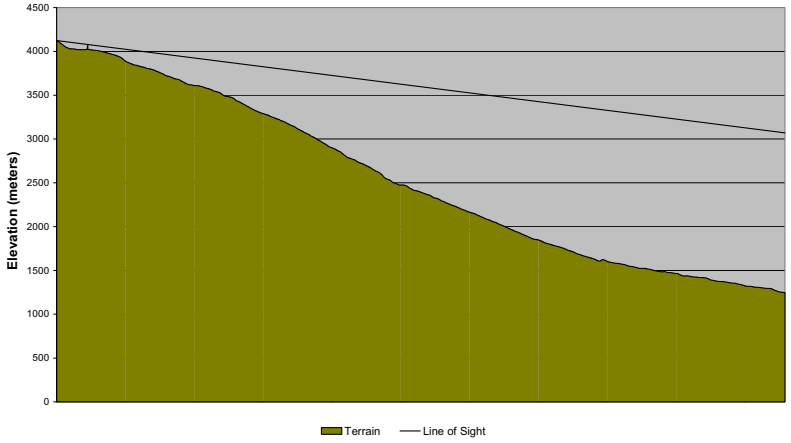






At site E2 the TMT Observatory would not be visible from Honoka’a.

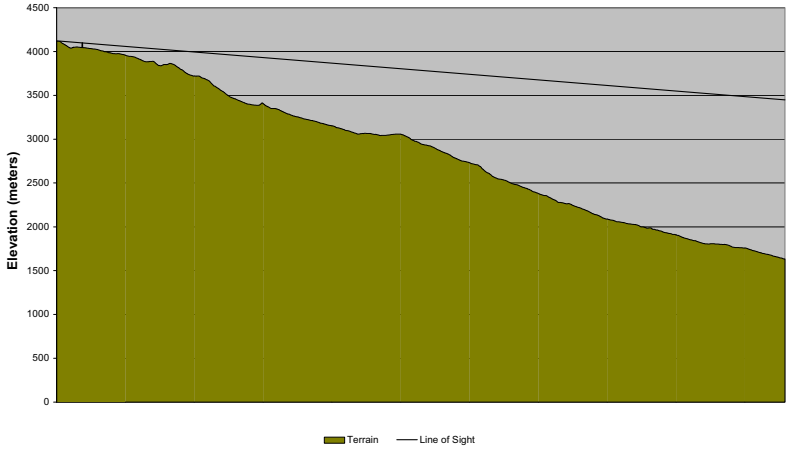
Kūkahau'ula - TMT Proposed 13N Site



Kūkahau'ula - Near TMT Proposed 13N Site



Kūkahau'ula - TMT Alternative E2 Site



Kūkahau'ula - Near TMT Alternative E2 Site

