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

EXHIBIT A-55

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In the Mauna Kea Science Reserve
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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

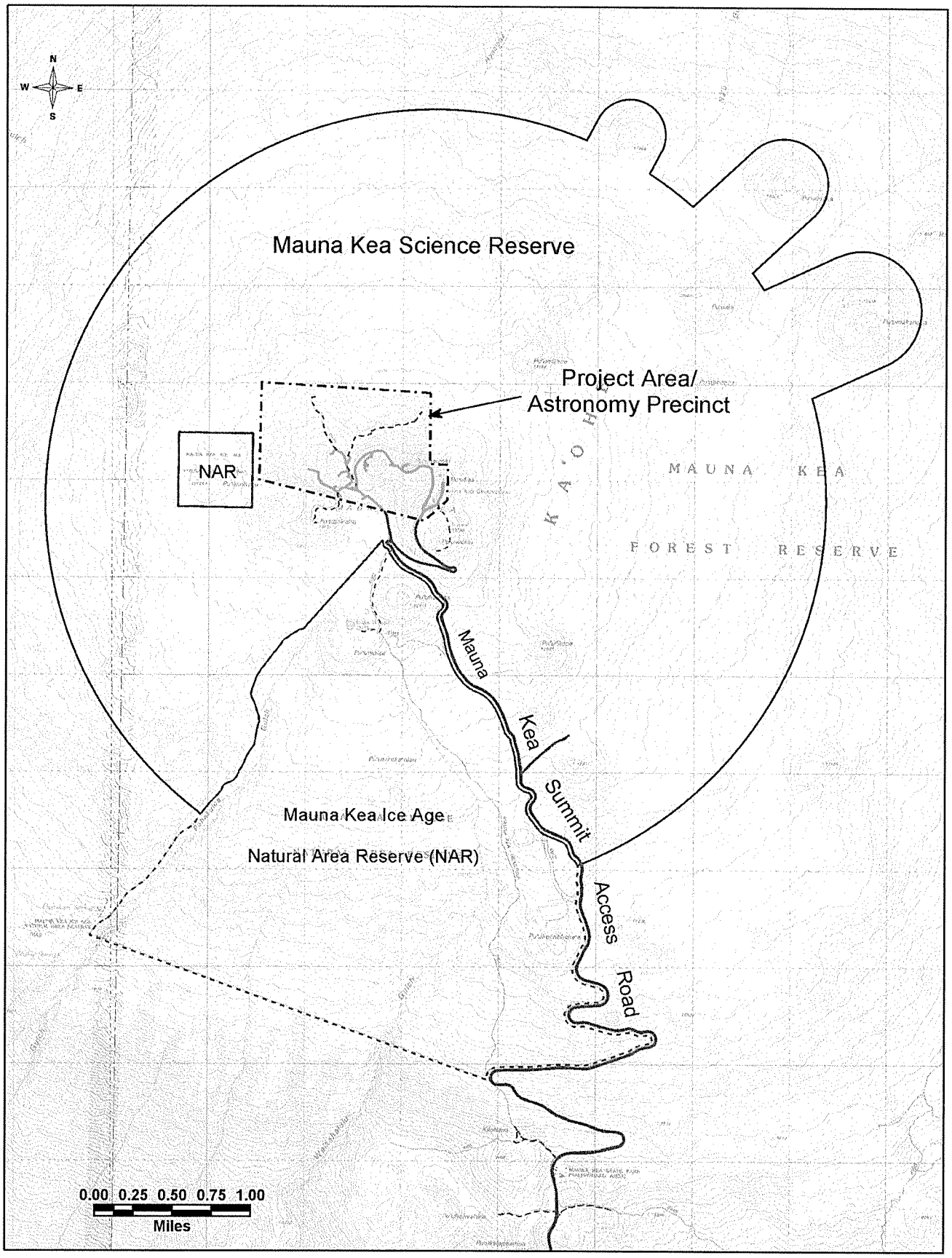


Figure 1.1 Project Area Location on U.S.G.S. Mauna Kea Quadrangle (1983).

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

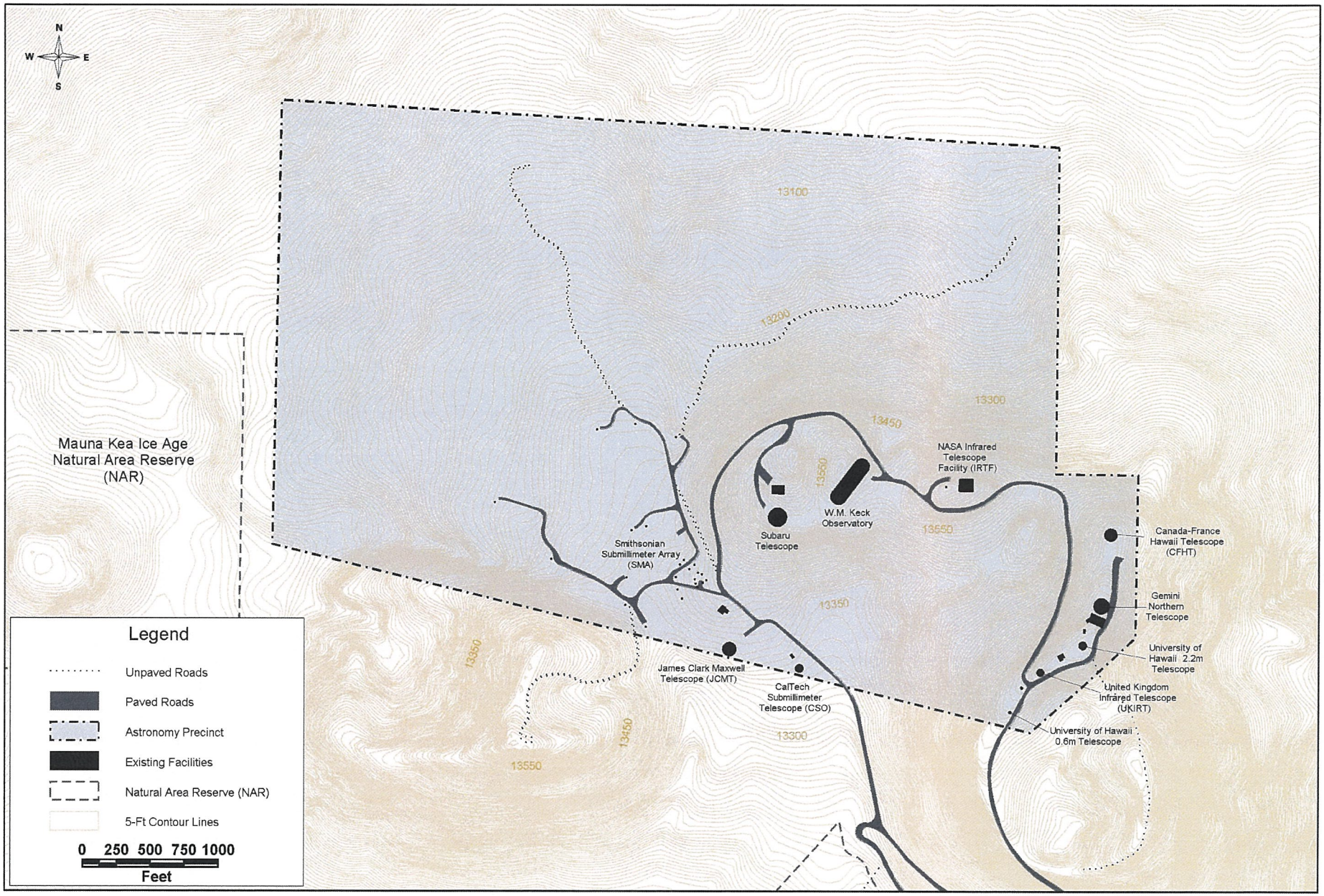


Figure 1.2 Approximate Boundary of the Astronomy Precinct and Existing Facilities

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

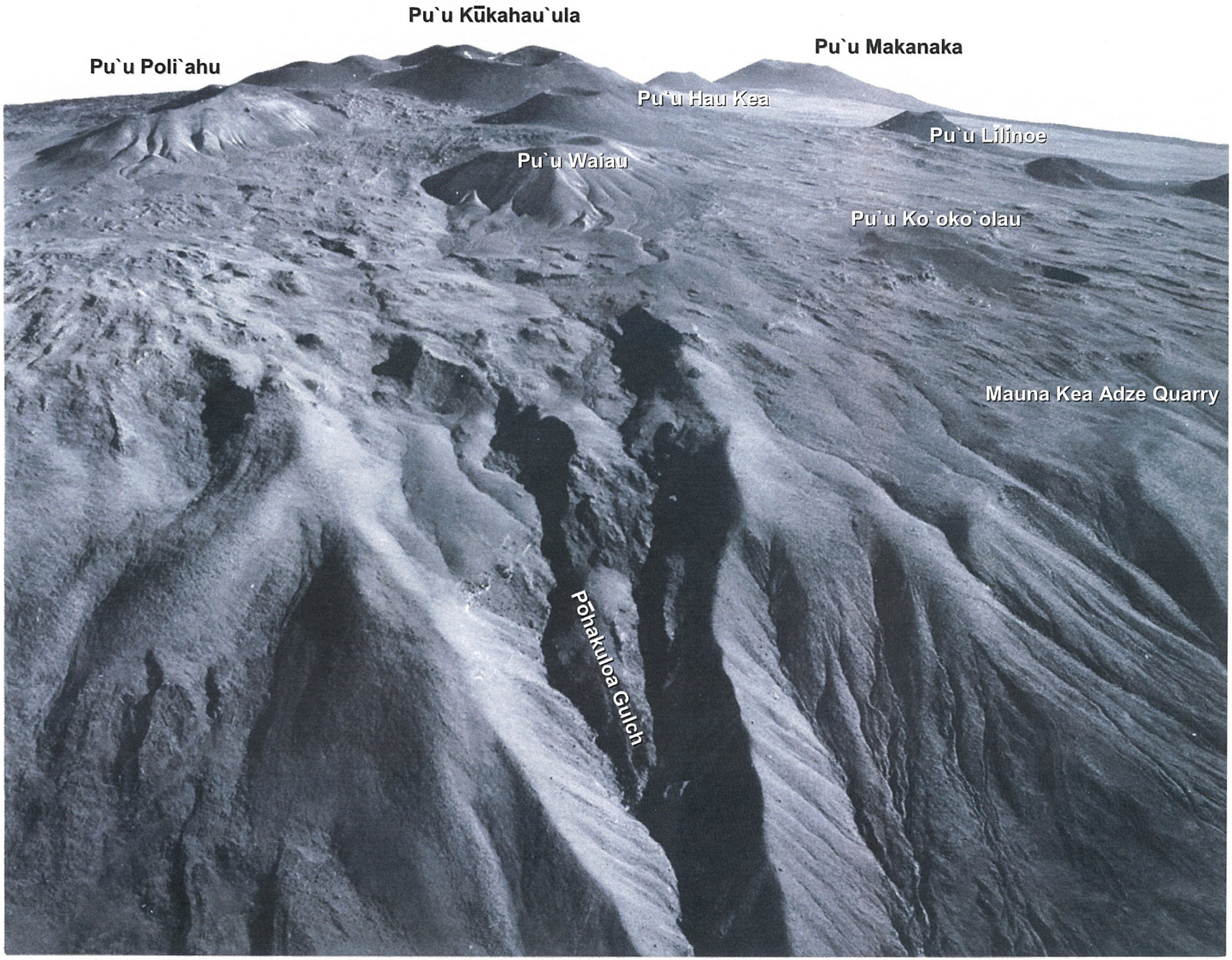


Figure 2-1. Aerial View of Summit Plateau and Dissected Landscape Below in the Pohakuloa Gulch Area.

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

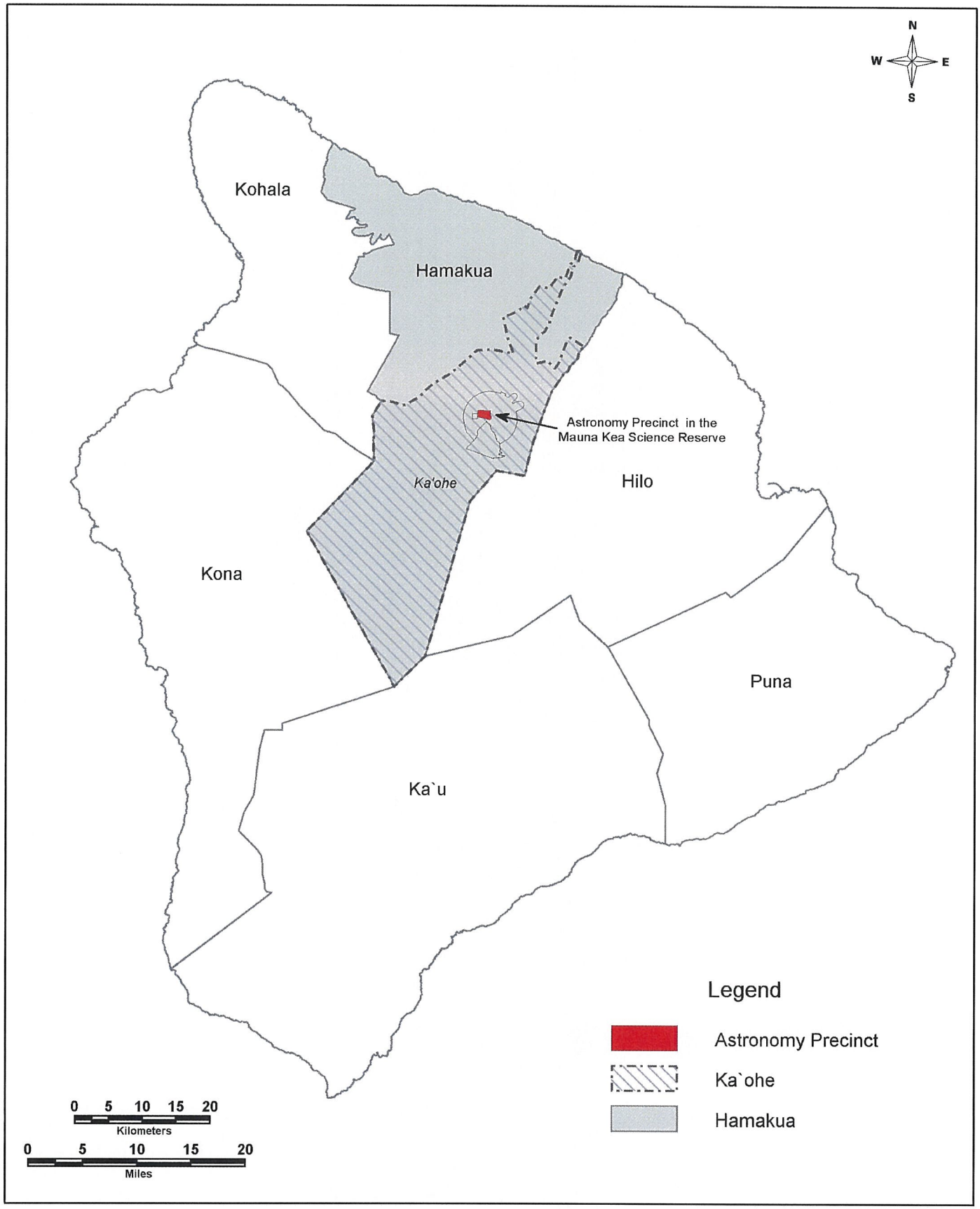


Figure 2.3. Socio-Political Map of Hawai`i Island Showing the Astronomy Precinct Location in Ka`ohe Ahupua`a, Hamakua District.

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,

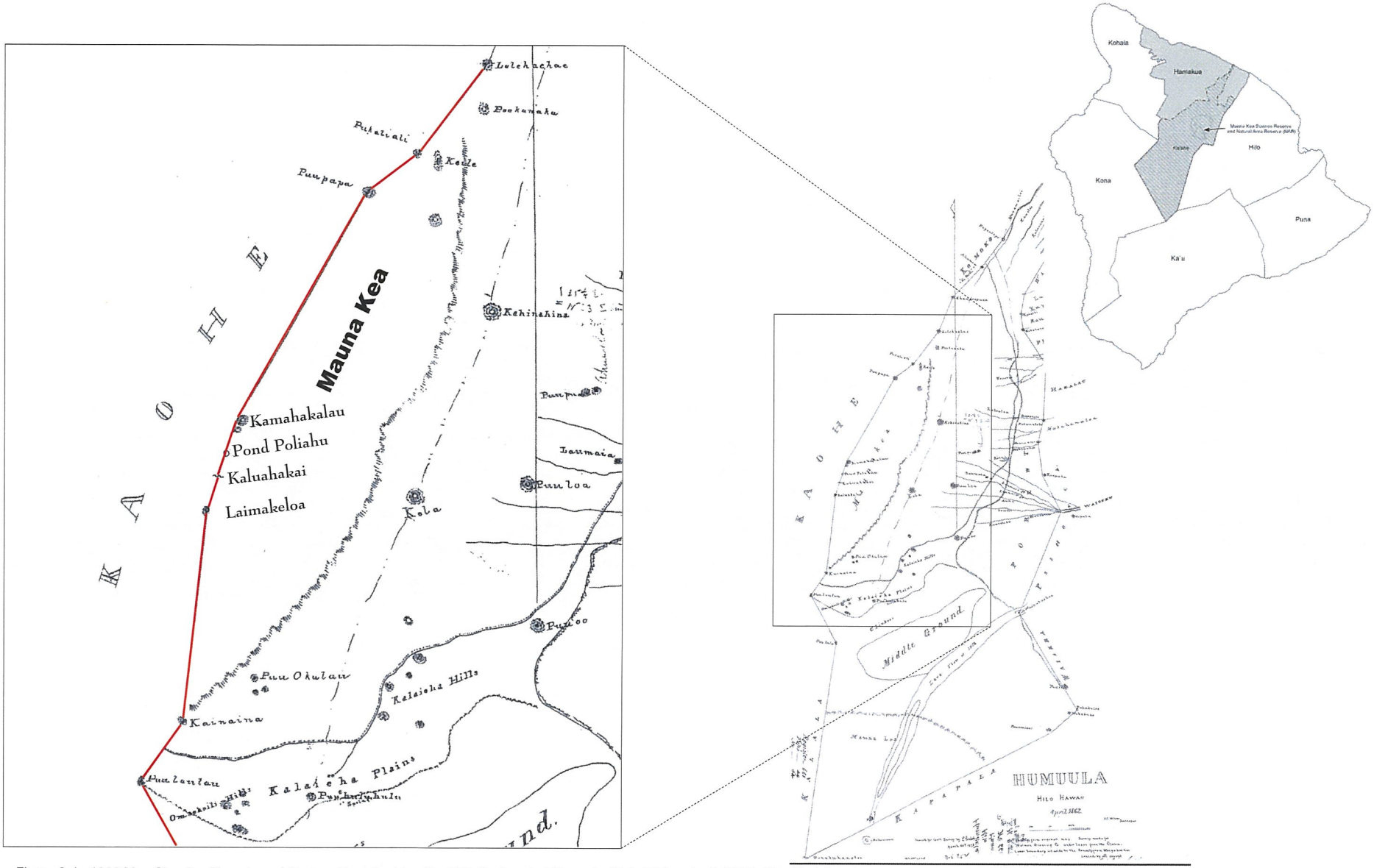


Figure 2-4. 1862 Map Showing Boundary of Kaohe. Register Map No. 668, the Land of Humuula (S.C. Wiltse, April 1862). (Modified from Kumu Pono Associates LLC 2005:281).

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

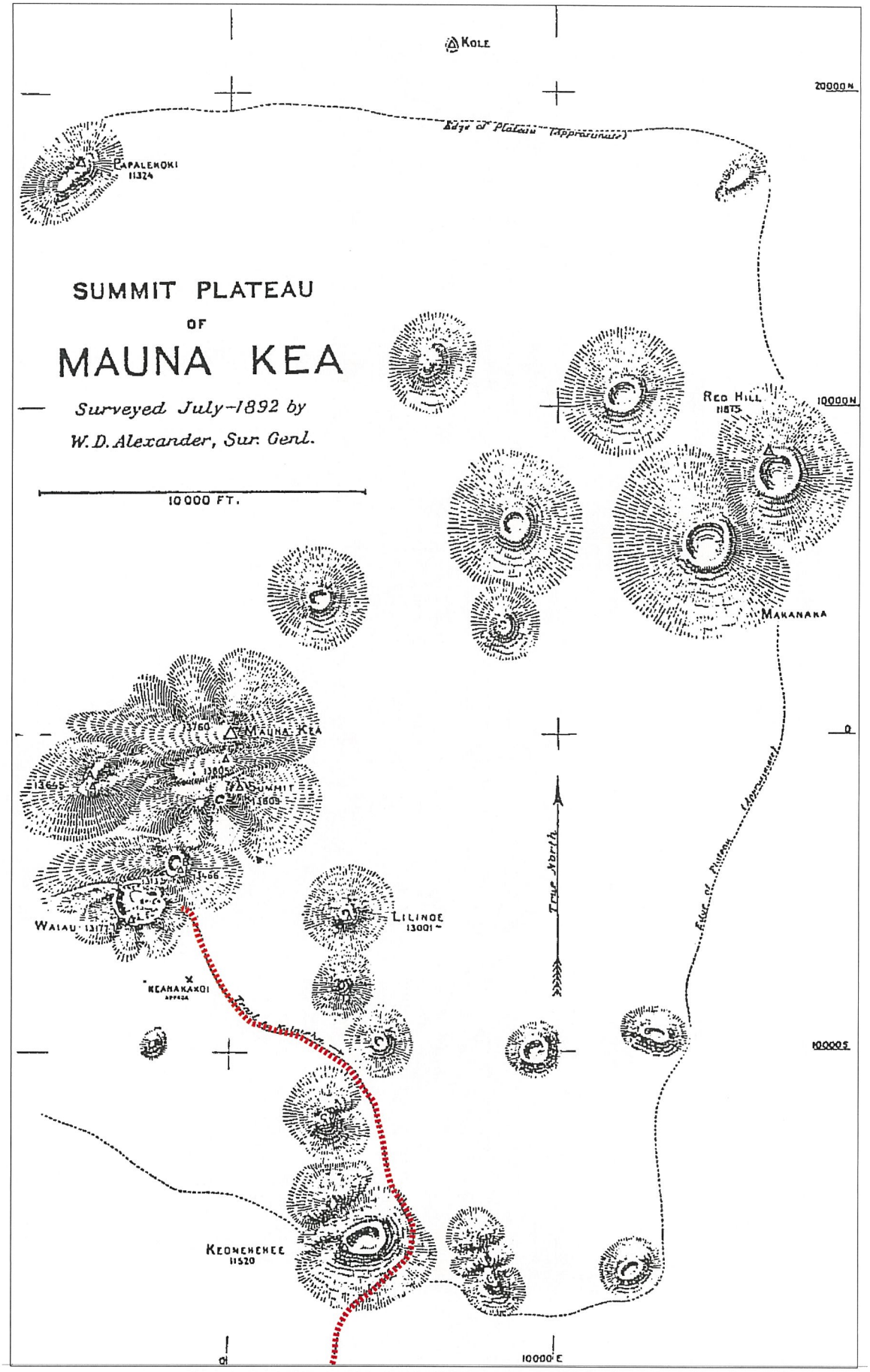


Figure 2.5. 1892 Alexander Map of the Summit Plateau and Alignment of the Humu`ula Trail.

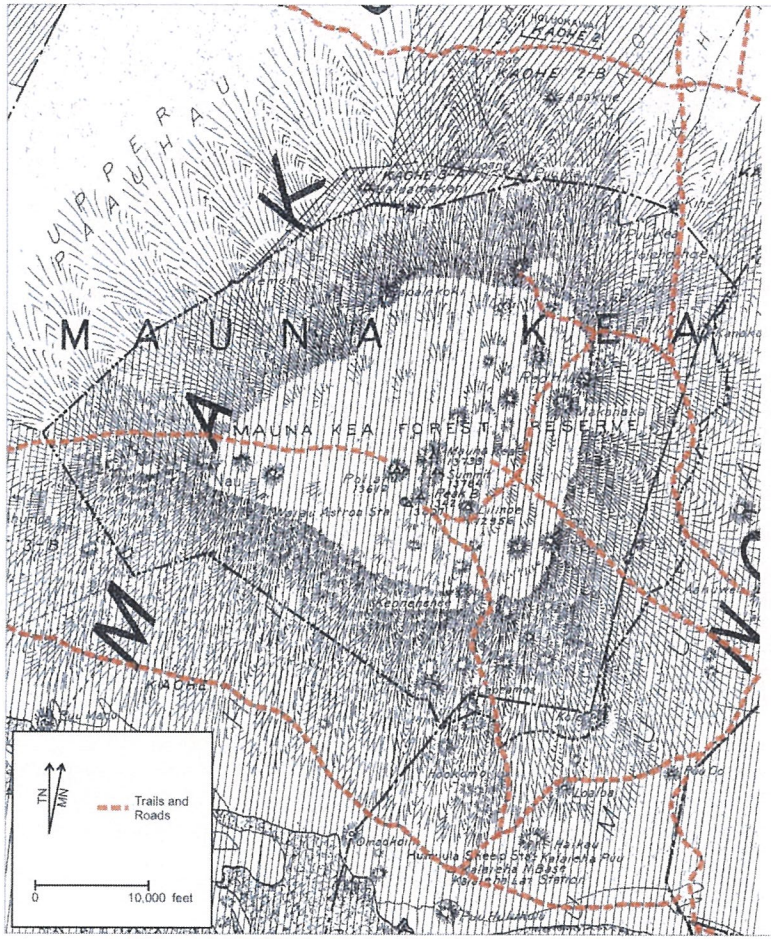


Figure 2.6. 1928 Walter E. Wall Map of the Island of Hawaii.

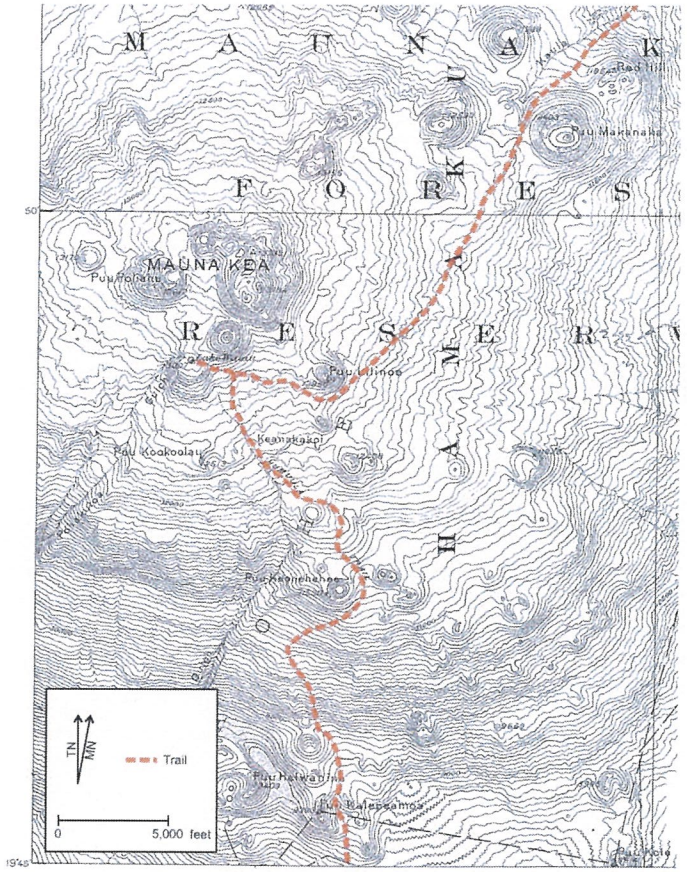


Figure 2.7. 1930 U.S.G.S. Mauna Kea Quadrangle Map Showing Trails in the Summit Area and Lower Elevations.

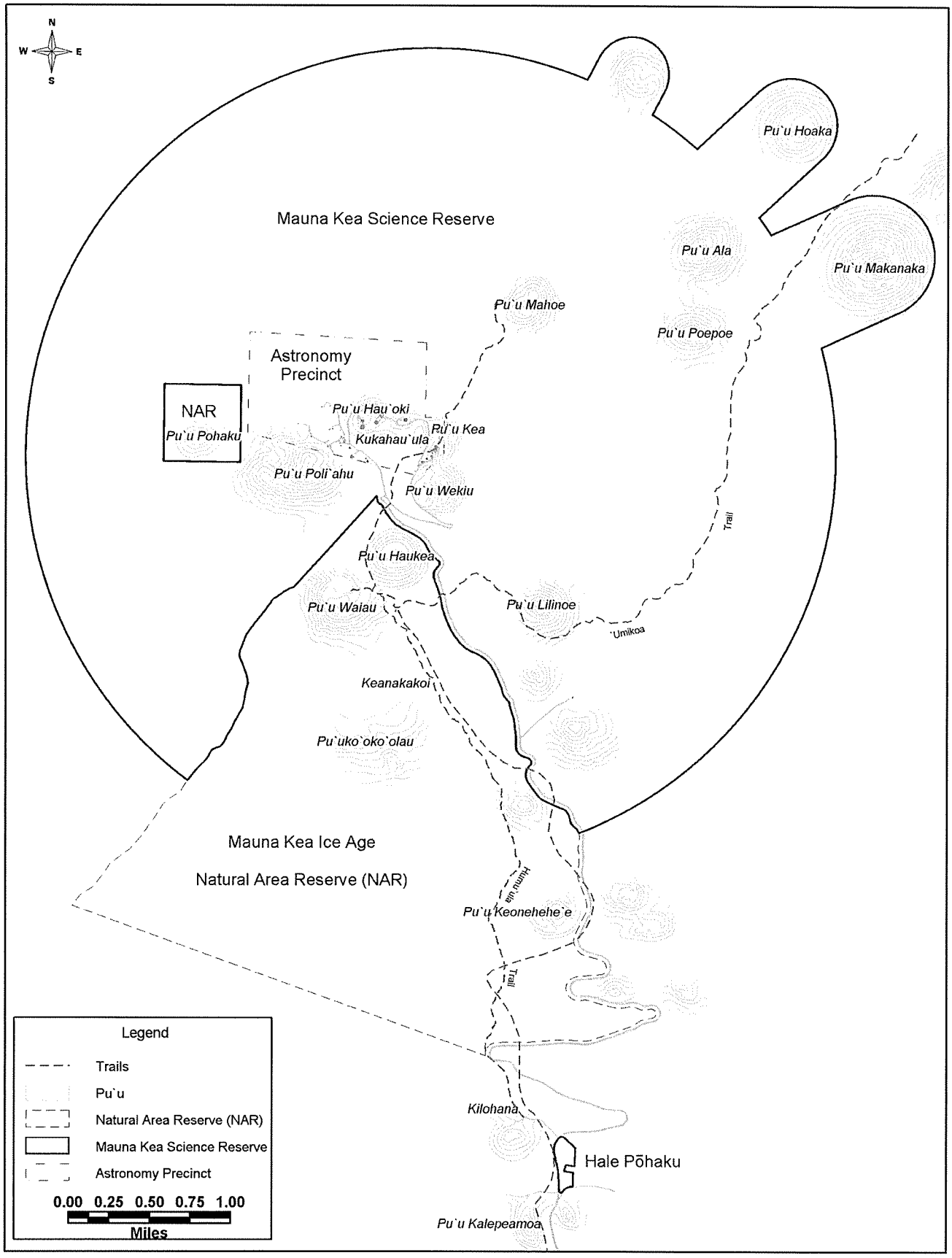


Figure 2.8. Hawaiian Place Names and Trails in the Summit Region of Mauna Kea.

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•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).

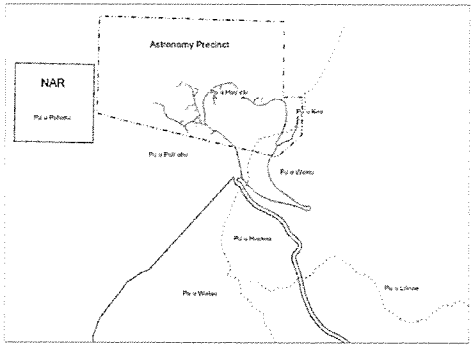
Table 2.2. Correlations Between Named Cinder Cones (and Peaks), Mauna Kea Quadrangle (modified after McEldowney 1982).

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).

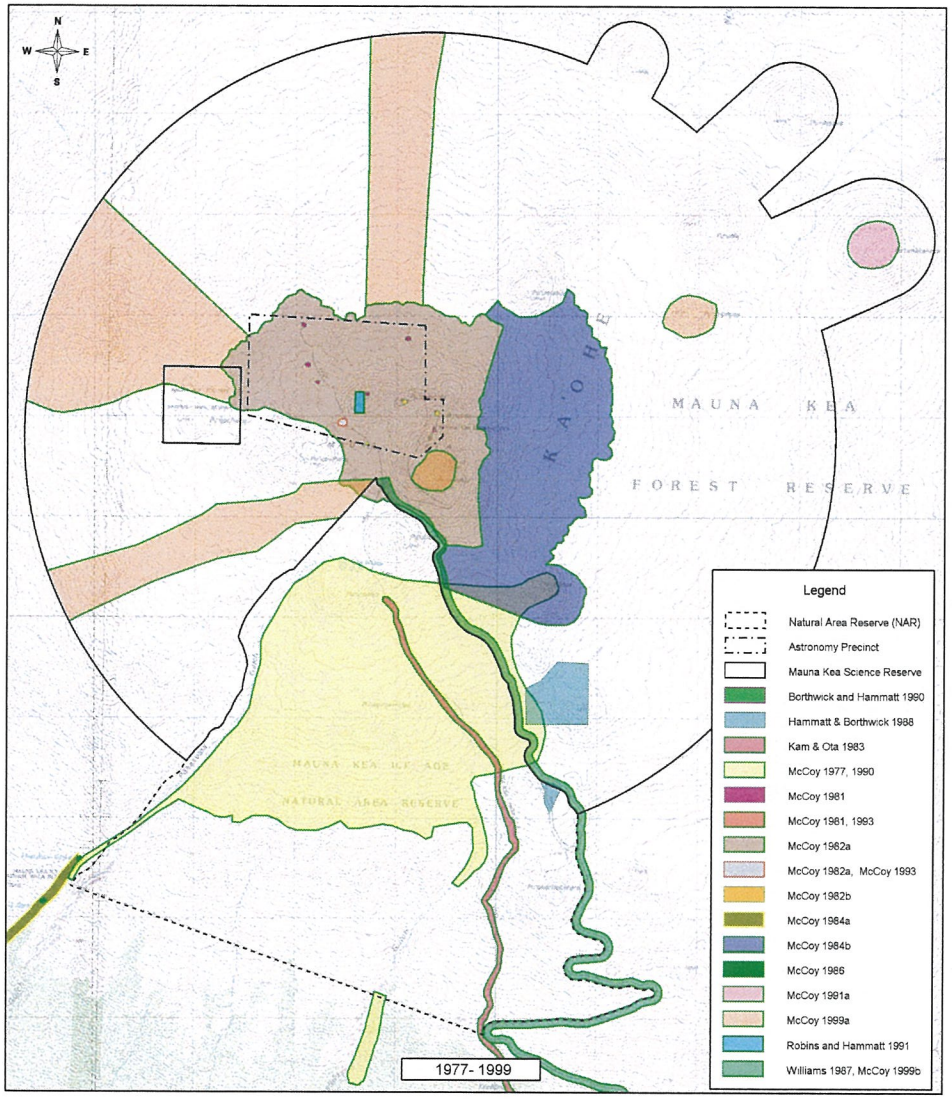
In contrast to the long history of geological research on Mauna Kea the only area that has been the subject of problem-oriented archaeological research is the Mauna Kea Adze Quarry Complex, which encompasses parts of the NAR, the Science Reserve, the Mauna Kea Forest Reserve, and other state lands in 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.



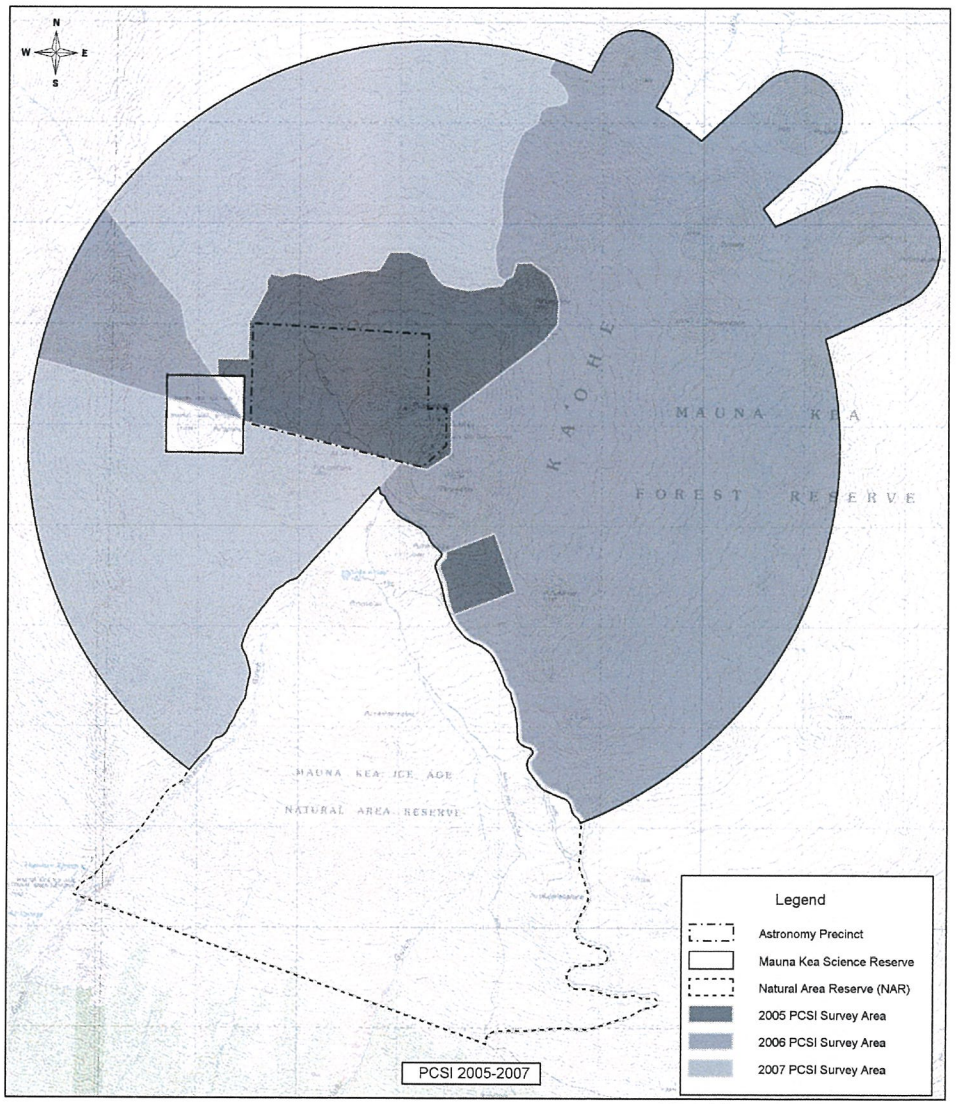


Figure 3.2 Location of Previous Archaeological Investigations in the Mauna Kea Science Reserve (1977-1999 and 2005-2007)

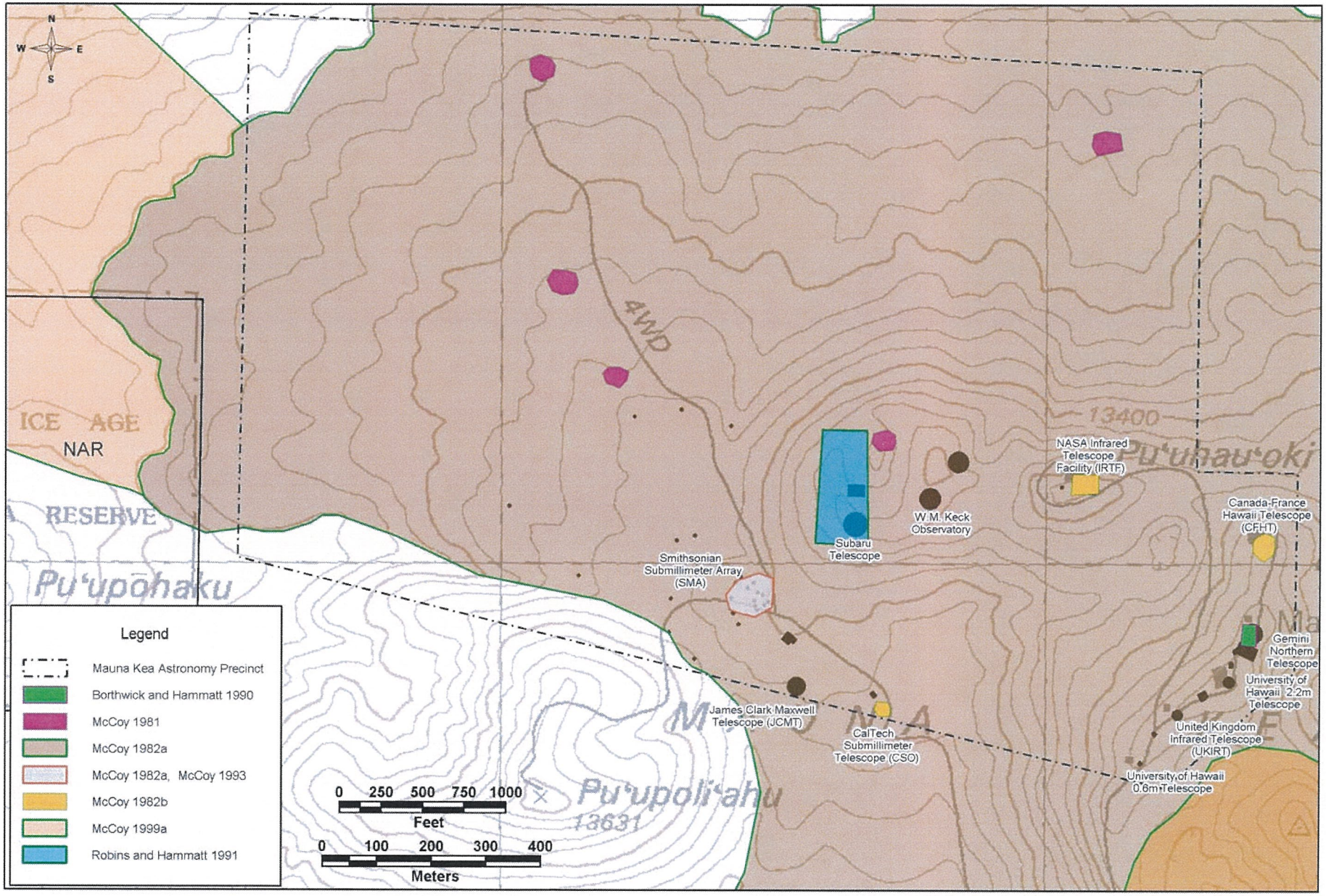


Figure 3.3 Location of Previous Archaeological Surveys for Observations, Telescopes, and Arrays in the Astronomy Precinct Portion of the Mauna Kea Science Reserve.

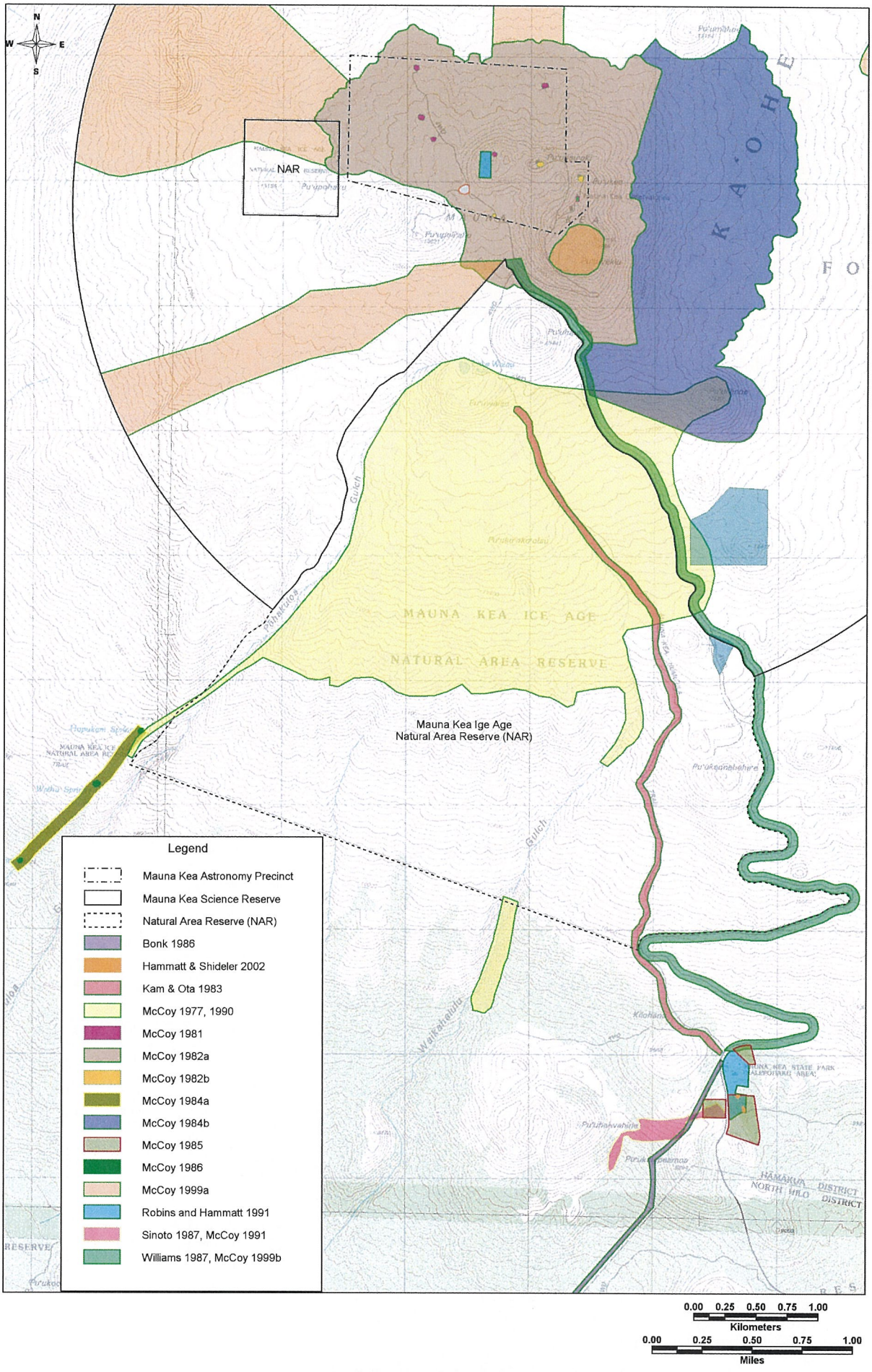


Figure 3.4 Location of Previous Archaeological Surveys and Data Recovery Projects in the Natural Area Reserve, along the Mauna Kea Observatories Access Road, and in the Hopukani, Waihu and Liloe Springs Areas.

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

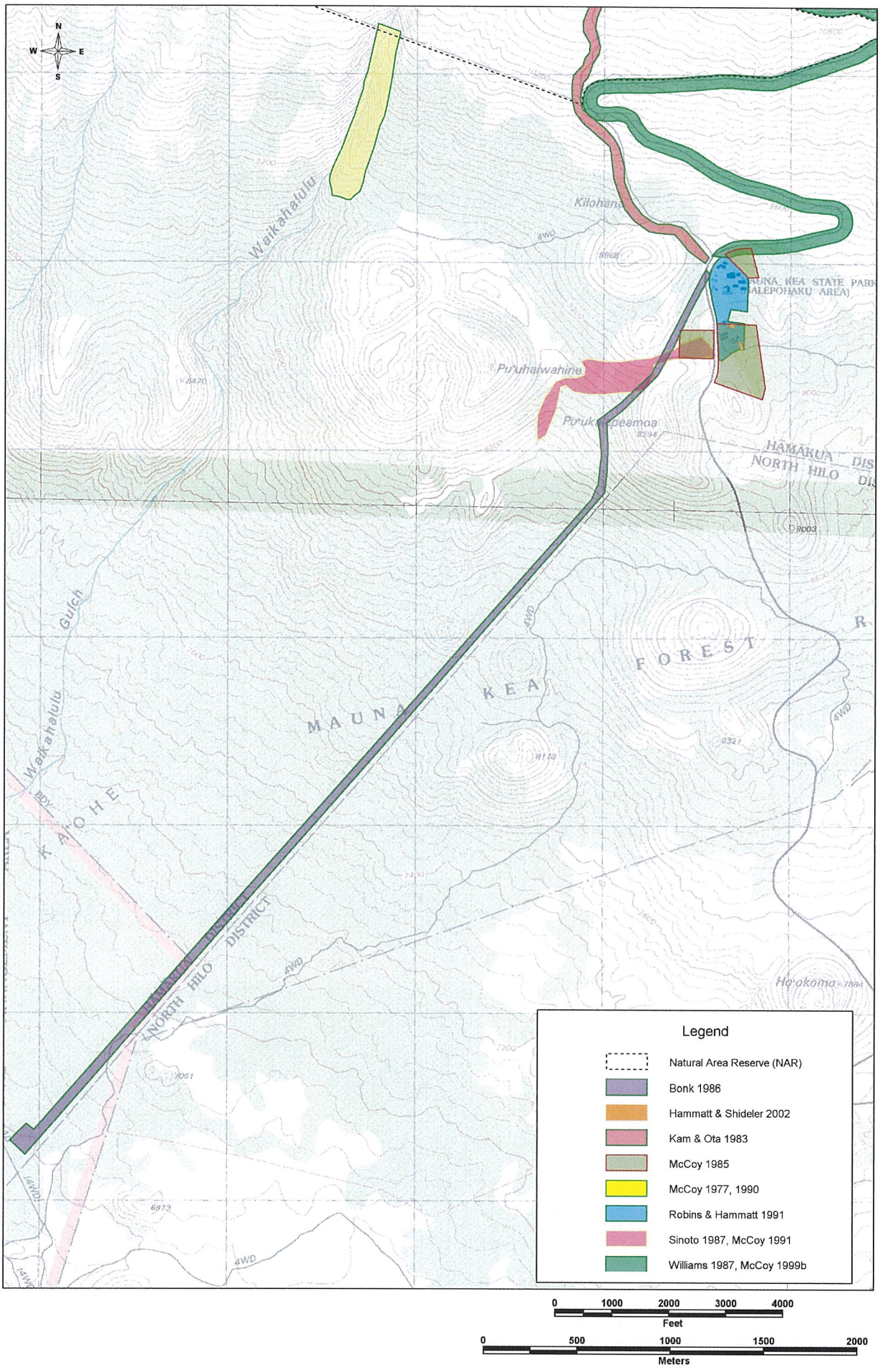


Figure 3.5 Location of Previous Archaeological Surveys and Data recovery Projects in the Hale Pōhaku Area

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

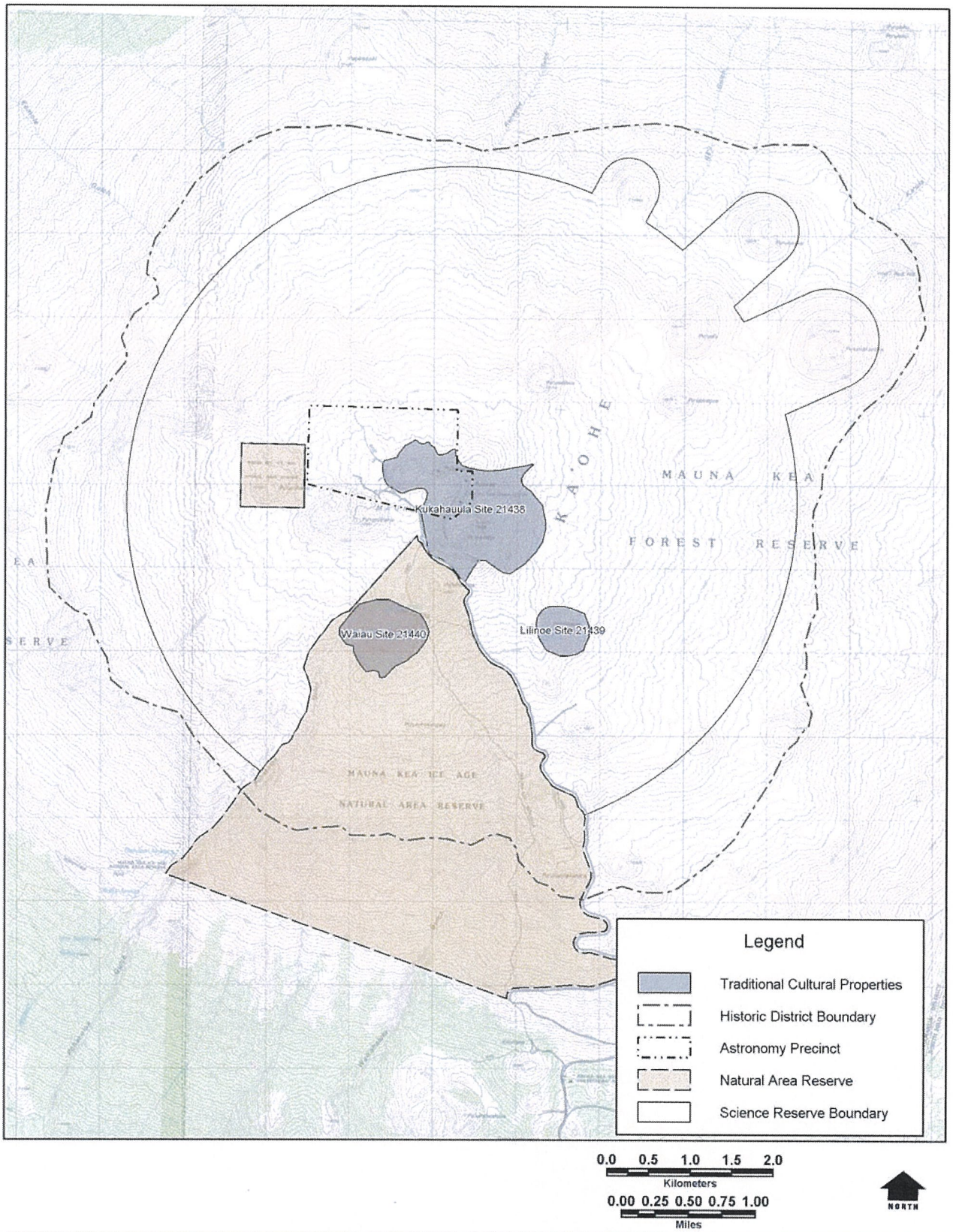
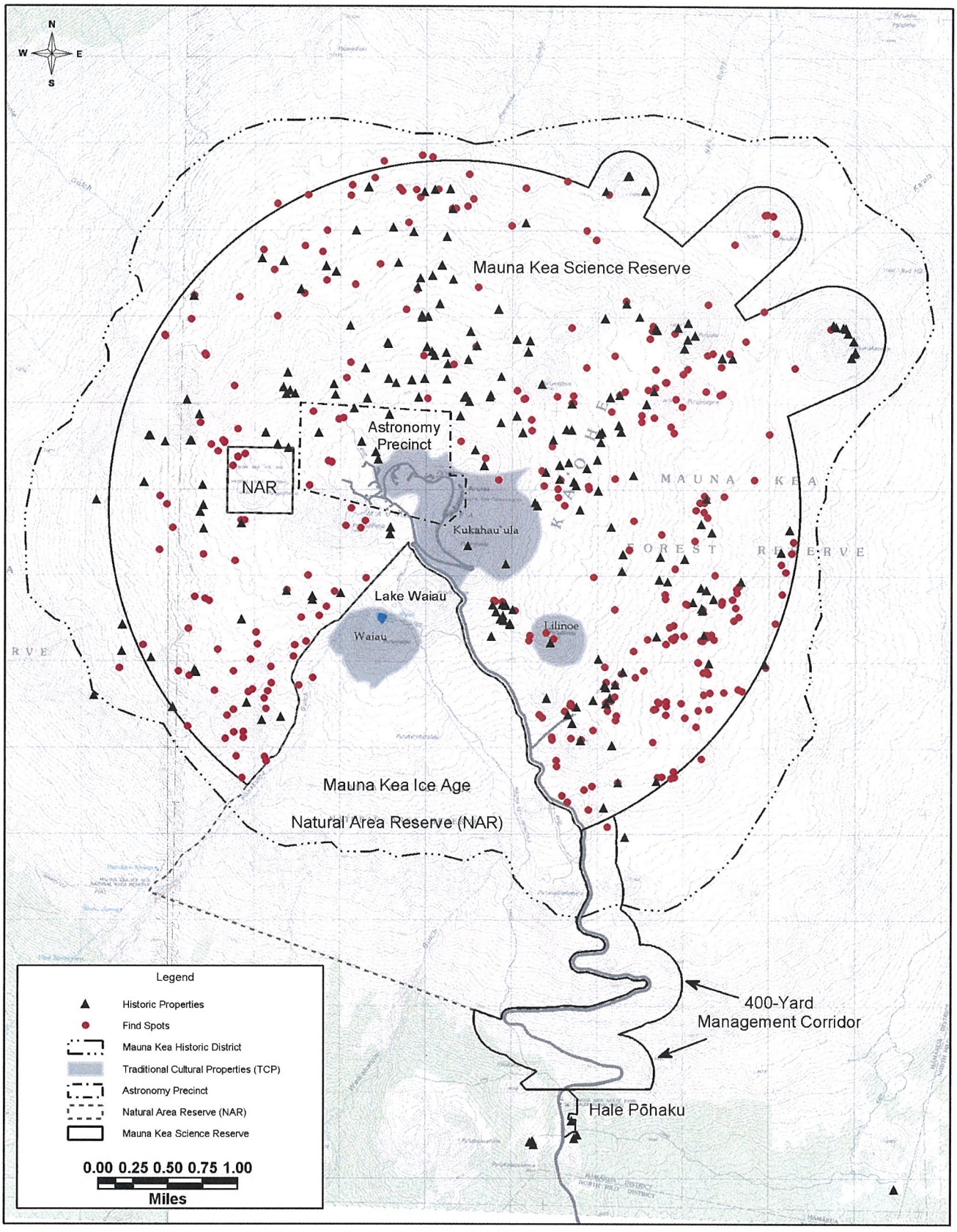


Figure 3.6 Location of Designated Traditional Cultural Properties in the Mauna Kea Summit Region.



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).

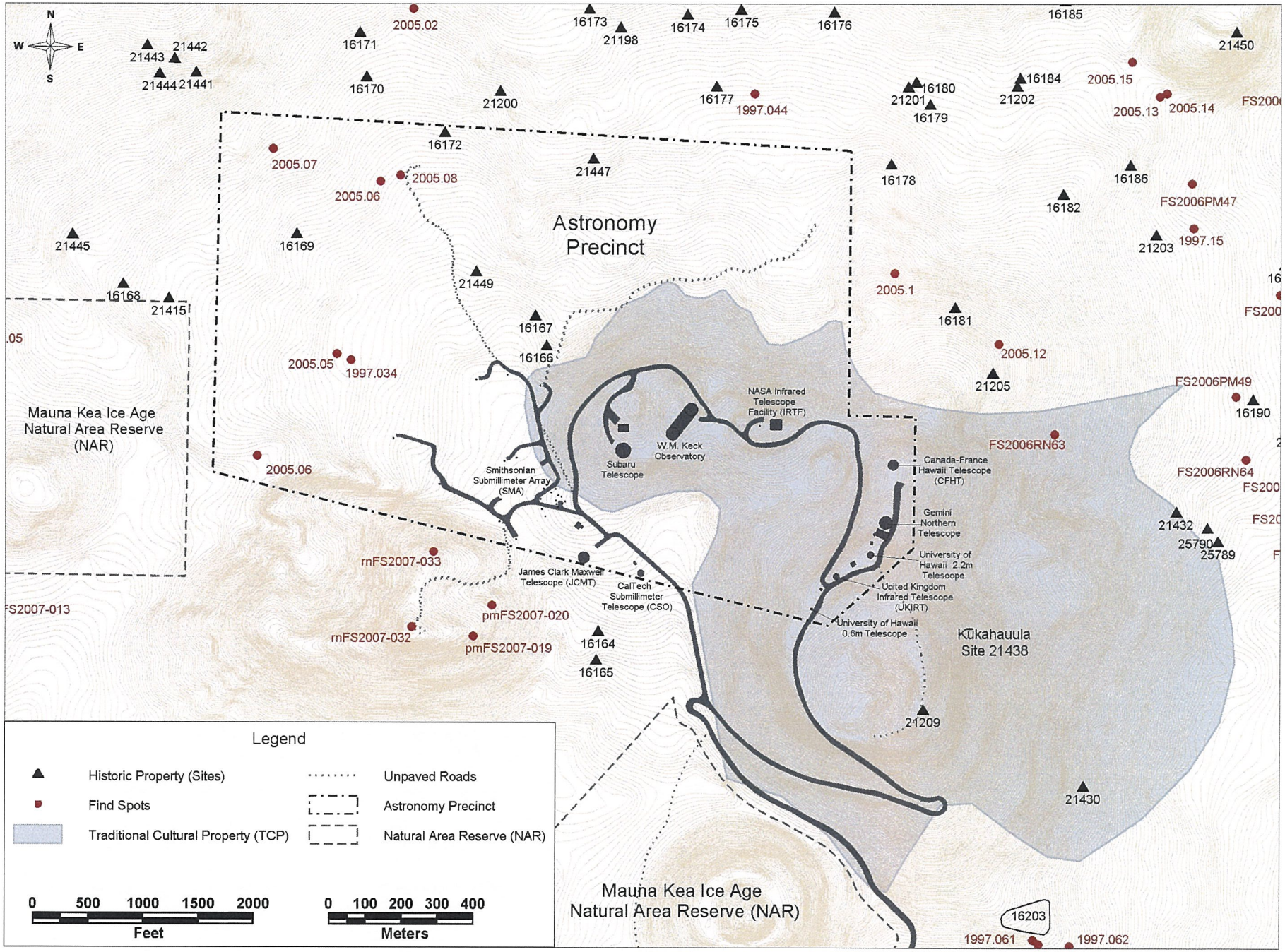


Figure 5.1. Location of Historic Properties and Find Spots in the Astronomy Precinct and Surrounding Areas.

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

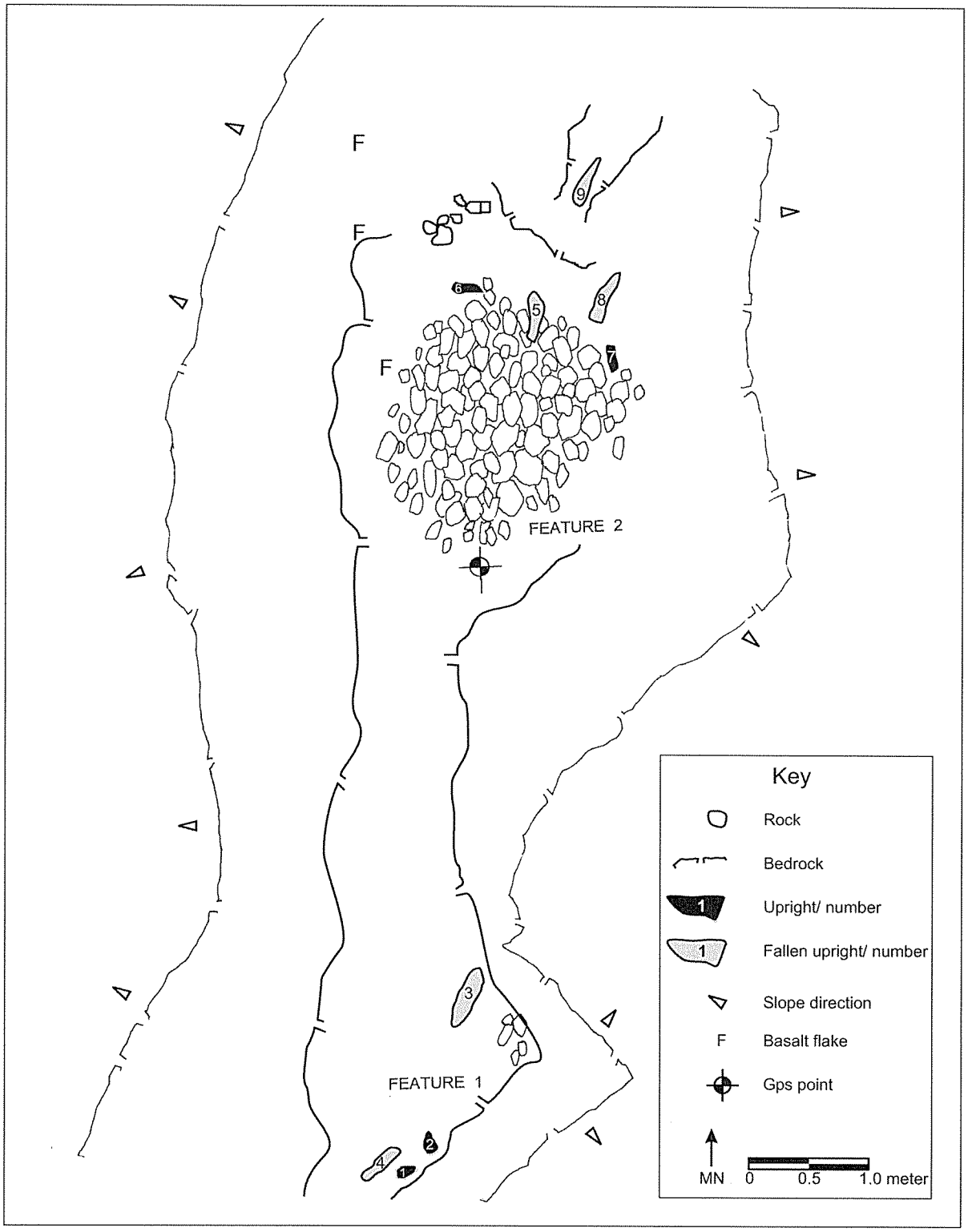


Figure 5.2. Site 16166, Features 1and 2, Plan View.

(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.	

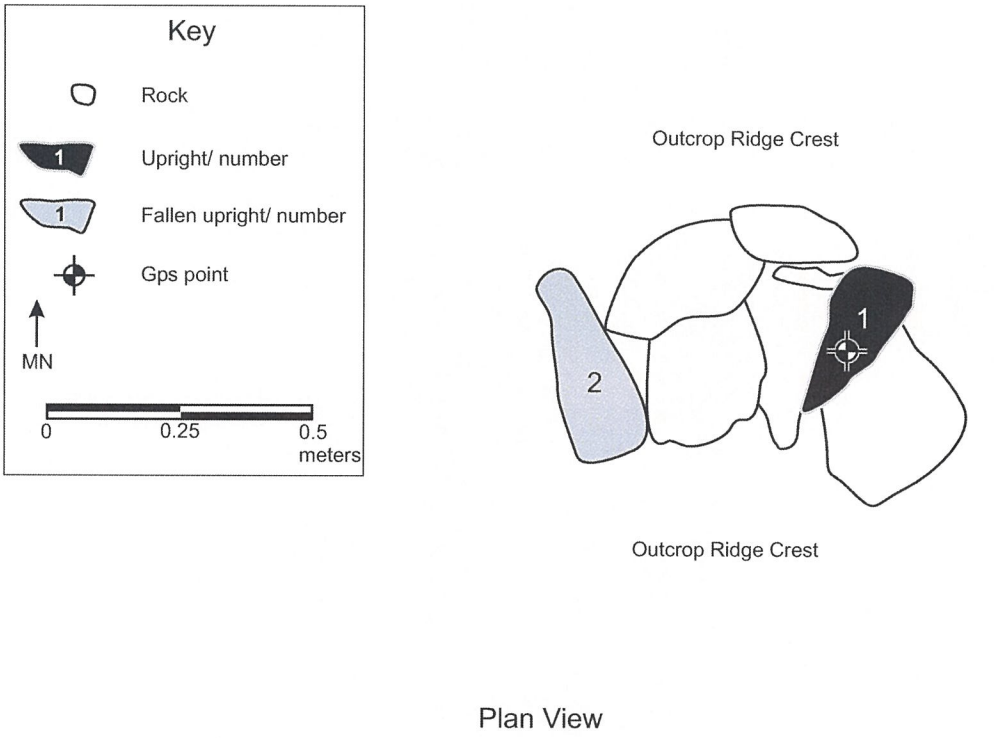
Description

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

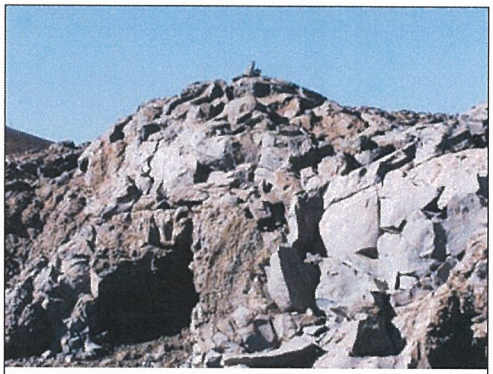


Plan View

View to the South

C1-08-31-05-Photograph No.4

View to the West



C1-08-31-05-Photograph No.5

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.	

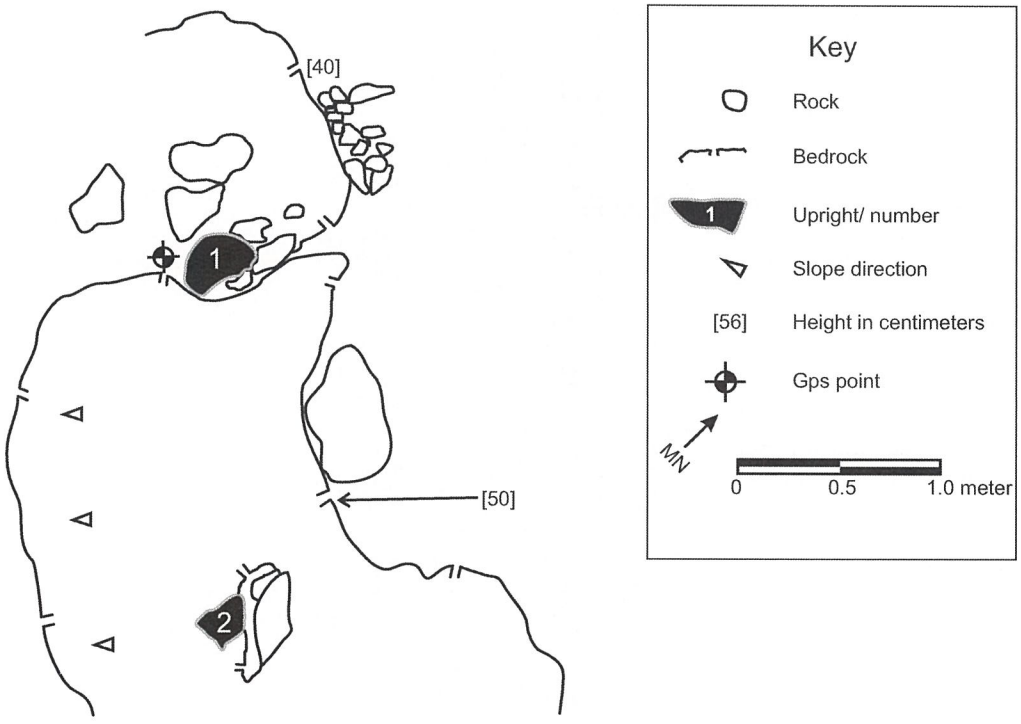
Description

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.

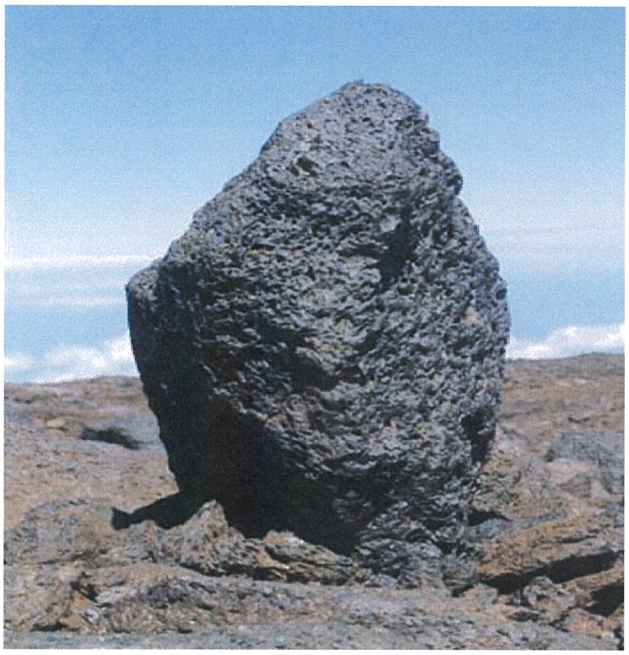


Figure 5.5. Photograph of Site 16172, Shrine.

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).

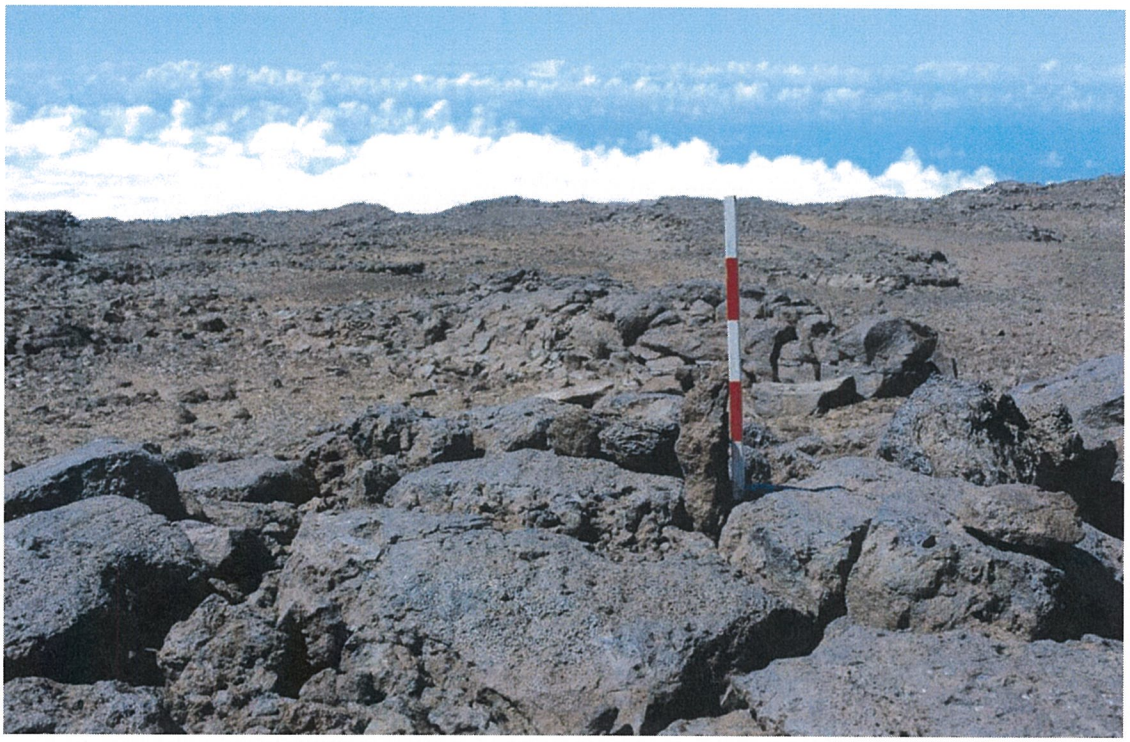


Figure 5.6. Photograph of Site 21447, Shrine.

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

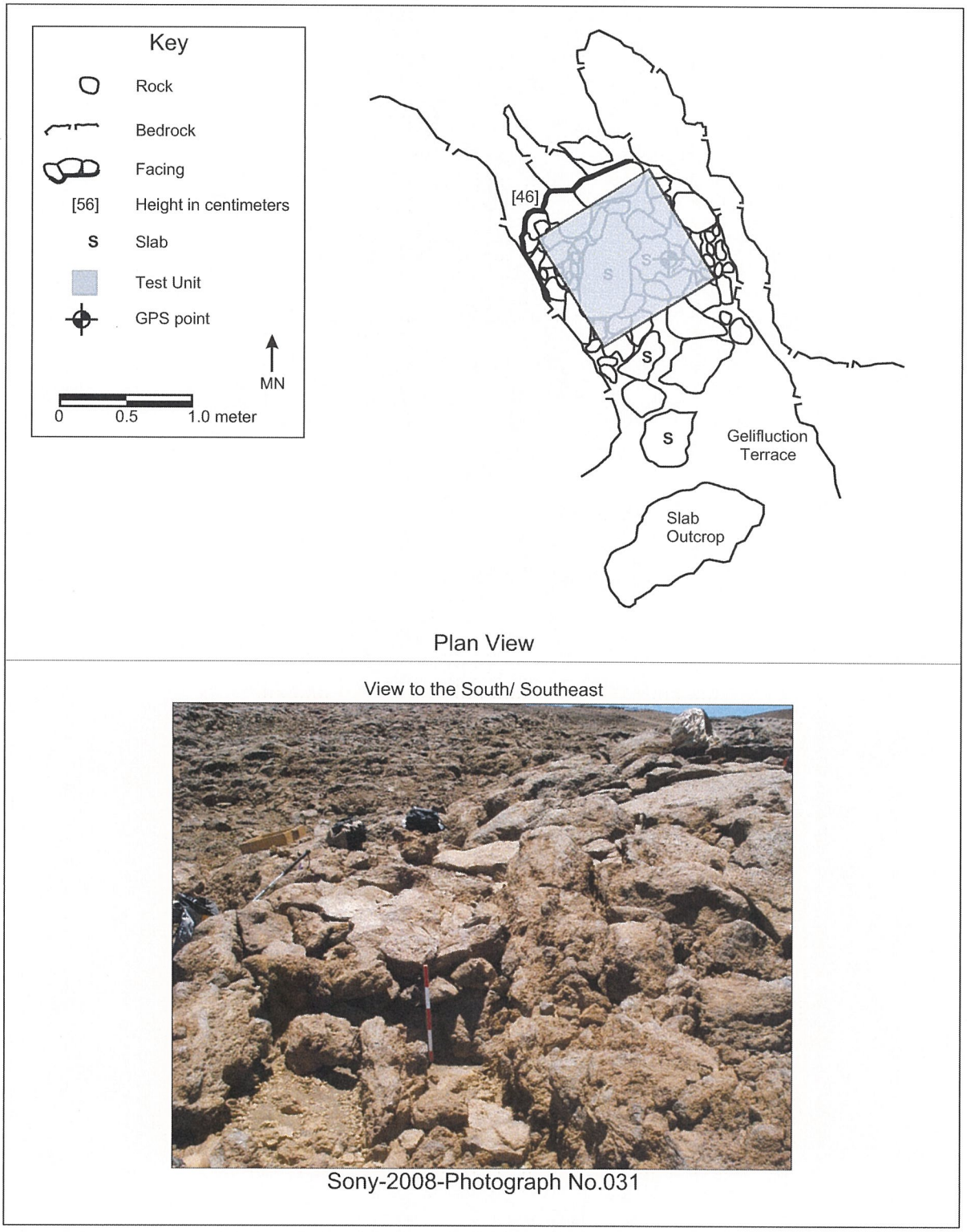


Figure 5.7. Site 21449, Plan View and Photograph.

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.

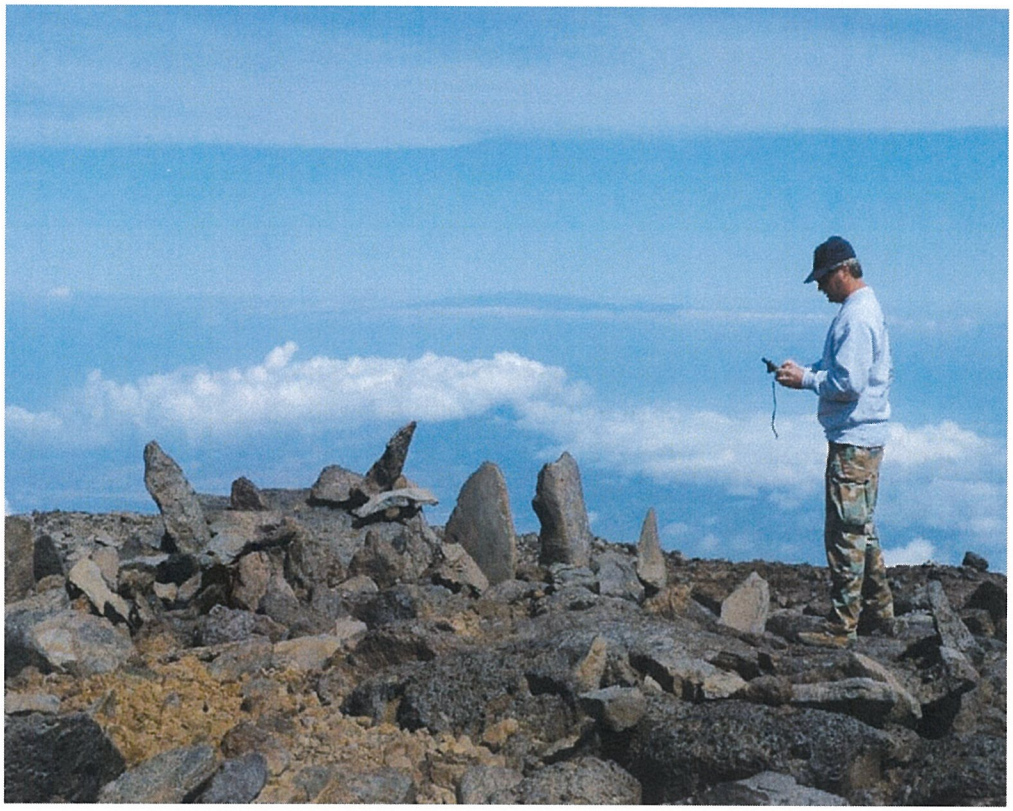


Figure 6.1. Photograph of Shrine Site 16168 Located Adjacent to the West Boundary of the Astronomy Precinct; View to South-Southwest.

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•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•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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