AN ARCHAEOLOGICAL INVENTORY SURVEY INCLUDING SUBSURFACE TESTING FOR A PORTION OF THE AHUPUA'A OF KE'EKE'E LOCATED AT TMK:1-2-09:29 (THE KALANI KAI SUBDIVISION), PUNA DISTRICT, ISLAND OF HAWAI'I

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Abstract

An archaeological Inventory Survey was conducted by Archaeological Consultants of the Pacific, Inc. for a 94 acre lot (TMK:1-2-09:29) at the request of the property owner, Mr. Richard Koob. This property is located in Ke'eke'e Ahupua'a, District of Puna, Island of Hawaii. Numerous archaeological features and sites were identified. The sites include a probable *heiau* (Site 21143), a cemetery (Site 2539), various enclosures (Sites 21140-21142), and a portion of an agricultural complex (Site 21139) which is represented by numerous walls, mounds, modified outcrops, modified depressions, pits, agricultural terraces and other agricultural features.

Several recommendations are made by ACP, Inc. in regards to cultural resources located on the subject property. **1)** It is recommended that the probable *heiau* (Site 21143) be preserved. This will require a Preservation Plan and the execution of this plan which will further need to meet appropriate policies. **2)** It is recommended that the cemetery (Site 2539) be preserved. This will require a Burial Treatment Plan which will need to accord with appropriate policies as well. **3)** Additional archaeological investigations will be necessary concerning Site 21139 and the archaeological features characterizing this agricultural complex. This will, of course, depend on future developments and activities relating to the subject property. Mitigation measures should be detailed in a Data Recovery Plan. The extent and nature of future archaeological investigations concerning Site 21139 will be dependent upon the nature of the research questions and approaches presented in the Data Recovery Plan. **4)** Additional archaeological data recovery may be necessary for Sites 21140-21142. Again, this will require a Data Recovery Plan which will be dependent upon the nature of future developments and activities conducted on the subject property as well as the nature of research concerns.

The following report presents a background of the region which includes previous archaeology, previous land-use and settlement. Following these sections, detailed description of the archaeological features and sites inventoried throughout the current investigation are provided. The descriptions are followed by discussions which focus on functional aspects of the features and sites, the evolution of the agricultural complex (Site 21139), and ideas concerning a possible correlation between the distribution of feature types and the vegetation zones resultant from land-use and geologic/flora zones. This correlation may prove to be a useful tool for predictive modeling in the region.

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Section 1: Introduction

An archaeological Inventory Survey was conducted for a 94 acre lot (TMK:1-2-09:29) located at Ke'eke'e Ahupua'a, District of Puna, Island of Hawaii. All historic features and sites were located and described. A large agricultural site (Site 21139) with numerous features was also encountered. Site 21139 is located throughout the majority of the subject property and likely extends into adjoining properties. Approximately 25-30 % of the subject property containing Site 21139 was surveyed and mapped in detail in order to provide an adequate sample of this site and its features. It was possible to conduct sub-surface testing on a small number of features. This testing was performed and the results are discussed and further assessed below.

Newman (1970:119) describes a 'field system' located in southern Puna (see also Yent & Ota 1982). Site 21139 may have been articulated with this field system, which may have operated as a large intensified dryland agricultural system. Large agricultural field systems are noted for the Island of Hawaii (e.g., the Kona Field System). However, detailed analysis of this possible field system has not been attempted compared to other field systems located in Hawaii which have received considerable archaeological attention. In the absence of 1) temporal information, 2) adequate understanding of the extent or magnitude of the possible field system, and 3) supporting evidence which could link known agricultural complexes located in the region into a larger contemporaneous agricultural field system, interpreting Site 21139 as belonging to a larger field system at this time may be unwarranted. More will be discussed concerning these issues below.

Numerous mounds, modified outcrops, modified depressions, pits, low walls and other agricultural features are located on the subject property which characterize the agricultural complex, Site 21139. The total number of features number in the hundreds and may number in the thousands depending on the true extent of the site. In the Site 21139 sample area, over 2,320 m of informal walls and 88 significantly large mounds were identified. Hundreds of additional smaller mounds and pits also relating to agricultural production were noted in the sample area. Also identified were modified gullies, modified outcrops and terraces which again relate to agricultural production. This density of features covers virtually the entire subject property. It is apparent that agricultural production had reached a significantly intensive level prior to the demise of the agricultural complex. The eventual abandonment and/or replacement of the agricultural complex may relate to a number of factors which are highlighted in the following discussion.

Additional archaeological features and sites of importance included the identification of a probable *heiau* (Site 21143), the identification of several enclosures morphologically related to enclosures representative of historic animal husbandry practices, and additional assessment of a previously recognized historic cemetery (Site 2539). Numerous additional agricultural features and several other features (e.g., walkways and C-shapes) were also identified. Most of these features likely relate to the agricultural complex (Site 21139), although several features were clearly related to

different functional and temporal contexts. Both traditional Hawaiian (some of which may be prehistoric) and historic archaeological features are represented.

Additionally, it was noted that archaeological feature type and density may be correlated to specific substrate and vegetation zones. Assuming that there may be an ecological and evolutionary relationship between existing substrate and vegetation zones with that of the productive potential for certain crop species to be cultivated in specific environments utilizing specific technologies available, it may be possible to predict archaeological feature types based on the nature of the geologic/flora zone. In other words, given a specific geologic/flora zone, it may be possible to predict that a certain class of archaeological features will predominate the area, or a specific ratio of archaeological feature types will occur. Further investigation into this hypothesis is required. The Puna region may be an ideal testing area. Furthermore, the subject property contains several temporally and physically distinct lava flow zones which may relate to these issues.

During the course of investigations, additional attention was given to mapping and testing the probable *heiau* (Site 21143) as this is an extremely important cultural resource. In addition, the cemetery (Site 2539) was mapped in further detail as there were some discrepancies between the original description and the current survey results.

Finally, several recommendations are made by ACP, Inc. in regards to cultural resource management of archaeological resources located on the subject property. It is recommended that further data recovery be conducted for the probable *heiau* (Site 21143) to more accurately refine interpretations concerning its function(s) through time. Because Site 21143 was likely a *heiau*, although it may have been subsequently utilized as a habitation platform, preservation is recommended. This will require a Preservation Plan, and the execution of this plan which will also need to meet the requirements of State and Local policies. It is recommended that the cemetery (Site 2539) be preserved. This will require a Burial Treatment Plan and the subsequent execution of this plan according to State and Local policies. Additional archaeological investigations will be necessary concerning the agricultural complex (Site 21139). This should be detailed in a Data Recovery Plan. The extent and nature of future archaeological investigations concerning archaeological features located on the subject property and relating to the Site 21139 will be dependent upon the nature of the research questions and approaches presented in the Data Recovery Plan. However, an adequate sample of Site 21139 has been collected on the subject property such that a future Data Recovery Plan need not be overly demanding. Furthermore, the extent and nature of future developments for the subject property will also influence the extent and nature of future archaeological investigations.

Section 2: Location and Description of the Subject Property

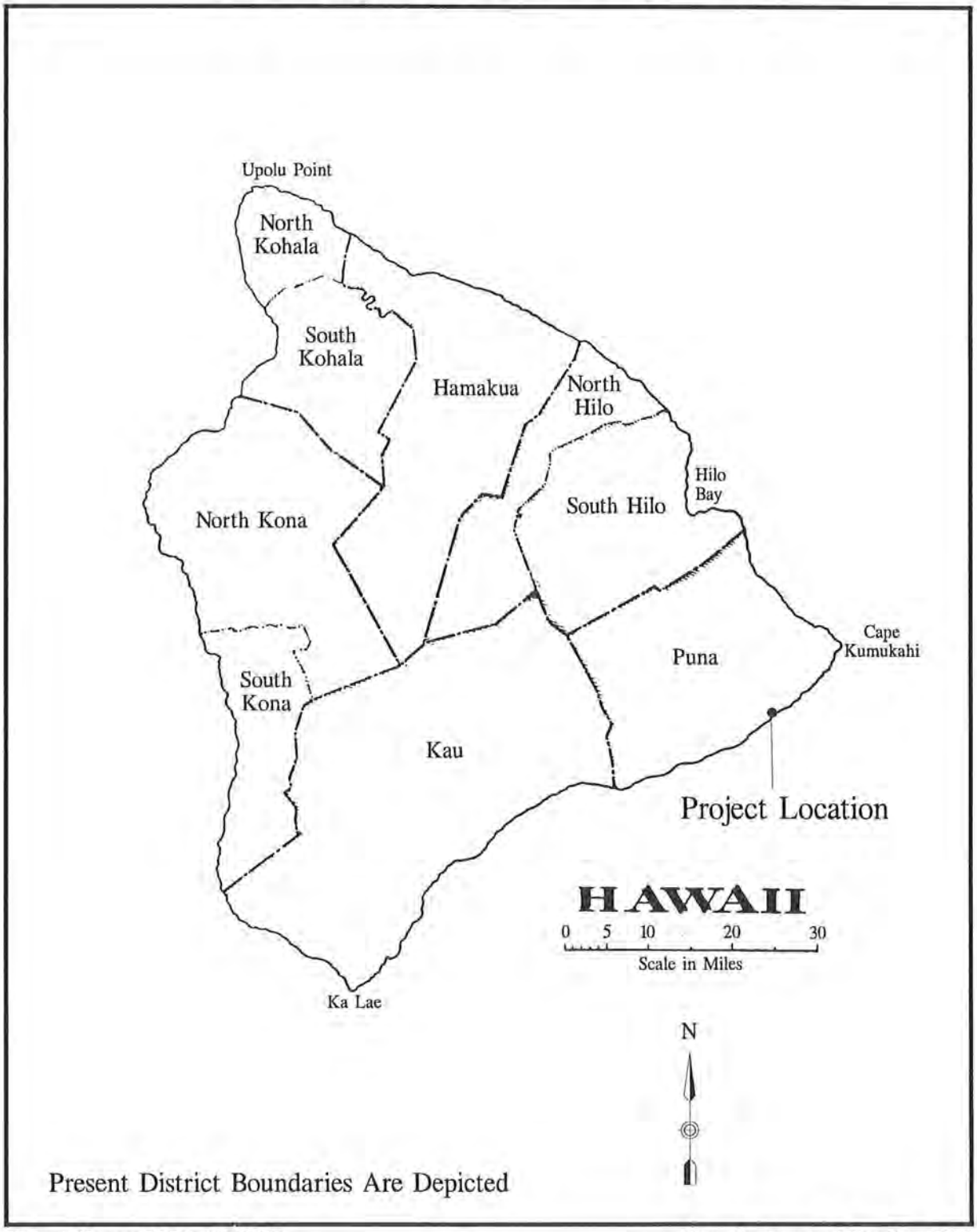
The subject property (TMK:1-2-09:29) is located on the Island of Hawaii, district of Puna, *ahupua'a* of Ke'eke'e (see Figures 1 and 2).

The subject property is a 94 acre lot. The southwest corner is located at geographic grid coordinates 154°55'10''W and 19°24'20''N (Universal Transverse Mercator (UTM) coordinates 29825mE and 214660mN). From this point, the subject property extends *mauka*, or inland, for 2,457 ft (749 m). This length borders the current Government property which separates the nearby Seaview Estates from the subject property. The most inland length of the subject property, which is oriented parallel to the coast, stretches for a length of 1,505 ft (459 m). This length borders Lot 18-B (Grant 6358: K. Waipo). The subject property is bordered to the northeast by the current Kalani Honua Conference Center and Resort which stretches *mauka-makai* in orientation for a length of 2,296 ft (700 m). The remaining length of the subject property is bordered by the coastal road for 1,898 ft (579 m).

The subject property ranges from 100 to 300 ft from the coast along the *makai* border. Elevation at this location ranges from 40 to 50 ft amsl (above mean sea level). Continuing inland, elevation steadily increases to a maximum of 175 ft amsl. The most striking elevational changes occur along the southwestern border of the subject property where the A.D. 1790 lava flow has left a nearly vertical wall (5 to 7 m high) composed of *a'a*. Along this lava flow, located towards the coast, a cemetery (Site 2539) rests on a commanding bluff which then drops abruptly in elevation towards the coast.

Three distinct lava flows are located on the subject property (see Figure 3). The oldest lava flow is located along the southwestern *mauka-makai* length of the subject property. This flow, dated to between 750 and 1,500 years old, is characterized as a *pahoehoe* flow. The basalt contains 3-6 % plagioclase and 3-6 % olivine phenochrysts in feldspathic groundmass. Only a relatively small remnant of this lava flow remains exposed. Moving east along the subject property from this area, a younger flow, dated to between 440 ± 60 B.P. and 490 ± 60 B.P. replaces or overlays the underlying flow. This lava flow is characterized as discontinuous spatter ramparts and extensive *pahoehoe* flows (the subject property predominantly contains extensive *pahoehoe* flows). Upon closer examination during the course of fieldwork, it was noted that concentrations of *a'a* are ubiquitous throughout the surface outcroppings of this lava flow. This pattern may fall within Lipman and Banks' (1987:1530) 'transitional lava' class. Basalt contains 4-6 % plagioclase and 4-6 % olivine phenochrysts. This lava flow dominates the greater area within the subject property. Finally, the most recent lava flow is located along the southwestern *mauka-makai* border of the subject property. This lava flow is characterized as spatter deposits, extensive *a'a* and *pahoehoe* flows, and littoral cone (Ka'akepa) which erupted about A.D. 1790. The subject property contains only the extensive *a'a* flow aspect of this flow. Basalt in this area has locally diktytaxitic texture and contains 10-15 % olivine and 5-10 % plagioclase phenochrysts and common xenoliths of gabbro.

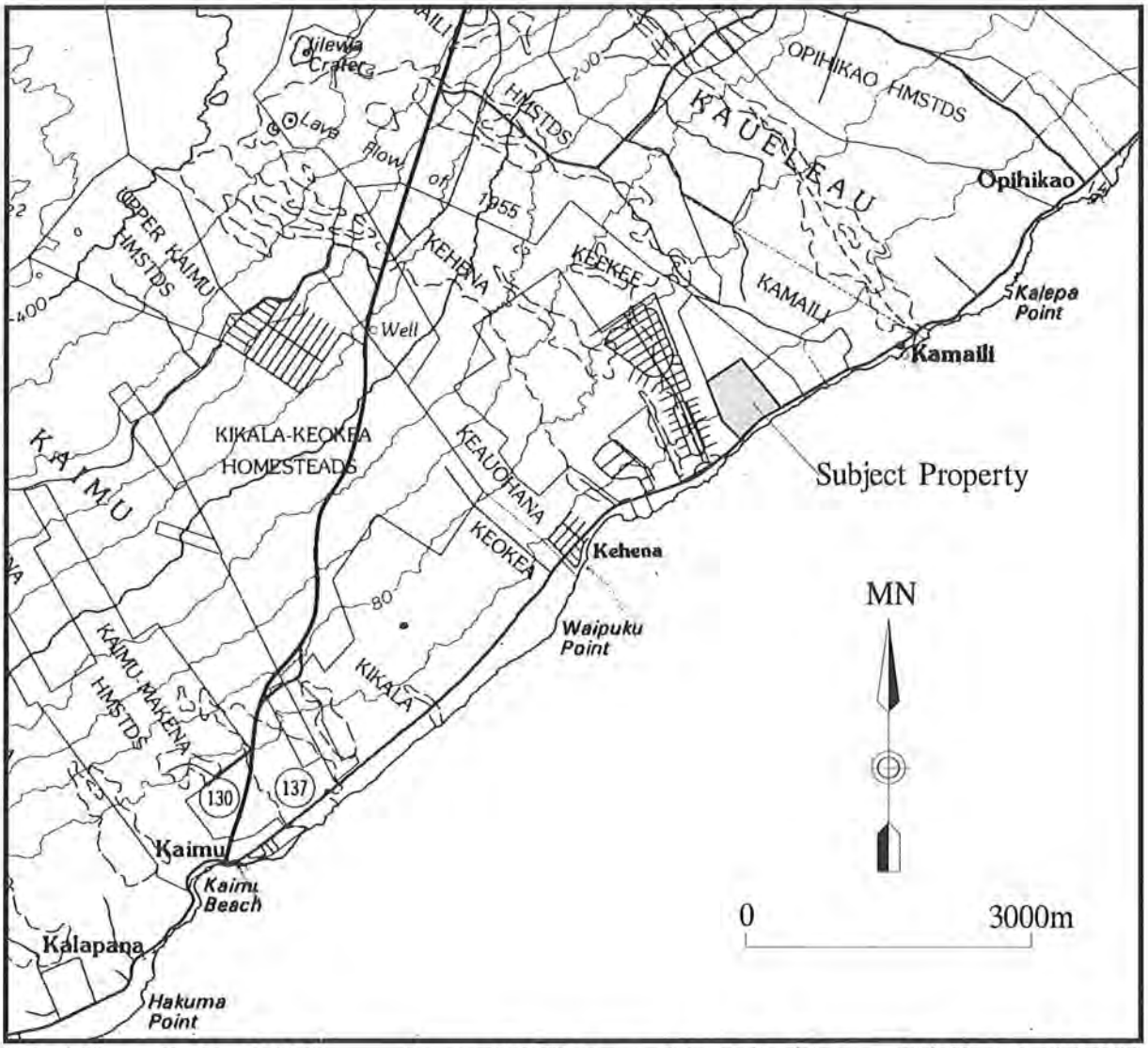
Figure 1: Project Location on a Map of Hawaii



Kalani Honua TMK: 1-2-09:29

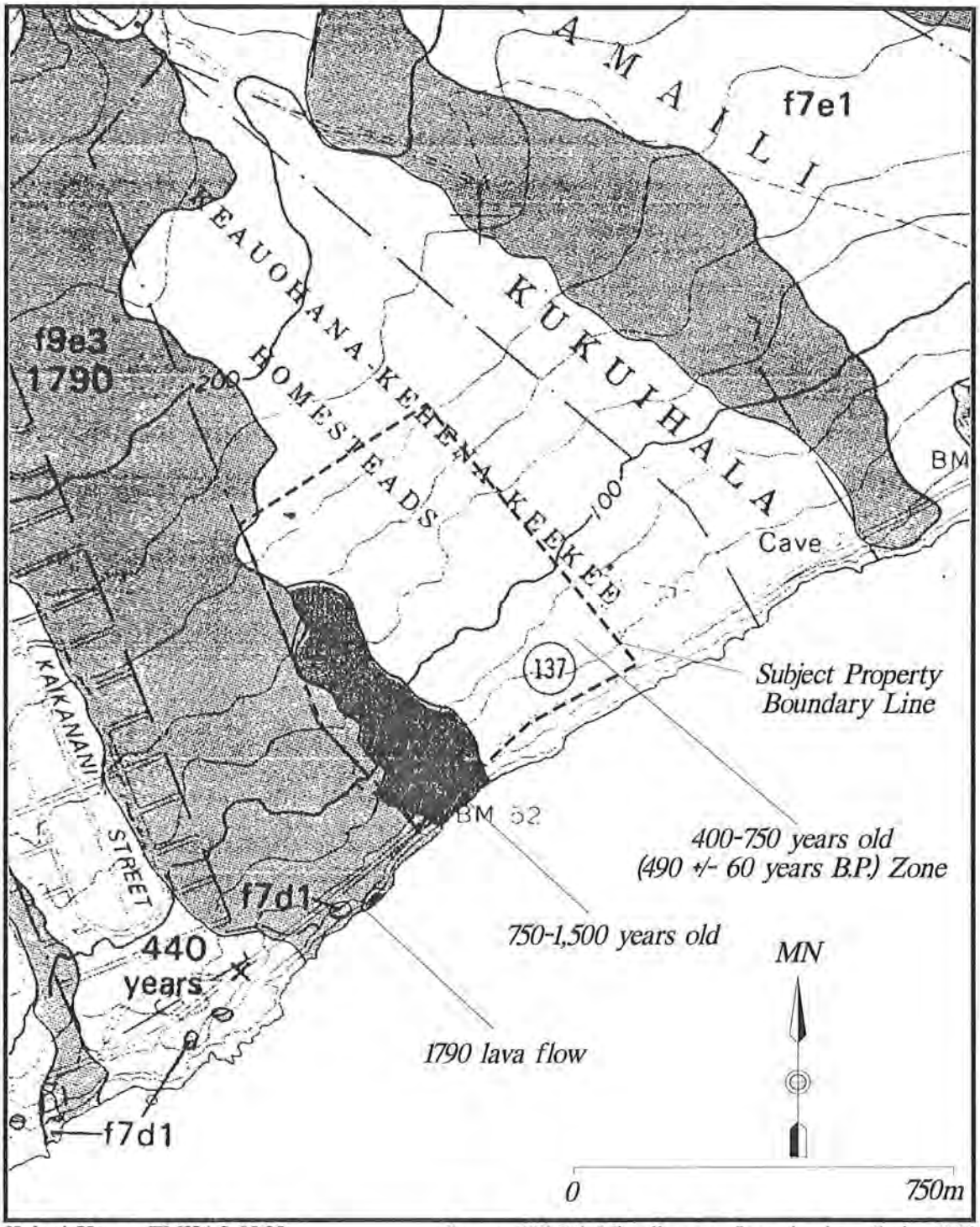
After: Spriggs and Tanaka 1988

Figure 2: Subject Property on U.S.G.S. Map



Kalani Honua TMK: I-2-09:29 Source: U.S.G.S. County Map Series (Topographic) Sheet 2 of 3 1980

Figure 3: Age and Location of Lava Flows



Kalani Honua TMK:1-2-09:29

Source: U.S.G.S. Miscellaneous Investigations Series 1990

Within the subject property, the transition to this flow is abrupt. This lava flow forms the distinct 5-7 m wall mentioned above.

Numerous stone mounds and rock outcrops were scattered throughout the subject property. Hundreds of these rock mounds were anthropogenically manufactured or modified; perhaps adding to existing natural mounds and outcrops. Much of the remaining mounded *a'a* material and many *pahoehoe* blister outcrops appear to be natural formations. However, these naturally occurring features potentially could have been utilized for agricultural practices such as yam (*Dioscorea* sp.) and sweet potato (*Ipomoea batatas*) cultivation. Some of the stone mounds may have resulted from intentional clearance of rocky areas, although evidence of intentional mound manufacture for only rock clearance is extremely elusive. Such intentionally manufactured mounds potentially could have served agricultural purposes as well. More will be discussed concerning this in the following sections.

In addition to the mounds and rock outcrops, numerous modified depressions are also scattered in various locations throughout the subject property. It is conceivable that some of these features may be natural. However, given the historic evidence for heavy land-use, intense agricultural production, and the unique methods for agricultural production, it is more likely that these depressions are agricultural features (e.g., areas from which rocks were extracted and the depressions subsequently mulched for taro cultivation).

Sato *et al.* (1973) describe two classes of geological/soil formations on the subject property. According to this classification, the subject property contains rLV lava flows which are composed primarily of *a'a* but may contain various amounts of *pahoehoe* in addition to Malama series soils. The lava flows represent geologically recent flows. There is no soil formation and the surface is bedrock. Lichens, mosses, ferns and *'ohi'a* trees are found growing in various densities from the rock.

The Malama series of soils are composed of fragmented *a'a* and extremely stony muck, providing a fairly poor top soil. The Malama series of soils are further characterized as dysic, isohypothermic, typic, tropofolists, lithosols. Malama series soils are well-drained, thin, extremely stony, organic soils over *a'a* lava. These soils are undulating to rolling. Mean annual soil temperature is 72-74° F. Malama series extremely stony muck (3-15 % slopes) soils are very dark brown with hues ranging from 7.5YR to 10YR (e.g., 7.5 YR 2/2 (Munsell color chart)). Surface layers average about three inches thick. The soils are strongly acid. The soil structures are moderate, medium and fine, subangular blocky structure. The soils are additionally characterized as friable, slightly sticky, slightly plastic, weakly smeary with many roots and fine pores. *A'a* cobbles and stones make up 40-80 % of the soil mass. Permeability is rapid, runoff is very slow, and erosion hazard is slight.

After careful assessment during the current fieldwork, it was noted that there may be some discrepancies with the descriptions in Sato *et al.* (1973) concerning the locations

and sequencing of lava flows in and around the subject property. It is apparent from more recent sources that there is a small exposed remnant of a much older lava flow on the southwestern side of the subject property (U.S.G.S. Map 1990). As this section is geologically at least twice the age of the adjacent lava flow to the northeast and more than four times the age of the adjacent lava flow to the southwest, the soil development in this area may be considerably more advanced. This would logically result from the greater amount of time that the rock has been allowed to weather and decompose coupled with the greater amount of organic deposits which have likely accumulated on the surface over time. Therefore, pockets of soil of a different nature may indeed be present on the subject property in these areas. Such areas may have supported a different variety of past vegetation, or, at least, supported a different density of plant material as potential soil nutrient value and soil depth may have been considerably different. These factors may have implications for past land use (e.g., agricultural exploitation) in this localized vicinity. More will be discussed in the following sections.

Rainfall in the region ranges from 75-100 inches annually. Monthly precipitation remains fairly constant with a slight decreases in rainfall during the summer months, and slight increases in rainfall during the winter months.

Vegetation on the subject property is dominated by strawberry guava (*Psidium cattleianum*), pandanus (*hala, Pandanus odoratissimus*), lantana (*Lantana camera*), and *liliko'i* (*Passiflora* sp. (possibly *P. pulchella*)). Stands of strawberry guava and pandanus were extremely thick, dense, of relatively old age and were generally covered with vines. Pandanus and strawberry guava did not necessarily cluster in only mutually exclusive concentrations, although concentrations were often predominated by one or the other species. This vegetation pattern dominated over 85% of the subject property. Areas which contained the A.D. 1790 lava flow were dominated by scatters of *'ohi'a* (*'ohi'a lehua, Metrosideros collina*) and ferns (possibly *Cibotium splendens* which are commonly associated with *'ohi'a*).

Other plant taxa included scattered, individual trees such as coconut (*Cocos nucifera*), breadfruit (*ulu, Artocarpus communis*), mango (*Mangifera indica*), papaya (*Carica papaya*), guava (*Psidium guajava*), banana (*Musa* sp.), *ti* (*Cordyline terminalis*), banyan (*Ficus benghalensis*), *alahe'e* (*Canthium odoratum*), *lama* (persimmon, *Diospyros* sp.), *milo* (*Thespesia populnea*), *noni* (*Morinda citrifolia*), and albizia (*Albizia* sp.). Coconut, breadfruit, papaya and banana also occurred in occasional clusters. A variety of lichens, mosses, ferns and vines were also present.

Section 3: Previous Land Use and Settlement

The District of Puna, in the time of Liloa (circa A.D. 1475, calculated from genealogies using 25 years per royal generation), was one of six autonomous chiefdoms on the island of Hawai'i. Liloa, according to tradition, was a descendent of Pili-kaaiea, a chief originating from Tahiti approximately ten generations prior to Liloa's ascension. Pili-kaaiea re-established a chiefly blood line on Hawai'i (Malo 1951, as quoted in Barrera & Barrere 1971:7). Liloa's son, 'Umi-a-Liloa, united the island into a kingdom (possibly by aggressive military action) and was acknowledged as supreme ruler by the chiefs of each of the six districts (Kamakau 1992:1). The period of 'Umi's reign may have been characterized by relatively peaceful conditions until his death. After his death, however, a period of political and economic instability may have followed (Kamakau 1992:21, 34-46). Politically autonomous district-like units may have repeatedly united and splintered throughout the prehistoric period with periods of relative peace, punctuated by warfare with the occurrence of transitions and divisions of land and power. Aggression, oppression and warfare may have been common (Kamakau 1992:229-245).

Puna, unlike the other districts, never played a dominant role in the political history of Hawai'i Island. Puna's lands were sought for their fertility and productive potential, but were not controlled by chiefs from Puna. These lands were often dominated by more powerful ruling families in the adjacent Ka'u and Hilo districts (Emory *et al.* 1959:15). This region was also controlled by the residing chiefs of Kona at various times.

The written history of the Puna area begins with observations aboard one of Captain Cook's ships, the Resolution, in 1779, as it sailed near the eastern shoreline of Hawai'i Island. Lt. Samwell described that many people gathered on the shore to look at the ship and that, "many canoes came off to us... (with) a great number of beautiful young women." Lt. King describes a brief comparison between the eastern and western parts of the district:

> The East part of Opoona (Puna) is flat, covered with Coco nut trees, and the land far back is of a moderate height. As well as we could judge this is a very fine part of the Island, perhaps the best.
>
> On the SW extremity of Opoona the hills rise abruptly from the Sea side, leaving but a narrow border, and although the sides of the hills have a fine verdure, yet they do not seem Cultivated and when we sailed pretty near and along this end of Opoona, we did not observe that it was equally populous with the eastern parts (Beaglehole 1967:606).

In 1823, William Ellis, Asa Thurston, and Artemas Bishop toured the Island of Hawai'i, searching for suitable locations for mission stations. When they reached Puna in August, the first Western contact was made. On their way from Kalapana to Kapoho, these missionaries preached in eight 'villages'. Throughout Ellis' journal entries (1969)

various comments give information concerning subsistence, agricultural development, settlement, population, village life, and numerous activities, rituals, and beliefs.

After visiting Kilauea and proceeding to 'Kearakomo', Ellis (1969:271-280) noted that vegetation became increasingly luxuriant as they approached the sea. He continued to describe that the water was hardly better than sea water and was collected from hollows 9-12 ft from the ocean where the water had percolated through vesicles (Ellis 1969:271). Later, Ellis (1969:280) noted that water was also collected from mountain caves.

Ellis further noted that the residents fermented an intoxicating drink made from sugar-cane juice, sweet potatoes, or *ti* root (Ellis 1969:271-274). Ellis continues with a description of *ti* and notes its multi-functional and symbolic usage. *Ti* was used for food, sugar, beer, intoxicating drinks, animal fodder, thatch, and cloaks. *Ti* was also considered an emblem of peace.

As Ellis' team passed 'Punau', 'Leapuki' and 'Kamomoa', "the country began to wear a more agreeable aspect. Groves of cocoa-nuts ornamented the projecting points of land, clumps of kou-trees appeared in various directions, and the habitations of the natives were also thickly scattered over the coast" (Ellis 1969:280). Ellis also noted the 'Wahaura' *heiau* in Pulama, built by Kamehameha and dedicated to 'Tairi', his war-god, where occasional human sacrifices were said to have occurred.

Upon arriving at Kupahua, Ellis (1969:281) described this area as, "well cultivated country." Ellis noted a large *heiau* in Kalapana and the residence of the *heiau* priest, Kapihi. By the time they had reached Kaimu, Ellis described the area as having plantations, coconut groves, and even mentioned a 'neat' garden at one of the residences. Kaimu soil was described (Ellis 1969:287) as decomposed lava forming a light fertile soil. Approximately 725 people resided in Kaimu and close to two thousand residents when the surrounding smaller settlements were included. There was a good sandy beach appropriate for a canoe landing and nearby brackish water wells. Well constructed stone walls were apparently utilized in the area as Ellis relates a story of how a wall and a well were damaged during an earthquake (Ellis 1969:286). Ellis describes the land use in the area as under more 'industrious' cultivation.

Of particular relevance concerning the current investigation, is Ellis' accounts from Kehena to Kamaili. Unfortunately, Ellis' accounts throughout this leg of his travels are not detailed, but do provide some useful information.

> After traveling a mile and a half along the shore, we came to Kehena, a populous village: the people seemed, from the number of their canoes, nets, &c. to be much engaged in fishing. Their contrivance for launching and landing their canoes was curious.

> Leaving Kehena, we walked onto Kamaili, a pleasant village, standing in a gently sloping valley, cultivated and shaded by some large cocoa-nut trees. Here we stopped to take breakfast, having traveled about four hours and a half. The people who were not employed on their plantations, or in fishing, afterwards assembled, and were addressed from Psalm lxvii.7... Our path from Kaimu had been smooth and pleasant, but shortly after leaving Kamaili, we passed a very rugged tract of lava nearly four miles across. The lava seemed as if broken to pieces as it cooled; it had continued to roll on like a stream of large scoria, or cinders. Our progress across it was slow and fatiguing. On our way, our guide pointed out Karepa, an ancient *heiau*, formerly dedicated to Tu and Rono, and built in the days of Teavemauhiri, or Tanakini, king of this part of the island. We could not learn whether this was the *heiau* of Rono, in which the bones of Captain Cook were deposited, and worshipped. About half-past one, we arrived at Opihikao, another populous village, situated within a short distance of the sea (Ellis 1969:289).

Ellis' accounts provide important information useful for archaeological assessments in this area: 1) it quite evident that vegetation and agricultural production becomes more intensive and well developed from the coastal regions past Kilauea, and increasing in intensity towards Opihikao (the ability of soil to support dense vegetation and agricultural exploitation appears to increase as well), 2) plantations and tree crops are repetitively described, demonstrating that an arboreal component in the subsistence practices was well established, 3) sweet potatoes and *ti* appear to be quite ubiquitous and major contributors to subsistence in this region, 4) house gardens appear to have been utilized, 5) marine resources were heavily exploited, 6) a number of small, village-like settlements were located along the coastal stretch with clusters of residential structures located along the coast (we can also infer population densities based on Ellis' estimates as well), 7) good canoe landings were located at Kehena and Kaimu, although they may have been engineered in unique ways (especially so for Kehena as Ellis notes, "their contrivance for launching and landing their canoes was curious"), 8) stone walls and wells, as well as cave water sources, were being utilized, 9) major *heiau* were located in the region although none are mentioned in the area from Kehena to Kamaili.

Fishing and marine exploitation, as was the case throughout the Hawaiian islands, undoubtedly played a major role in the early subsistence economies of this region. In each area there were generally one to several *heiau*, designated as a *ku'ula heiau*, for invoking the aid and/or protection from gods prior to major fishing expeditions (Crozier & Barrere 1971:14). Crozier and Barrere (1971:15) note that, "since Puna was also noted for its '*opelu* (*Decapterus pinnulatus*), it is quite possible that more than one *ku'ula heiau* in the district was similarly used long after the formal observances of the old religious order was abolished." The coastal areas in Puna provided suitable environments for the exploitation of numerous fish, shellfish and other marine species. Pond systems in Puna (e.g., the brackish water ponds of Keahiakaka (Site 2518) located *mauka* of the Mahinaakaka Heiau) may have also contributed to marine resource exploitation. The existence of numerous complex pond systems has not been recognized for Lower Puna,

although Kikuchi (1973) classified 21 ponds between Hilo and Puna during his Hawaiian aquaculture practices study. However, marine resources provided a major contribution to the subsistence economy, having varying dominant roles throughout the evolutionary sequence of human occupation.

In the 1830's, as part of a growing concern for the depopulation of native Hawaiians, the missionaries took several censuses of the islands. In 1831-32, Puna, Olaa, and Hilo together supported 12,500 people. In 1835, this had dropped to 11,894; 7,087 in Hilo, 307 in Olaa, and 4,500 in Puna. This decline in population is relatively small compared to other parts of the archipelago, possibly due to the delayed impacts of Western contact which occurred later than other locations throughout the islands.

Christian missionaries were remarkably successful in converting Puna residents. In 1835, Reverend Titus Coan assumed control of the Hilo Mission station where he lived for fifty years and became, in some ways, a major influence over the lives of the people of Puna and Hilo. When Wilkes came through Puna in 1841, he noted that,

> Almost all the hills or craters of any note (in Puna) have some tradition connected with them; but I found that the natives were now generally unwilling to narrate these tales, calling them 'foolishness' (Wilkes 1845, Vol. 4:186).

In 1841, Coan wrote in the *Missionary Herald Extracts* that most of the inhabitants of Puna lived along the shore, though hundreds were scattered inland. Coan noted the population at 4,371, of which none were foreigners (Holmes 1985:7). This account suggests that inland habitation was present, though not in great density.

In 1846, Chester Lyman went through Puna with Reverend Coan, stopping at Pohoiki and describing the area as a pleasant inlet of the sea with fine groves of coconuts. 200 people reportedly gathered there for a sermon (Lyman 1924:96-97).

Dryland farming was practiced in coastal Puna during the late prehistoric and early historic period. Newman (1970:118) suggests that the table-land areas along the lower slopes of Hawai'i Island were used for the cultivation of un-irrigated taro (*Colocasia esculenta*), sweet potatoes (*Ipomoea batatas*), yams (*Dioscorea alata*), bananas (*Musa* sp.), breadfruit (*Artocarpus communis*), *olona* (*Touchardia latifolia*), sugarcane (*Saccharum officinarum*), and paper mulberry (*Broussonetia papyrifera*). Newman suggests that these crops were possibly organized in scattered fields, or possibly a "dryland field system." There is evidence of this in Ellis' accounts. Ellis (1917:204-214) mentions taro, sweet potatoes, and sugarcane in cultivation along the southern coast. Furthermore, of Puna in general, Wilkes (1845, Vol. 4:188) noted, "the inhabitants seemed to have an abundance of bread-fruit, bananas, sugar-cane, taro, and sweet potatoes," and that sweet potatoes, "are seen to be growing literally among heaps of stones and pieces of lava, with scarcely enough soil to cover them; yet they are, I am informed, the finest on the island."

From Newman's suggestions and past accounts, it is evident that a fairly sophisticated 'field system' may have evolved in the Puna region. Other field systems are certainly present in the leeward regions of Hawaii Island by the proto-historic period. However, the intensity and nature of the field system in Puna may be unique, although it is not as well understood as other field systems on Hawaii Island (e.g., the Kona field system). Furthermore, it may by unwarranted to assume the existence of a large field system in the area without additional archaeological and historical verification.

It should be noted that the place which Wilkes calls Puna is designated on his map as a village north of Kapoho Point. This location corresponds to the narrative in which he says that after leaving Panau (a village where canoes were built), he went three miles and then saw the coast five miles off (this point was 2260 ft amsl). Wilkes (1845, Vol. 4:194) then headed to Kapoho past a line of craters and, "as we approached the sea shore, the soil improved very much and was under good cultivation; taro, sweet potatoes, sugar cane, and a great variety of fruits and vegetable."

In the late 1840's, epidemics reportedly killed over a thousand people in Puna and Hilo. Following this, the population of Puna steadily declined (Barrera & Barrere, as quoted in Bevacqua & Dye 1972:4). During this time period (beginning in 1840), native agricultural field systems were gradually abandoned (Cordy n.d.:21 as quoted in Bevacqua & Dye 1972:4).

Following the Great Mahele at the end of this period, many of the lands of Puna were given to heirs of Kamehameha's supporters. The lands that Kamehameha I had given to warrior chiefs, his counselors, and his favorites, remained in their possession after his death (Kamakau 1961:219). Title to the lands went to eleven *ali'i*, all absentee owners. Only two *kuleana* awards were issued in all of Puna.

During the second half of the nineteenth century, Puna's population continued to decline. When Chester Lyman revisited Puna in 1871 (Lyman 1924:103), he noted that, "... there are but a few people in this region... miserably poor and for some time past have been almost in a state of famine." Dutton, in 1884, stated that Puna's population was 'scanty' and had undergone a great decrease within the present century (Dutton 1884:147). This shift in population was accompanied by the gradual emergence of ranching, coffee production, and sugarcane into the local economy (Cordy n.d., as reported in Bevacqua & Dye 1972:4). These trends are also reflected in the Tax Assessment books for the District of Puna for 1859-1883.

By the 1930's, agricultural practices in Puna had changed dramatically. Handy (1940:128) notes,

> One of the most interesting things about Puna is that Hawaiians believe, and their traditions imply, that this was once Hawaii's richest agricultural region and that it is only in relatively recent time that volcanic eruption has destroyed much of its best land. Unquestionably lava flows in historic times have covered

more good gardening land than in any other district. But the present desolation is largely due to gradual abandonment of their country after sugar and ranching came in.

Rainfall and arable land for dryland taro is still ample in Puna. Seven miles inland from Kapoho through Malama and Kamaili, Handy and Handy (1972) describe steep slopes largely covered with rich soil, mostly in sugar in 1935, but likely planted throughout with taro in prior time periods.

A unique method of taro cultivation was practiced in the pandanus forest from Kapoho through Pohoiki (Handy 1946:53). From Joseph Ilala'ole, as told to Mary Pukui, comes the following description (see Handy & Handy 1972:104) of planting in the wet lowland forest areas of Puna:

> At Kalapana, Kehena, and Kamaili our kinsmen grew fine taro by the *pa-hala* (pandanus clearing) method and the advantage was that there was not the constant weeding required by taros growing in good soil. This is the process: Make holes in the *a'a* by taking out some of the stones. Be sure that the place chosen is in a *pu-hala* grove, to save the labor of hauling *hala* branches into the patch later on. Fill the holes with whatever weeds can be found and leave them there for six weeks or more. The weeds rot and make soil. When the weeds have rotted away, the taro *huli* are wrapped in *lau hala* (leaves) to keep them moist and are planted. When three or four leaves have appeared on each *huli* then that is the time to cut down the *pu-hala* to let in the sun. The branches of the *hala* are cut off and the patch covered with them until there is not a trace of the taro to be seen. This is left until sufficiently dry to set on fire. The fire does not hurt the taro much as the *huli* were already well rooted. The *hala*, reduced to ashes, gives the taro the needed nourishment and they grow so tall that a man can be hidden under their leaves.

This account is indicative of the unique methods of taro cultivation which may have, at one time, been practiced during various stages of field system agriculture. However, detailed evidence is still absent.

Detailed reviews of maps dating from the late 19th and early 20th centuries yield some information concerning land use, development, and settlement during this time period. However, other than listing the presence or absence of a few settlements already known, sparse information is provided for the areas close to the subject property (e.g., few identifications of cemeteries, schools, *heiau*, etc.). An interesting feature of all these maps is that boundaries between *ahupua'a* divide various *kipuka* (areas surrounded but not overrun by lava flows) into halves. This may indicate that *kipuka* were regarded as specialized resource environments which were divided evenly between adjacent *ahupua'a*.

In the 1890's, a man by the name of Rycroft ran a coffee operation from neighboring Pohoiki. He purchased 652 acres in 1879, and established a mill during or before 1894 (Rycroft 1894:99 as quoted by Cordy 1977:4). Rycroft planted about 35 acres with coffee and was processing crops in his own mill. On an 1895 map, a small *kipuka* is labeled as 'Dickman's coffee patch'. In 1902, this same *kipuka* is designated 'small arable opening'. By 1905, Hawaiian coffee growers could no longer compete with foreign growers, and coffee declined in the Puna economy. By 1927, coffee was no longer cultivated in Puna (University of Hawaii Study of Coffee 1927, as quoted in Cordy 1977:4).

Between 1930 and 1932, Alfred Hudson, an early archaeologist, undertook a site inventory for the entire eastern coast of Hawai'i. In his narrative, he reported that there were no towns and that no large scale agricultural developments had destroyed sites in the southern part of Puna (Hudson 1932, vol. 2:337). Hudson also reported that a 'numerous' Hawaiian population still lived here, mostly along the coast, and that their ancestors had lived in the same locality (Hudson 1932:339).

Hudson (1932) reported that people from Kalapana lived along the coast and maintained gardens a few miles inland, which they visited from time to time. Hudson also described the growing of sweet potatoes in the hollows and cracks of bare lava by simply covering the budding parts with decayed leaves and herbs (Hudson 1932:340).

The introduction of guava into the area has had significant impacts. Strawberry guava, in particular, generally remains a pest throughout much of the area. It has encroached into many areas and is particularly dense in the subject property. In 1932, a Mr. Kamau was ranching from the north side of Kahuwai to Ahalanui. According to a Puna informant, cattle were 'semi-wild', and with the encroachment of guava that destroyed the pastures, Mr. Kamau worked the herd until it dwindled to nothing (Gilbert Hay, verbal communication, 1/20/71, as quoted in Crozier & Barrere 1972:20).

By the mid-20th century, sugarcane cultivation had become more important in Puna than coffee or ranching. Papayas, anthuriums and orchids have also been commercially cultivated.

Since the 1955 and subsequent lava flows, the landscape in this region has continued to change dramatically. This has also resulted in dramatic changes in settlement and land-use over the last fifty years.

The Ahupua'a of Ke'eke'e

The name of the *ahupua'a*, Ke'eke'e, is a reduplication of the word *ke'e*, meaning crooked, angular or full of faults. This seems to correspond to the shape of this *ahupua'a* as well as the neighboring *ahupua'a*, Kukuihala (later subsumed by Kamaili), and Kehena. It is possible that Ke'eke'e was an ancient *ahupua'a*. It is also possible that it was etched out during the time Kamehameha I was apportioning Puna lands among his

supporters. Ke'eke'e is shown on maps of Puna surveyed in 1895 and 1902, but only one boundary, that shared with Kukuihala is partially defined.

In the Tax Assessment books for the District of Puna for 1859-1883, a small and steadily declining population was recorded in Ke'eke'e. In 1859, six tenant taxpayers are listed for the *ahupua'a*. If we take Ellis' estimation of each household consisting of five people (1917:91), the population of Ke'eke'e would have been approximately 30 individuals, a great decrease since the time of his visit in 1823. By 1863, the number of taxpayers had declined to three, and again declined to two by 1869. In 1875 there was only one tenant still paying tax, and by 1876, Kaleopaa and Pukue, both of whom had paid tax in Ke'eke'e in 1869, had moved to Kamaili. After 1878 there were no taxpayers listed in Ke'eke'e. This shift in population during the late 1800's was accompanied by the gradual emergence of ranching, coffee, and sugarcane into the economy of Puna (Cordy n.d., as reported in Bevaqua & Dye 1972:4).

The Homestead map surveyed in 1902 shows land use patterns for Ke'eke'e and the surrounding area. At that time, only five houses and a church are designated in the village of Kamaili. In Kehena, the area of a village is seen on the shore but no structures are marked. In Ke'eke'e itself, *pu-hala* and guava "woods" occupy the upper portions, along with *'ohi'a* forests. Closer to the shoreline, an ancient cemetery and a schoolhouse can be seen. There is some question as to whether or not this is a reference to the Kamaili School. At present, this cannot be verified.

In 1935, it was said that throughout the inland sections of Ke'eke'e, Kehena, Kamaili, Kaueleau, Keauohana, and 'Opihikao dryland taro was cultivated. The traditions of Puna imply that it was once Hawai'i's richest agricultural region, and that it only in recent times has lava destroyed much of this land. In 1935, in all of the *ahupua'a* mentioned above, some taro was still being grown by Hawaiians for home consumption (Handy & Handy 1972:542). Homesteading areas for Keauohana, Kehena, Ke'eke'e, and Kamaili had been established as early as 1902.

By the mid-20th century, sugarcane cultivation had become more important in Puna than coffee or ranching. As mentioned above, papayas, anthuriums and orchids have also been cultivated commercially. The land for the Kalani Honua Conference and Retreat center was purchased from Joanne Vincent in 1975. Kalapana Sea View Estates, a somewhat large subdivision, straddles the boundary of Ke'eke'e and Kehena.

Section 4: Previous Archaeology

Archaeological research in the Puna region of Hawaii Island is still rather limited although a number of investigations conducted since the 1970's (both research and compliance) have contributed to understanding the prehistory and history of the Puna area. The following section will briefly discuss some of these investigations with particular attention focused on investigations which have a direct relevance to the subject property.

The earliest studies of particular archaeological significance conducted in the Puna area focused on the description and mapping of *heiau* by Stokes in 1906 and Thrum in 1907. Thrum (1907:49-55) describes four *heiau* in Puna (Wahaula Heiau in Pulama, Punaluu Heiau in Kalapana, Niukukahi Heiau in Kalapana, and Kukii Heiau in Kapoho). At least two of these *heiau* (Wahaula and Punaluu Heiau) were built with *a'a* or slab lava walls and pavings, but furthermore, contained pavings and platforms constructed with waterworn beach stones. Bevacqua and Dye (1972) also note a similar construction with beach stones for the Mahinaakaka Heiau located in the *ahupua'a* of Keahialaka. Although *heiau* were located and described in neighboring areas (see also Ellis' accounts (1969) of several *heiau* which were visited following his departure from Kilauea and subsequent trip through Puna), no *heiau* have thus been recognized and described in Ke'eke'e.

From 1930-32, Alfred Hudson conducted surveys along the east coast of Hawaii Island. However, many of the sites which were recorded have subsequently been destroyed by land development or lava flows (Bevacqua & Dye 1972:5). After a period of almost thirty years of virtually no archaeological investigations, Kenneth Emory prepared a volume (n.d.) on the natural and cultural history of the Kalapana Extension of Hawaii National Park in 1959 which offers information concerning the history, traditions and environment in Puna. In 1970, Virginia Loo and William Bonk prepared a site inventory (n.d.) which included descriptions and evaluations of significant sites in the districts of Kohala, Hamakua, Hilo, and Puna. In 1971, Cox and Stasack (1971) discussed petroglyphs in Puna. Also in 1971, Crozier and Barrere (1971) conducted investigations in the *ahupua'a* of Pualaa which contained the ruins of the Hawaiian village of Pualaa. Features which were recognized included stone walls, walled enclosures, stone mounds, platforms, modified lava tubes, pavings, pits, mounded graves, warm springs, and a stepping stone trail. Crozier & Barrere (1971:27) suggest that one of the larger mounds (Site 50-HA-A10-7) was likely a *heiau* with vertical side walls and a platform (and two paths) constructed of numerous waterworn stones.

In 1972, Bevacqua and Dye conducted an archaeological survey for the proposed Kapoho-Kalapana Highway in Puna which was defined by a corridor 15 miles long and 2,000 ft wide. This survey recognized 48 sites which included two *heiau*, eight petroglyph clusters, four platforms, six enclosures, five cemeteries, three trails, 14 site complexes, two ponds, a mound, a lava tube, a coffee mill, and a village. Many of the enclosures and complexes were composed of poorly to well built walls, many having no

definitive function or shape. Many of the platforms occurring singularly or as part of a complex were interpreted to possibly be habitation platforms. Some of these were constructed of *pahoehoe* slabs and waterworn stones. Site 2539, described as a cemetery containing 24 burial platforms is located in Ke'eke'e at the southwest corner of the current subject property. A remnant of the Kehena Beach Trail (Site 2540) is located just across the highway along the ocean front not far from the cemetery (Site 2539). Site 2536 (a complex consisting of a platform abutting a wall, an L-shaped structure, and an open-ended rectangular enclosure constructed of *pahoehoe* fragments and waterworn stones) is located near the property currently under investigation. Another complex (Site 2537) and another cemetery (Site 2538) were also recorded in the neighboring *ahupua'a* of Kamaili. It has also been suggested that the Kamaili School may have been located on the coastal portion of the Kalani Honua property, but this has yet to be verified despite detailed research of historical documents and maps.

In 1977, Ross Cordy and David Sox (1977) conducted a walk-through reconnaissance survey in the vicinity of the Isaac Hale Park in Pohoiki Bay. Although, no archaeological sites or features were discovered with the exception of two historic metal poles, the report provides a summary of past research and historical information.

An archaeological and historical literature search for the area between Kapoho and Hilo was conducted by Holly McEldowney in the late 1970's (McEldowney 1979) resulting in a settlement pattern model. McEldowney suggested that older substrates are more conducive to human settlement. Settlement patterns are the result of adaptive patterns centered around maximizing use of a frequently changing landscape with a rough, uneven, and highly variable surface having little soil development. Practices typical of the area (e.g., modifications of lava tubes and outcrops for shelter, the use of mounds and mulching practices for cultivating plants) and the correlation between substrate age and site densities typify this adaptation (McEldowney 1979:14-15). Five zones of settlement and land use, located at varying distances from the coast, were identified by McEldowney (1979).

The coastal zone which stretches from the coast and continues inland for approximately one kilometer, contained the most dense population in the early historic period. Structures representing permanent or temporary settlement are present within this zone. When not occurring singularly or clustered in small groups, these structures may be grouped in villages located along the coast. Each village was comprised of the same complex of huts, gardens, windbreaks, and utilized groves. Access to marine resources and fresh or brackish water resources were likely a dominating factor in settlement locations.

The second zone defined by McEldowney (1979) is the upland agricultural zone which stretches from the inland limits of the coastal zone (perhaps with some overlap) to the forest line at approximately 500 m elevation. This zone was characterized by scattered residential features in a matrix of agricultural features.

Zone three is classified as the lower forest zone which ranges in altitude from 1500-2500 ft.. This zone was likely utilized for the exploitation of forest (arboreal) resources. Temporary shelters, small religious shrines and numerous paths characterize the site types found in this zone. Zone four is classified as the rainforest zone between 2500-5500 ft.. This area was likely less intensively exploited for arboreal and avian resources. The density of archaeological features and the intensity of prehistoric land use are likely less than what would be expected in the lower forest zone due to climatic conditions and distance from settlement areas. Zone five is classified as the sub-alpine or montane zone which ranges from 5500-9500 ft.. Exploitation of some arboreal and avian resources likely occurred. The Mauna Kea Adze Quarry was also exploited for highly valued lithic resources. In the historic period, cattle grazing also occurred in this zone.

In 1980, William Bonk conducted an archaeological walk-through survey of a part of the Ke'eke'e area (Bonk 1980). The property surveyed was near the Kalani Honua Conference and Retreat Center, and had been previously bulldozed. No archaeological features or sites were recorded.

An archaeological reconnaissance of the Halepua'a section of the Nanawale Forest Reserve was conducted by Martha Yent and Jason Ota in 1982. The survey covered the *makai* portion of the reserve which fronts the Old Puna Road. Recognized sites included enclosures, mounds, pits and depressions, free-standing walls, and *ahu* (mounds), many of which composed site complexes. The interior portion was thought to represent a remnant of the native agricultural system, including agricultural features utilized for cropping breadfruit, sweet potato, banana, and possibly taro. Enclosures for pigs were also mentioned. The sites in the outer portions of the forest reserve area, mainly free-standing walls and large enclosures, were interpreted to represent more recent activities such as ranching. No residential complexes or features were identified. However, the authors reported that there was a village complex at Kahuwai. It has also been suggested that residential features would have been located further *makai* in accordance with traditional settlement patterns (Kennedy *et al.* 1991).

Ross Cordy conducted an archaeological reconnaissance survey in 1987 in Keauohana Ahupua'a (Cordy 1987). Cordy (1987:16) recognized the, "intact remains of former settlement patterns." This was located close to the coastal stretch. Fifteen sites were identified which included platforms, platform burials, walls, mounds, pits, clearings, trails, enclosures, agricultural complexes, cemetery(s), and complexes. Many of the agricultural features are interpreted to have articulated into an agricultural system which had developed during the prehistoric settlement in Puna. No permanent house sites were recorded in this area, although Ellis reported a village on the shore at Keauohana which may have been subsequently destroyed during housing or highway construction.

A study of a portion of Hawaii Volcanoes National Park south of Kalapana (encompassing parts of Puna and Ka'u) was conducted by Ladefoged, Somers and Lane-Hamasaki in 1987. The researchers used a detailed computerized database to analyze settlement patterns in the area. This area of Puna is considerably more arid than the area

containing Ke'eke'e. This may give reason to suggest that a different settlement pattern and land-use history may be present than at other locations. The survey covered 1,154 acres and extended approximately four kilometers inland.

Three distinct zones were identified. Two distinct zones of settlement were noted; one on the coast extending inland approximately one kilometer, and one further upland extending inland approximately between two and one half to four kilometers inland from the coast. Between these two zones was an intermediate zone in which no permanent residential sites and only low concentrations of intermittent residential features were identified. However, a high density of agricultural mounds were present. In the coastal residential zone, 16 residential complexes, grouped into six settlements, were identified. The inland residential zone contained ten residential complexes grouped into two settlements. Initial occupation (possibly from AD 1300) was thought to be in the coastal zone, with seasonal movement to the uplands to tend agricultural crops. Following Western contact, habitation was concentrated along the coast with a few homesteads in the uplands (Ladefoged *et al.* 1987:114).

In 1989, Ross Cordy conducted an archaeological survey at Kahuwai Village (Cordy 1989). Identified sites included a number of enclosures, modified depressions, terraces, platforms, walls, mounds, modified gullies, and small irregular walled depressions. The results of the survey work (Cordy 1989:12), "found virtually continuous sites in the Mixed Forest and Hau Forest, and virtually no sites in the 'A'a Pandanus Forest and the Shoreline outside of the sandy cove." Almost all of the sites are interpreted to be agricultural in many regards (although habitation sites were recognized, many of these are also associated with agricultural features)(Cordy 1989:12). Furthermore, Cordy (1989:13) notes, "the extent of the land covered by Kahuwai's agricultural sites is impressive, as is the pattern of small, rectangular walled fields."

In 1991, Kennedy and Reinstema (1991) conducted an archaeological inventory survey for a small easement located between the current subject property and the Kalapana Sea View Estates. No surface features of archaeological significance were encountered. However, this investigation was conducted on only a narrow stretch of the 1790 lava flow.

Perhaps one of the larger and more recent archaeological projects conducted in the area was the A & O Golf Course Project (Kennedy *et al.* 1991; Dunn *et al.* 1995). This project inventoried and tested a 200 acre parcel of land which included lands in the *ahupua'a* of Ahalanui, Oneloa and Laepao'o. Kenndy *et al.* (1991) utilized lava laydown sequencing in conjunction with radiocarbon analysis to aid in temporal assessment of archaeological features which potentially allows for more accurate processual interpretations. Historic documentation and various dating techniques allow lava flows to be fixed in known temporal contexts. With this information, relative age of sites can be determined (assuming that sites could not have been constructed on a lava flow which had not yet existed). For example, a cemetery located on a 19th century lava flow could not have been constructed prior to the flow; therefore suggesting historic construction.

The combined studies of the A & O Golf Course Project (Kennedy *et al.* 1991 & Dunn *et al.* 1995) recognized a total of 48 sites-22 single feature sites, and 26 complexes. Radiocarbon dates and lava laydown sequencing suggest an initial occupation of this area beginning at least as early as A.D. 1250. Many of the complex sites consisted primarily of agricultural features (e.g., Site 12157 which contained 611 separate features). Twelve formal 'type' categories were recognized: alignments, caves, C-shaped features, enclosures, hearths, agricultural features, modified outcrops, mounds, platforms, terraces, trails, and walls (Dunn *et al.* 1995). One possible *heiau* (Site 12127) was also recognized. Functional categories included agricultural, habitation, ancillary habitation, temporary habitation, boundary wall, burial, animal husbandry, and transportation (Dunn *et al.* 1995) (note: functional categories in Dunn *et al.* did not include ritual/religious/ceremonial).

All permanent habitation features were located within the coastal zone. However, agricultural features were located throughout the subject area. Two sites in particular (Site 12157-encompassing 120 acres, and the smaller Site 12146) give evidence of the extensive agricultural complexes which had developed in this region, attesting to the richness of Puna's agricultural potential in the past. It is interesting to note that two distinct field system(s) were identified (Kennedy *et al.* 1991). The more *makai* oriented field system was engineered to articulate an informal conglomeration of mounds, pits and depressions while the more *mauka* field system was engineered to articulate more formal features characterized by small fields enclosed by walls. While settlement patterns do not deviate substantially from typical patterns noted in this region (primarily coastal in orientation), Kenndy *et al.* (1991) provide some interesting patterns and interpretations concerning settlement, land use, and site locations for this area (e.g., preferential use of specific lava surfaces for specific features, sites, and activities). This investigation is important because it encompassed an area extensive enough to; 1) provide better predictive modeling for future work in the Puna area, 2) better understand the extent and nature of agricultural systems in the Puna area, 3) provide a baseline data-base for assessing diachronic evolutionary processes in land use, settlement, and human adaptation to this region, and 4) provide information concerning spatial patterning at a larger level which is not often possible for compliance projects.

Section 5: Settlement Model

The purpose of this section is to provide an archaeological settlement and land-use model based on the previously discussed information. Historical sources for this part of Puna are limited. Furthermore, there is still a comparative paucity of past archaeological research which has been undertaken in Puna. However, historical accounts and previous archaeological research in nearby and similar areas aid in predictive modeling.

The *ahupua'a* of Ke'eke'e was likely settled or used by past Hawaiian people at least by the late prehistoric period, and most likely, much earlier. Oral tradition indicates that the district of Puna existed as a political unit from A.D. 1475. Radiocarbon dating and lava laydown sequencing suggests that Ahalanui, Oneloa and Laepao'o were occupied as early as A.D. 1250 (Dunn *et al.* 1995; Kennedy *et al.* 1991).

Oral tradition indicates that Puna was known for the fertility of its soil. Before the lava flows of 1640, 1790 and 1888, the southeastern area of Puna would have been well suited for agricultural practices. The early historic accounts of Cook, Ellis and Wilkes also indicate that northeastern Puna was a fertile and populous area. When Cook sailed near the Puna coast in 1779, the eastern part of the district was fairly well populated, more so than the western portion, and coconut trees were spread over the land. By the time Ellis visited Puna, a distinct settlement pattern was observed on the coastal areas. A large population was clustered into a discrete number of village-like aggregates. Ellis mentions that eight villages were spatially separated by areas of less dense or no population. Agriculture in this period was organized into dryland fields. Un-irrigated taro, sweet potatoes, bananas, yams, breadfruit, *olona*, sugarcane and paper mulberry were all cultivated along the coast.

An A.D. 1300 habitation date estimated for the coastal area of Volcanoes National Park may indicate that other parts of the Puna coast were occupied at this time (Ladefoged *et al.* 1987:119). It is plausible that northern Puna may have been settled earlier than southern Puna due to higher rainfall, more reliable water resources, and more conducive terrestrial subsistence conditions. However, this may be an unwarranted assumption as earlier subsistence economies may have relied more heavily on a marine component rather than a dryland farming component.

Increased rainfall, in some cases, may have directly increased the potential of the total subsistence economy. This would be expected for a dryland farming economy with no formal irrigation systems. However, increased amounts of rainfall beyond an adequate limit (beyond a 'saturated' limit) likely had little effect in increasing the potential subsistence economy (also, compare effects of increased precipitation on potential yields of a predominantly marine based subsistence economy versus a dryland farming subsistence economy). The potential yield curve will plateau or level out at a certain point even when the precipitation curve continues to increase. The precipitation levels in northern Puna are more than adequate to support a dryland farming subsistence economy with little modifications or complex irrigation systems. Although a detailed discussion

could be presented concerning rainfall, potential yields and subsistence economies, it is only important at this point in the discussion to highlight that using rainfall alone to gage the potentiality of a subsistence economy may be inadequate due to the general complexity of subsistence economies. Often, additional factors which are not considered have significant implications.

Dryland farming in this region likely increasingly developed over some time and likewise became an increasingly greater contributor to the subsistence economy. Although it would be interesting to discuss in great detail the temporal development/evolution of subsistence economies and dryland farming systems in this region, this will not be discussed in this section.

After reviewing previous investigations, certain similarities in the settlement patterns are appropriate for development of a settlement pattern model. Most studies suggest a pattern in which coastal zones from the shore to about one kilometer inland generally contained one or more villages, or a high concentration of dispersed permanent residential complexes or settlements. Such permanent residential sites often existed within a matrix of agricultural features. Villages within this zone were always on the coast, although many *ahupua'a* did not contain villages at contact. Coastal site clusters generally included a number of residential sites as well as a *heiau* or religious feature within each settlement (Ladefoged *et al.* 1987:20). Canoe sheds and landings were also sometimes found among these coastal settlement areas.

Further inland from the settlement area (at varying distances depending on suitability of environment), agricultural areas were developed which often may have contained only a few temporary shelters and habitation structures and even fewer permanent residential features. Two distinct types of agricultural complexes have been identified which may have occurred in these zones. These two types are generally defined as, 1) formal: characterized by small walled fields, and 2) informal: characterized by a large number of mounds, modified depressions and perhaps other modified features such as rock outcrops. It seems reasonable to suggest that as dryland agricultural exploitation intensified, this trend was reflected in the development of an increasing number of agricultural features (both formal and informal). Relatively few temporary and permanent habitation structures would be expected in these areas if residents maintained a preference for coastal habitation during this period of intensified agricultural exploitation. However, there would be substantially more of these classes of site than would be expected during an episode of heavier marine based resource exploitation. An increasing use in agricultural resources based on inland cropping may also be reflected, but not necessarily unquestionably indicated, by an increase in inland religious/ceremonial sites as well.

In the early 1800's, Puna was still quite populous. However, epidemics, demographic trends, and historic events which seriously disrupted traditional systems caused a serious population decline in Puna following the late 1840's. By this time,

traditional agricultural practices and the use of traditional field systems had been abandoned.

During the early to mid-1800's, grazing animals were introduced and much of the area was used for ranching. High walls, which have often been regarded as historic structures, and animal pens were constructed in ranching areas. Coffee and sugarcane production were also introduced into the local economy, affecting significant changes in the area. Even the architectural design of residential and other sites had changed. Changes in land-use also occurred with changes in settlement for obvious reasons. By the mid-20th century, settlement, land-use and demographics had dramatically altered.

In summation, settlement of the lower Puna area, and specifically in Ke'eke'e Ahupua'a, may have experience several transitions. Initially, the area was likely heavily exploited for marine resources with small clusters of coastal settlement. Exploitation of various terrestrial resources likely increased over time. This transition likely resulted in the development of additional inland sites, exploitation of inland resource zones, the development of site networks and sites relating to a communication and transportation infra-structure (e.g., trails and temporary shelters), and increased settlement. Following this trend, more sophisticated exploitation of inland resources likely developed (such as the integration of more developed forms of agriculture and arboriculture). If demands on agricultural resources increased (either external--the demand for agricultural products from power centers located elsewhere; or internal--the demand for agricultural products due to increased local population), more sophisticated agricultural practices and well developed agricultural complexes may have arisen to meet these demands. This may reflect organizational aspects of the social hierarchy such as the uneven distribution of power and resources. Perhaps the construction of religious and ceremonial sites was facilitated by the ability to organize and control human resources as well; religious and ceremonial sites further functioning to reinforce the reigning ideology.

Internal and external factors may have been responsible for a subsequent demise of population and power in the region (e.g., population decrease from disease and demographic shifts, environmental degradation, decreasing demand for resources from external powers due to loss of power or conflict within the external powers, etc.). This may have resulted in a period of partial abandonment and decreased settlement.

During the subsequent historic period, the area was likely increasingly exploited again, but for a variety of other reasons. The area was probably targeted for various agricultural resources, but likely included introduced species and practices more related to plantation or intensified agricultural exploitation (e.g., sugar cane and guava). Some cattle ranching may have been attempted. Finally, as it appears to be a standard trend, modern land developments for housing, agriculture, and the tourism industry will likely further impact land transformations and settlement.

In summation, many of the previous trends should be reflected in Ke'eke'e Ahupua'a. As the subject property contains part of the coastal zone and extends inland

into an area where some inland resource exploitation and potential dryland agricultural developments are highly probable, sites and features typical of similar areas are expected. Expected sites and features include habitation (permanent and temporary), agricultural, some religious/ceremonial, transportation and communication (e.g., paths and walkways), resource extraction and processing, and perhaps specialized (e.g., craft production). However, early permanent habitation sites may also be located in more suitable areas closer to the coast which is often typical of traditional settlement patterns in Hawaii and may be notably absent in the more inland area of the subject property.

Section 6: Methodology

An archaeological inventory survey was conducted for a 94 acre parcel of land located at TMK:1-2-09:29, in the *ahupua'a* of Ke'eke'e, District of Puna, Island of Hawaii. This project was directed by principal investigator, Joseph Kennedy, M.A.. Fieldwork was conducted from April 29 to May 24, 1996. Fieldwork was directed by James R. Moore, B.S., and D. Kyle Latinis, M.A.. Fieldwork was aided by field archaeologist, Michael O'Shaughnessy, B.A..

A series of main transect paths were cleared across the subject property and aligned with the aid of a field transit and tape. These main transects were cut to form a path through the vegetation and subsequently marked at consistent intervals with flagging tape. The main transects were oriented to run parallel to the coastline (240°-60°) and were spaced approximately 60 m apart. Using these transects as baselines, a series of parallel sweeps were surveyed across the subject property at approximately 20 m spacings. These were further reduced when dense vegetation precluded accurate survey at wider spacings.

All non-agricultural features encountered during the course of survey were marked with flagging tape and also with metal tags designating a temporary feature number (e.g., TF 37). Approximately one-third of the agricultural complex was sampled. Major features within this sample area were sketch mapped, assessed, tested where appropriate, and plotted on a base map while the numerous small mounds and less extensive agricultural features were plotted and assessed. Features were mapped with a tape and compass and subsequently sketch mapped in the field. Features were tested by sectioning or excavation only when testing aided in assigning probable function. All tested features were sectioned or excavated by ten centimeter arbitrary levels through all stratigraphic layers. However, few features were tested during the course of fieldwork due to the nature of the features encountered. Profiles and sketch maps were drawn in the field. Soil samples were collected from each stratigraphic layer if deposits were present.

All portable cultural remains and soil samples which were collected in the field were returned to the ACP laboratory facilities at 59-624 Pupukea Rd, Haleiwa, Hi 96712 where they were further analyzed and curated. It was requested that all cultural materials were to be returned to the proprietor of the subject property following laboratory analyses with the exception of the soil samples.

The twenty four features which composed Site 2539 (a cemetery) were mapped with a transit and tape and further visually analyzed as to their condition as this was not completed during the previous survey (see Bevacqua & Dye 1972). All of these features were recorded as human burials (likely Hawaiian ethnicity). Some of these may contain the remains of more than one individual. As this site is located on the A.D. 1790 lava flow, these burial platforms and mounds were built following the laydown events of this particular flow. However, little is known as to the historic nature of this cemetery. Marc Smith conducted a field inspection of the cemetery after consultation with DLNR/SHPD

and the Kanahele family. Additional features were noted which consisted of pavings and burials which did not include platform or mound structures. These were located between and adjacent to the platform features which were mapped during the current survey. Additional information concerning the site, site history and the nature of the features has been registered with DLNR/SHPD (Marc Smith, pers. comm.). It has been requested that no further investigation be conducted at this site.

A significant platform (Site 21143) constructed with waterworn beach pebbles and cobbles was also identified. This feature was cleared of vegetation, mapped in detail, and tested to further determine function. As this feature may be a previously unrecognized *heiau*, special attention was given to mapping and testing.

Section 7: Archaeological Findings

Feature Types

The following feature type descriptions are representative of the features encountered during the course of fieldwork. These are provided to briefly outline the types used to classify features, provide some functional interpretations, and further provide additional explanation for the reader in order to reduce confusion or add clarity. Following the list of formal types encountered, individual sites and features will be described including some commentary and justifications for assigning function and/or age as well as how individual features are likely articulated within each site.

Mounds-These features consist of roughly stacked piles of angular basalt stones (measuring 10 to 75 cm in diameter) which are generally oval in shape with a mounded, convex surface. Mounds exhibit no evident facing or raised edges. Mounds on the subject property predominantly fall within a dimensional range which measures approximately 1.00 to 3.00 m in length and 0.75 to 2.00 m in width, reaching a height of up to 1.50 m agl in many cases. However, there is great variation in overall dimensional measurements. Some mounds are smaller or greatly exceed the aforementioned ranges. Furthermore, many of the mounds or mound-like features do not adhere to the standard shape or morphology of typical mounds. Some mounds are linear or curvilinear, forming roughly stacked alignments of angular basalt stones which extend for lengths of 10 m or more and were sometimes difficult to distinguish from short deteriorated wall segments.

Mounds are generally located on mixed *a'a* and *pahoehoe* surfaces in stands of strawberry guava. Mounds were likely utilized in the pre-Contact Period as a surface on which to cultivate agricultural crops (e.g., the description by Wilkes 1845, Vol. 1:188 suggests sweet potatoes were cultivated in stone 'heaps': see discussion above for further details) or may have resulted from land clearance activities. The following account by Menzies (1920:75-76) further attests to land clearance activities and the use of stone mounds and other stacked stone features for agricultural practices:

> For several miles round us, there was not a spot that would admit of it but what was with great labor and industry cleared of the loose stones and planted with esculent roots or some useful vegetables or other. In clearing the ground, the stones are heaped up in ridges between the little fields and planted on each side, either with a row of sugar cane or the sweet root of these islands, where they afterwards continue to grow in a wild state, so that even these stony, uncultivated banks are by this means made useful to the proprietors, as well as ornamental to the field they intersect.

Numerous researches (e.g., Schilt 1984, Newman 1970, Kelly 1983) have also discussed agricultural practices and land tenure in Hawaii. Many of their conclusions attest to the multi-functionality of agricultural features in Hawaii. These examples should

also be considered when reviewing the potential functions of many of the following features discussed below, such as walls and modified outcrops.

Modified Outcrops-Modified outcrops are generally natural rock outcrops which have been anthropogenically modified in some way for a variety of functional reasons. Modifications are often in the form of rearrangements or additions to the natural morphology. Examples are stone buttresses added to rock outcrops, possibly for agricultural (as a growing medium similar to the case with stone mounds) and animal husbandry activities. These are often informal stone stackings but may be quite sophisticated and formal in some cases.

Modified outcrops occurring on the subject property consist of natural exposed *pahoehoe* blisters which were modified by stacking angular basalt stones on their surface. They occur in areas towards the western boundary of the subject property exhibiting sections of exposed *pahoehoe* lava flow. Modified portions of the outcrops were generally oriented towards the east and *makai.*

Modified outcrops, like mounds, may have served similar agricultural functions. Modified outcrops were constructed on natural outcrops apparently to 'opportunistically' take advantage of natural topography or geological formations (e.g., for growing sweet potato, *ti*, some fruit trees, etc.).

Pits-Pits are small modifications to the surface of the naturally undulating *a'a* flow. Pits consist of areas from which pieces of *a'a* have been removed forming circular depressions in the ground. In some instances the sides of the pits appear to be lined and/or to have had the stones arranged or organized. In other instances there appear to be alignments of stones around the rims of the depressions. Morphology varies slightly from pit to pit and many of the observed features are in a state of varying deterioration.

The pits generally measure between 1.0 and 2.0 m in diameter and reach a depth of 0.50 to 0.75 m bgl. Like mounds, there is significant variation in overall dimensions and some of the observed features fall below or exceed this range.

Pits were likely used as mulch pits for the cultivation of sweet potatoes and/or taro. This suggestion is further supported by ethnographic accounts (Handy & Handy 1972:104).

During archaeological investigations conducted within Volcanoes National Park, fieldworkers described morphologically similar (i.e., in diameter, depth and use of *a'a* as substrate) features as 'natural planters', 'modified planters', and depressions (several coastal areas which were mapped were simply labeled 'many depressions')(Ladefoged *et al.* 1987:67). Ladefoged *et al.* (1987) note that the distinction between 'natural planters', 'modified planters' and depressions is unclear, suggesting that, "the term 'natural planter' implies no cultural use or modification has taken place." However, when the features were examined during subsequent fieldwork (Ladefoged *et al.* 1987:67), "it appeared

most of the features were in fact cultural." This seems to be the case on the current subject property as well. Across the undulating sections of exposed *a'a*, numerous pits and depressions were identified, the majority of which had clearly been modified.

There are several early historic accounts which describe the cultivation of sweet potatoes and taro in Puna which also appear to describe a pit/depression type feature. These include as follows (from Yent & Ota 1982:11 as compiled from Crozier & Barrere 1971):

> **Wilkes** (1845)-"Sweet potatoes are seen to be growing literally among heaps of stones and pieces of lava, with scarcely soil enough to cover them, yet they are, I am informed, the finest on the island."
>
> **Lyman** (1846)-"The natives pick out the stones to the depth often of from 2 to 4 feet, and in the bottom plant the potato-how it can expand in such a place is a wonder."
>
> "Potatoes are almost the only vegetable that can be raised, and these seem to flourish well amid heaps of stone where scarcely a particle of soil could be discovered."
>
> "...the holes dug among the stones to receive the potatoes were some of them 6 feet in depth-thus securing a degree of moisture and shelter from the sun though no more soil than at the surface."
>
> **Nordhoff** (1874)-"... by digging holes in the lava where it was a little decayed, carrying a handful of earth to each of these holes, and planting there in a wet season, he got a very satisfactory crop."

Perhaps the most thorough description of cultivation occurring in these feature types was described to Mary Pukui by her informant, Joseph Ilala'ole (refer to the block quotation in Section 3 of this report, as quoted from Handy & Handy 1972:104-105).

Based upon these accounts it is evident that both taro and sweet potato were cultivated in these small pits and that the pits and depressions are indeed cultural. Furthermore, some of these accounts indicate that stone 'heaps' which may have been mounds, modified natural features, or even wall segments were utilized for cultivating various plant species. This is certainly not atypical of historic and modern practices as well.

Modified Depressions/Gullies-Modified depressions/gullies are larger than pits, consisting of natural topographic features which have been modified, presumably, to enhance their agricultural potential. Attributes of the natural topography utilized include; sides of gullies (similar to features described by Cordy 1989:11), tongues of *pahoehoe* which form curving walls from 0.5 m to 2.0 m in height above the surrounding ground level, areas of soil adjacent to *pahoehoe* blisters, etc..

These features measure from 3.0 to 10.0 m in diameter with a depth as much as 2.0 m bgl. Again, there is dimensional variation and some features exceed these limits. Walls are modified by stacking stones, sometimes nicely faced and sometimes forming sloping revetments which almost appear terrace-like. Soil accumulates in the flat floors of these modified depressions. Modification (e.g., forming a channeled terrace-like feature) may allow greater and faster soil accumulation. Many of these features also appear to have been constructed in order to enhance or take advantage of the natural flow and retention of rainfall, perhaps engineered to take advantage or modify natural hydrological systems.

One important distinction between the modified depressions and the pits is that pits have material removed from the feature in order to form the structure while modified depressions are formed by adding material to the walls and sides of naturally occurring low spots in the topography.

Walls-Walls on the subject property include both 1) informally stacked alignments of stone which form low walls, and 2) more formal, well constructed, bifaced, core-filled structures which form significantly different walls.

There were many examples of low staked walls which weave their way between areas filled with mounds and pits. These structures were informally constructed from stacked angular basalt stones which measure from 10 to 75 cm in diameter. Some of these low stacked walls extend for lengths of over 100 m, though some segments are as short as 3 m in length. Some of these low stacked walls may have been constructed in the pre-Contact period as land division markers (e.g., to separate garden plots). It is also possible that the walls themselves were utilized as a growing medium. In some cases, the walls may have been formed as a result of clearing activities (e.g., a default of the removal and subsequent stacking of stones to form the many pits throughout the subject property). Finally, from the plan view, it appears that some of these walls may have formed enclosures at one time. However, as these walls are seldom faced and rarely exceed 0.75 m in height, it is unlikely that they served as animal enclosures used for animal husbandry practices. Furthermore, without conclusive evidence which indicates that these features were indeed enclosures, they cannot be classed as enclosures at this time.

It is also possible that over time, some of the walls may have been modified or fallen into disuse. Subsequently, it is possible that materials from existing walls may have been periodically removed to construct other features, thus, serving a function as a source for construction material. The reuse of construction materials from abandoned sites and features was likely a common a practice, with perhaps the exception of materials deriving from *kapu* sites.

The bifaced, core-filled walls were constructed of angular basalt stones 30 to 50 cm in diameter which were stacked to provide facings on both sides of the wall and subsequently filled with smaller stones 5 to 15 cm in diameter. These walls are found in

only a few locations. Two short wall segments which measure approximately 5 m (Site 21139, Feature Y) in length are located in the midsection of the property and appear to be bifaced, core-filled walls which are in a deteriorated condition. A lengthy bifaced, core-filled walls runs the entire length of the subject property along the lower *makai* border which parallels the existing highway.

Enclosures-Enclosures are generally formed from wall segments which form a delimited and obviously enclosed area. However, enclosures can also be manufactured to incorporate naturally occurring or modified topographic features such as outcrops or caves and/or may have included additional elements such as wooden fences and gates (often noted in historic cattle ranching features). Enclosures may have functioned to contain animals or exclude animals; both relating to animal husbandry. Various agriculture plots may have been enclosed in order to protect them from destructive animals such as pigs and/or define the boundaries. Enclosures may have served to define property limits or define the borders of specific important sites (e.g., *heiau*).

Walkways-There were several features on the subject property which are believed to be walkway sections. On the subject property these walkways were of three morphological styles which include; 1) raised, 'curb-lined' walkways, 2) a short walkway lined with single course alignments of stones, and 3) a short raised segment bridging raised areas of *pahoehoe* (e.g., between blister domes). In addition, just off the subject property's southwestern corner (on the *makai* side of the "Old Red Road", a.k.a., the "Old Government Road") there is a short section of a stepping stone trail which has been designated Site 2540, the Kehena Beach Trail (Bevacqua & Dye 1972:22).

The longest segments of walkways identified consisted of raised, 'curb-lined' structures (Features U, AB, and AC of Site 21139). The sides of these walkway segments are lined with two to three courses of stacked stones measuring 20 to 30 cm in diameter and standing approximately 40 cm agl. These 'curb' alignments retain a filled core of small fragments of *a'a* measuring 5 to 10 cm in diameter in some cases, while in others, a filled core of soil. The curb-lined trails measure between 1.0 and 1.5 m in width. The raised walkway features identified on the subject property are similar to the "curblined trails" described by Ladefoged *et al.* (1987:74) but differ in that their widths are thinner and they are oriented perpendicular rather than parallel to the coast.

One example of a short walkway lined with single course alignments of stones was identified on the subject property. This trail segment consists of one feature within a group of features designated 21139AD. As implied in the description of this feature type, this walkway consisted of a soil covered pathway delineated by two, roughly parallel, single coarse alignments of stone which measured approximately 10.0 m in length and just less than 1.0 m in width. The trail led from a small gully to the end of a raised, 'curb-lined' walkway segment that was separated from the lined soil pathway by a stone step. One waterworn stone was also identified which was incorporated into the alignment of stones bordering the pathway (refer to the description of Feature AD of Site 21139).

Finally, a single example of a walkway segment bridging two *pahoehoe* blisters was identified (21139Z). This segment was constructed of angular basalt stones 30 to 50 cm in diameter which connected two natural, exposed blisters of *pahoehoe*. It measured approximately 2.0 m in length, 1.0 m in width and was raised about 70 cm agl at either end but only 30 cm agl in the middle. The edges of the walkway formed neatly stacked facings.

These walkways may have provided access to and between garden patches on the subject property. None of the segments identified could be attributed to being trails serving a larger area (such as coastal trails). Walkways may have served the secondary purpose of separating cultivated areas. In addition, it is possible that some of the low stacked walls are raised walkways which have fallen into a state of disrepair.

Identified walkways were primarily located between Transects K and G. Although, there may appear to be a concentration within this area, it must be noted that additional walkways and walkway segments may have appeared to be wall segments on other sections of the subject property, and subsequently interpreted as walls. Without further information and given the deteriorated condition of many features, definite conclusions were often problematic.

C-Shape Structure-C-Shape structures are special structures often built of stone walls and having the characteristic semi-circular design; hence the name C-Shape. These may have been shelters and/or agricultural features. More detailed discussion is provided below in the site and feature descriptions.

Terrace-'Terrace' as defined by the Webster's Dictionary gives at least four definitions. Archaeologists have often utilized the term rather loosely to describe agricultural areas. Agricultural terracing often implies that a series of step-like flat earthen areas have been created in order to facilitate cultivation of certain agricultural products. Often, terraces are formed on sloping surfaces with a wall or embankment utilized to retain soil and create a level area.

However, terracing may also refer to structures and other non-agricultural features having one to three raised edges (e.g., terracing of a hillside may have been conducted to facilitate the development of a residential area). In the following site and feature descriptions, these issues are highlighted in order to reduce potential confusion.

Platforms-Platforms are generally characterized as stone architectural features. Although there exist of continuum of platform types and symbolic, functional, and religious interpretations which fall on a continuum as well, a detailed description will not be presented in this report. However, for the sake of providing a basic classification, two classes of platforms were noted on the subject property; burial platforms and habitation platforms. Burial platforms, described in detail below, were characteristic of the cemetery site (Site 2539) and only found within the cemetery boundaries.

Only one other platform was encountered on the subject property which proved to be a unique case (Site 21143). Functionally, after its abandonment as a religious site and likely subsequent re-use as a living floor, the probable *heiau* (Site 21143) could also be considered to have been a habitation platform during this episode. More will be discussed in following descriptions and interpretations.

Heiau-*Heiau* are traditional Hawaiian religious sites generally characterized by stone masonry architectural features (e.g., stone platforms and/or stone enclosures). As there currently exists a significantly large discourse covering *heiau* in Hawaii (e.g., see Bennett 1930; Graves & Cachola-Abad 1996; Dye 1991; Kirch 1985; Kolb 1991, 1992; Stokes 1917,1991; Thrum 1907a, 1907b, 1908, 1909, 1910, 1938), these will not be detailed in this report. However, a brief discussion is provided below concerning the *heiau* (Site 21143).

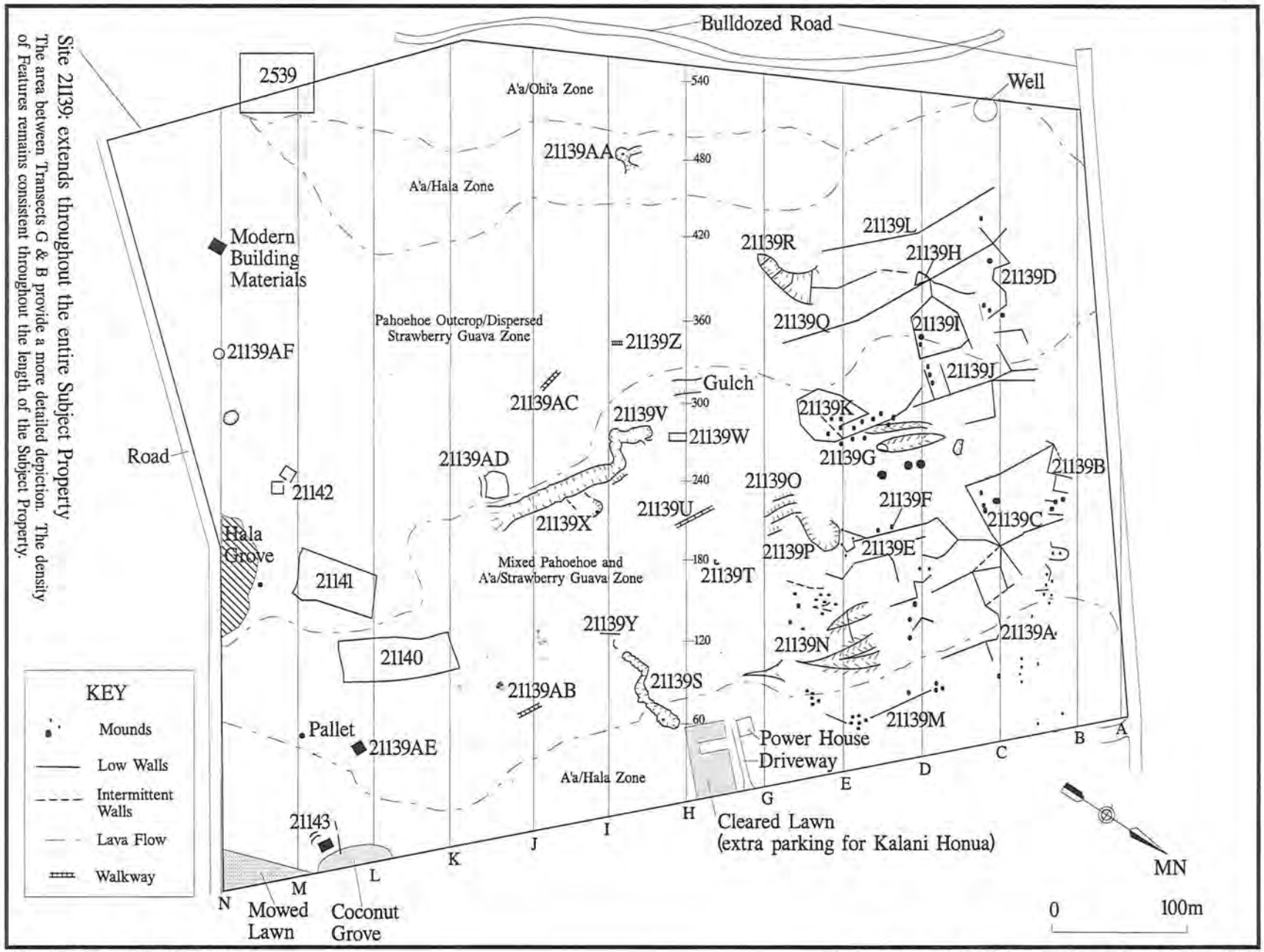
Manuports-Manuports represent a class of artifacts and features which may not have any apparent function, but are displaced or unnatural in their surrounding context due to anthropogenic activities. The typical example from the current investigations are a few waterworn beach stones which are located in various places on the subject property. It is possible that these may have been locational markers, though this has not been verified for the current investigation.

Caves-Caves have been utilized and modified for a variety of reasons relating to prehistoric and historic activities. Some caves have been extensively modified (e.g., refuge and habitation cave) while others may have been utilized with no evident modifications (e.g., some storage cupboards). As there were almost no caves located on the subject property and the few that were noted appeared to be of a general morphology which precluded utilization, these will not be detailed in this feature type description list. More detailed descriptions are provided below in the feature descriptions.

Individual Site and Feature Descriptions:

The following descriptions highlight features identified throughout the course of fieldwork (refer to Table 1). A sample of the agricultural complex (Site 21139) was detailed from Transects C, D and E (see Figures 4-6 and refer to Table 2). Similar features were located throughout the subject property. Frequencies of feature types are similar throughout the subject property as well. Furthermore, feature type and frequency/density appear to be correlated to substrate type and vegetative zone. Many of the features have been collapsed and consolidated into single feature numbers to avoid extensive confusion (e.g., Features H-K represent numerous walls and mounds which were originally separate but overlapping features). Major features that were either exceptional in some way (e.g., a special type such as the probable *heiau* platform (Site 21143) or may not have been interpreted as contemporaneous with the agricultural complex features, Site 21139 (e.g., the probable historic enclosures, Sites 21140-21142 (see Figure 4)) were treated separately and assigned different site numbers.

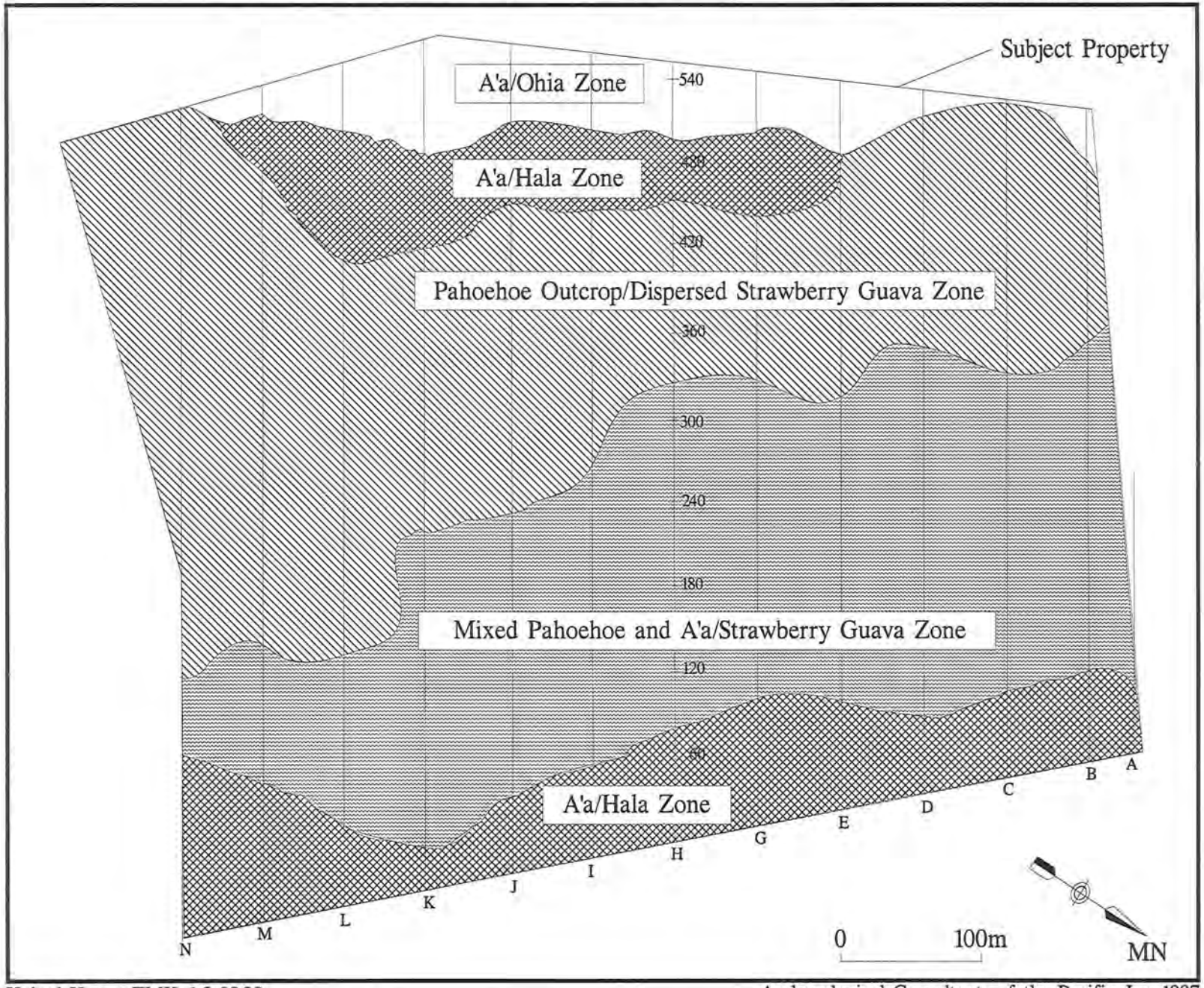
Figure 4: Site Location Map



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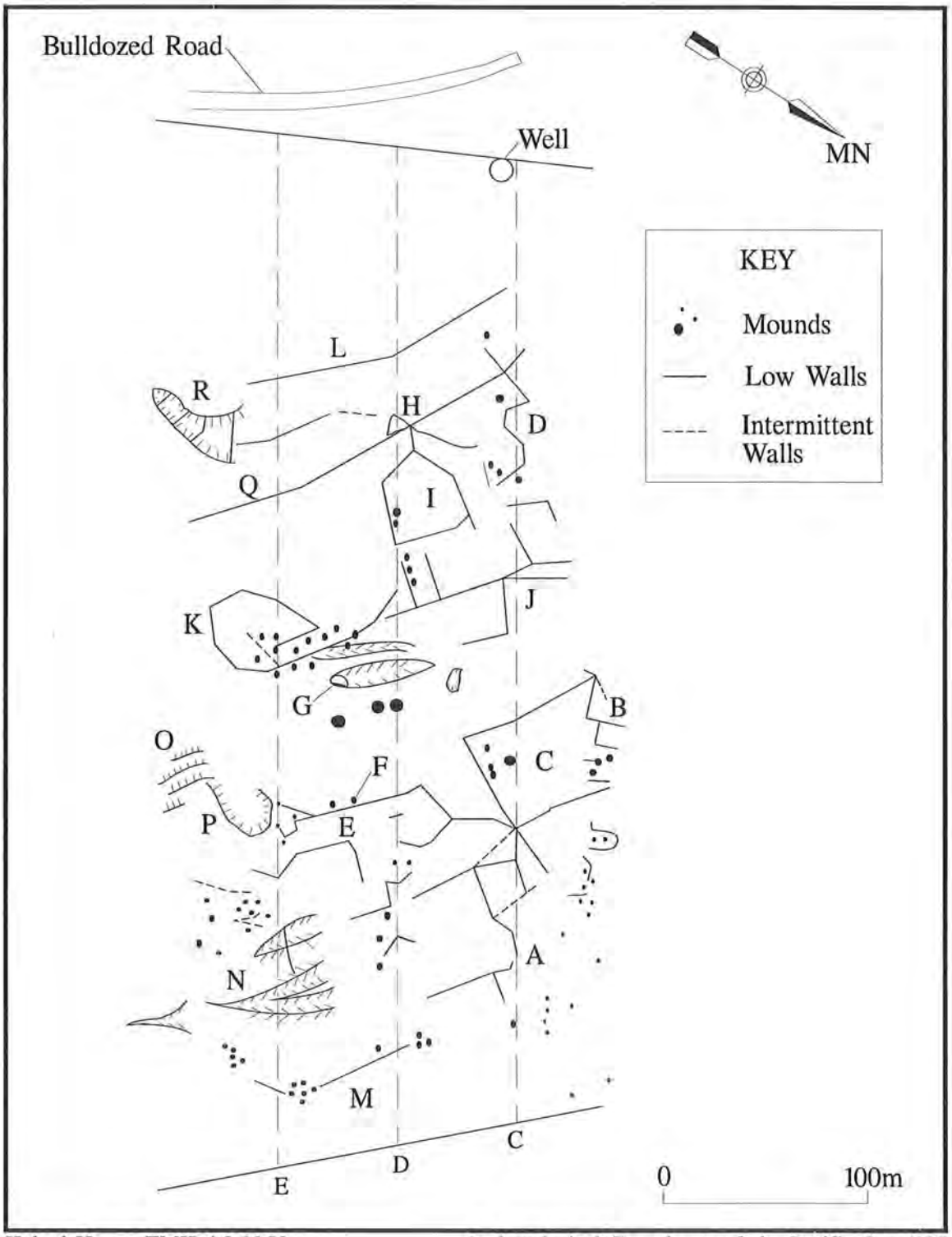
Figure 5: Zones of Vegetation and Cultural Feature Distribution



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Figure 6: Sample Feature Location Map of Site 21139 (Features A to R)



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Table 1: Individual Site/Feature Descriptions and Assessments

Site	Feature #	Description	Tentative Function	Current Archaeological Work	Current Condition
21139	A	Walls & Mounds	Ag.	2	Poor
	B	Walls	Ag.	1	Poor
	C	Mounds	Ag.	1	Poor
	D	Walls & Mounds	Ag.	1	Poor
	E	Walls & Mounds	Ag.	1	Poor
	F	Manuport	Marker/?	1	Good
	G	Modified Gully, Modified Outcrop & Mounds	Ag.	1	Poor
	H	Walls	Ag.	1	Poor
	I	Walls & Mounds	Ag.	1	Poor
	J	Walls & Mounds	Ag.	1	Poor
	K	Walls & Mounds	Ag.	1	Poor
	L	Wall	Ag.	1	Poor
	M	Walls & Mounds	Ag.	1	Poor
	N	Modified Gully	Ag.	1	Poor
	O	Walls & Terraces	Ag.	1	Poor
	P	Modified Gully	Ag.	1	Poor
	Q	Wall	Ag.	1	Poor
	R	Modified Gully, Modified Outcrops, Walls & Terraces	Ag.	1	Mod.
	S	Modified Depression	Ag.	1	Mod.
	T	C-Shape	Ag./TH	1	Mod.
	U	Walkway	Walkway	1	Mod.
	V	Modified Depression & Possible Terrace	Ag.	1	Poor
	W	Enclosure	AH/Ag.	1	Poor
	X	Cave Opening & Manuport	Marker/?	1	Mod.
	Y	Wall Segment	Ag.	1	Poor
	Z	Walkway Segment	Walkway	1	Good
	AA	Modified Depression, Mound & Terrace	Ag.	1	Mod.
	AB	Walkway Segment	Walkway	1	Mod.
	AC	Walkway Segment	Walkway	1	Mod.
	AD	Modified Outcrop & Enclosure (w\ adjacent walkway segments & small terrace)	Ag.	1	Mod.
	AE	Terrace	Ag./H/?	2	Mod.
	AF	C-Shape	Ag./TH	2	Mod.
21140		Enclosure	AH/Ag.	1	Good
21141		Enclosure	AH/Ag.	1	Mod.
21142		Enclosures	AH/Ag.	1	Mod.
21143	A	Platform (Probable *Heiau*)	Religious/ Ceremonial	2	Mod.
	B	Terrace (Probable *Heiau*)	Religious/ Ceremonial	2	Mod.
	C	Wall(s) (Probable *Heiau*)	Religious/ Ceremonial	2	Mod.

Key at end of Table 1

Table 1: Individual Site/Feature Descriptions and Assessments (Continued)

Site	Feature #	Description	Tentative Function	Current Archaeological Work	Current Condition
2539	A	Platform	Burial	1	Mod.
	B	Platform	Burial	1	Mod.
	C	Platform	Burial	1	Mod.
	D	Platform	Burial	1	Mod.
	E	Platform	Burial	1	Mod.
	F	Platform	Burial	1	Mod.
	G	Platform	Burial	1	Mod.
	H	Platform	Burial	1	Mod.
	I	Platform	Burial	1	Mod.
	J	Platform	Burial	1	Mod.
	K	Platform	Burial	1	Mod.
	L	Platform	Burial	1	Mod.
	M	Platform	Burial	1	Mod.
	N	Platform	Burial	1	Mod.
	O	Platform	Burial	1	Mod.
	P	Platform	Burial	1	Mod.
	Q	Platform	Burial	1	Mod.
	R	Platform	Burial	1	Mod.
	S	Platform	Burial	1	Mod.
	T	Platform	Burial	1	Mod.
	U	Platform	Burial	1	Mod.
	V	Platform	Burial	1	Mod.
	W	Platform	Burial	1	Mod.
	X	Platform	Burial	1	Mod.

Key:

Tentative Function: **Ag.**=Agricultural, **H**=Habitation, **TH**=Temporary Habitation, **AH**=Animal Husbandry.

Current Archaeological Work: **1**=Extensive Mapping, **2**=Mapping and Subsurface Testing.

Current Condition (refers to the current condition of preservation): **Ex**=Excellent, **Good** (slightly deteriorated), **Mod.**=Moderate (fairly deteriorated), **Poor** (heavily deteriorated).

?=Unknown or Unable to be Determined.

Table 2: Feature Descriptions and Assessments From Transects C, D, & E

Features from Site 21139#	Description	Tentative Function	Total Distance of Walls	Total Number of Large Mounds	Current Condition
A	Walls & Mounds	Agricultural	60 m	18	Poor
B	Walls	Agricultural	260 m		Poor
C	Mounds	Agricultural		7	Poor
D	Walls & Mounds	Agricultural	105 m	5	Poor
E	Walls & Mounds	Agricultural	560 m	21	Poor
F	Manuport	Marker/?			Good
G	Modified Gully, Modified Outcrop & Mounds	Agricultural		3	Poor
H	Walls	Agricultural	142 m		Poor
I	Walls & Mounds	Agricultural	150 m	2	Poor
J	Walls & Mounds	Agricultural	243 m	3	Poor
K	Walls & Mounds	Agricultural	286 m	13	Poor
L	Wall	Agricultural	140 m		Poor
M	Walls & Mounds	Agricultural	65 m	15	Poor
N	Modified Gully	Agricultural			Poor
O	Walls & Terraces	Agricultural	65 m		Poor
P	Modified Gully	Agricultural			Poor
Q	Wall	Agricultural	185 m		Poor
R	Modified Gully, Modified Outcrops, Walls & Terraces	Agricultural	60 m	1	Mod.
18 Features			2321 m	88	

Agricultural Complex (Site 21139):

Agricultural features are located across the subject property (see Figure 4). The agricultural complex located on the subject property may also represent a portion of a larger dryland field system in lower Puna. This agricultural field system was first described in moderate detail by Newman (1970). Dryland farming was practiced in coastal Puna during the late prehistoric and early historic period. Newman (1970:118) suggests that the table-land areas along the lower slopes of Hawai'i Island were used for the cultivation of un-irrigated taro, sweet potatoes, yams, bananas, breadfruit, *olona*, sugarcane, and paper mulberry. Newman suggests that these crops were possibly organized in scattered fields, or possibly a "dryland field system." There is evidence of this in Ellis' accounts as well. Ellis (1917:204-214) mentions taro, sweet potatoes, and sugarcane in cultivation along the southern coast. Furthermore, of Puna in general, Wilkes (1845, Vol. 4:188) noted, "the inhabitants seemed to have an abundance of bread-fruit, bananas, sugar-cane, taro, and sweet potatoes," and that sweet potatoes, "are seen to be growing literally among heaps of stones and pieces of lava, with scarcely enough soil to cover them; yet they are, I am informed, the finest on the island."

From Newman's suggestions and past accounts, it is evident that a fairly sophisticated 'field system' may have evolved in the Puna region. Other field systems are certainly present in the leeward regions of Hawaii Island by the proto-historic period. However, the intensity and nature of the field system in Puna may be unique, although it is not as well understood as other field systems on Hawaii Island (e.g., the Kona field system). Furthermore, it may by unwarranted to assume the existence of a large field system in the area without additional archaeological and historical verification.

Although, this field system has not been completely characterized systematically in meticulous detail, several of the previous archaeological studies conducted in Puna have provided glimpses of the extent and nature of the system (see discussion in Section 4). However, due to the lack of evidence, interpreting the various agricultural complexes as belonging to a unified contemporaneous system at this time may be unwarranted.

Yent & Ota distinguished five major types of archaeological sites during their reconnaissance survey in the Nanawale Forest Reserve; enclosures, mounds, pits or depressions, free-standing walls, and *ahu* (1982:15). They also noted a correlation between the vegetation of a specific area and the type of cultural feature found within it (1982:15).

A similar correlation was also noted during the current investigations where certain feature types were more prevalent on specific surfaces (e.g., *a'a* vs. *pahoehoe*). Ecological differences are also dependent on ground surfaces. Therefore, because 1) feature type in an agricultural system is likely dependent on the type of crop(s) cultivated at and around the feature, and 2) it is evident that ecological differences are related to changes in substrate surfaces, it is likely that probable patterns of cultural feature types

can be predicted by patterns in vegetation. Again, these factors are also related to substrate, soil formation and local environmental/climatic conditions.

However, it has been brought to our attention by DLNR/SHPD that, "informant testimony indicates that there is no one to one correspondence between a feature type and cultigens, that the same crop can be grown in several different feature 'types'" (DLNR/SHPD DOC NO:9610PM23, November 26, 1996). Thus, the above premise (1) should be approached with some caution and is only included as a speculation deserving further attention during the course of future research and not as a prescription for research or interpretation, and (2) is not intended to suggest a one to one correlation; rather, to suggest general trends.

Additional feature types distinguished in the lower Puna area include modified depressions, modified gullies, terraces, low walls (Cordy 1989), platforms (simple, stepped, and terraced)(Cordy 1989, Crozier & Barrere 1971), paved areas, modified lava tubes (Crozier & Barrere 1971), and interconnecting paths, many of which were likely related to horticulture/agriculture. All of the feature types distinguished in the studies cited above were recognized on the subject property during the current study with the exception of *ahu*, paved areas, and modified lava tubes. The absence of *ahu* and paved areas can be explained by one of two possibilities; 1) there were none of these features present, or 2) these feature types were unable to be recognized due to feature deterioration. While there were small lava tube type cave openings identified during the current investigation, none were adequate or appropriate for human modification and/or utilization, often being small and devoid of potential usage.

Finally, it is emphasized that the numerous agricultural features encountered during the investigations may not have been constructed in a single event. It is likely that these features were generated over the course of significant time spans (minimally over multiple generations). Previous features in the agricultural complex may have been abandoned, modified, or incorporated into an evolving or expanding system. The climax was likely an intricate, inter-woven and articulated agricultural complex which had developed over time. However, the magnitude of this system and its relationship with other agricultural complexes in the region is not yet well understood.

Based on results from the current investigation and a detailed literature review, it appears that this area was rather intensively cultivated during an undetermined period (lack of datable materials precluded accurate assessment of temporal context). 'Opportunism', defined as incorporating advantageous natural conditions (e.g., topography and substrate composition) with minimal modifications, appears to have been one possible strategy utilized by the groups who developed the agricultural complex. However, more complex engineering designs for intensively cultivating the area appear to have been utilized as well. This may have developed as a response to demands for increased intensification over time. We do know that there were increased demands on the agricultural production and increased intensification of agricultural field systems located in other parts of Hawaii Island at various points in time. It is quite possible that

demands set on the agricultural production by Kona chiefs for the South Hilo and Puna areas resulted in increased intensification in this region. Unfortunately, this is a difficult question to answer for Site 21139 without additional research. These types of interpretations should be posed as mere speculation and approached with caution due to the current paucity of strongly supportive evidence and temporal information.

Site 21139 appears to have been abandoned or only marginally utilized by the early historic period (perhaps even later towards the latter half of the 1800's). This may be supported by the lack of historical information describing traditional land use in the area and evidence which suggests a drastic decline in population, minimal land claims and sparse land use descriptions. It is difficult to pose a causal relationship. Factors which may have contributed to this are disease and high mortality, demographic shifts, exhaustion of resources and labor, a transition to other economically important products and practices, a decrease in outside demand for agricultural products from this region, etc.. It is likely that the demise of the agricultural complex resulted from a number of factors which will prove to be much more complex than can be answered through current investigations. Future investigations will undoubtedly contribute to understanding these processes.

Although this investigation primarily involves a functional perspective towards highlighting a portion of the agricultural complex (Site 21139), it is emphasized that a more processual approach towards understanding the genesis and degeneration of this agricultural complex and/or field system may prove interesting and useful for future researchers.

Site 21139 is composed of numerous features which likely articulated to form an agricultural complex. This complex may be part of a larger field system in lower Puna first detailed by Newman (1970). However, it is unknown as to the extent of this field system. Whether or not additional agricultural complexes located in Puna were also integrated into a contemporaneous field system also remains unknown. It is likely that a system of some magnitude occurred if there were sufficient demands for agricultural resources in Puna. However, after discussions with DLNR/SHPD personnel and assessment of the temporal information available, it has been decided that a functional interpretation of Site 21139 as belonging to a dryland field system of significant magnitude may be unwarranted at this time.

The numerous features which compose Site 21139 consist of walls, mounds, modified outcrops, modified gullies, terraces, modified depressions, C-shaped structures, enclosures, walkways, pits, and a possible small cave opening with a manuport. These features likely related to agricultural developments and practices during the prehistoric and early historic period. Details are provided below.

In order to adequately sample a portion of this agricultural complex, three transects were surveyed in detail (Transects C-E). This represents approximately 30-33% of the subject property. This sample allows an adequate prediction of the density and

location of similar sites throughout the subject property. Furthermore, substrate and vegetation information allows more detailed prediction of site types and distributions throughout the subject property. The following features were identified.

Feature A: Walls and Mounds

This feature is composed of numerous wall segments, mounds (18 of which are fairly large), and a larger wall segment (over 60 m in length)(see Figure 6). Construction is similar to Feature B and Feature C (see descriptions above and below for more detailed assessment of the potential function of walls and mounds. The function of this feature was likely related to agricultural production. Numerous pits were located in the area which were likely related to agricultural production as well.

Three of the mounds were dis-assembled and 'sectioned' to determine construction design and the presence/absence of additional cultural remains. There was no formal design evident in the tested mounds. The construction design appears to have been somewhat haphazard stacking of stones with no formal facings or platform-like flat surfaces. Furthermore, there were no cultural remains present. This indicates a rather informal construction design for the mounds, and that the mounds were likely not utilized for other practices (e.g., burials).

Feature B: Walls

This feature consists of low, interconnected stone walls. This feature is located along Transect C approximately 170-200 m southwest of the eastern property border (see Figure 6). The total length of the walls are approximately 260 m. Wall height inconsistently varies from 30-75 cm agl. Wall thickness varies from 50-150 cm. The walls were constructed with angular basalt pebbles, cobbles and boulders which range in diameter from 5 to 50 cm (sometimes larger). The walls appear to have been loosely constructed with no formal facings.

Although it appears that the walls may have formed some type of enclosure in the past when viewed from the plan view, it is highly unlikely that this related to animal husbandry practices. The walls would probably not have prevented the movement of animals in and out of the area due to their design and size. The more likely function was agricultural and/or delimiting a property boundary (e.g., garden plot boundary).

As mentioned previously, the agricultural potentials may have been numerous. Thus, the walls may have been a multi-functional agricultural feature. For example, the walls may have 1) resulted from clearing agricultural land, 2) have served as a medium for cultivating certain plant species (e.g., sweet potato), 3) retained soils for cultivating certain plant species and controlling soil movement and erosion, and 4) channeled water or retained moisture necessary for controlling the level of agricultural productivity.

The overall conditions of the walls are poor, apparently having been extremely weathered and eroded. Numerous pits were located in the area which may have been part of the integrated agricultural complex.

Feature C: Mounds

This feature consists of numerous stone mounds, seven of which are fairly sizable (see Figure 6). The mounds were constructed of angular basalt stones which range in diameter from approximately 5-50 cm. There appear to be no formally constructed facings. The mounds range in diameter from less than one meter to several meters (not usually exceeding four meters). The mounds range in height from approximately 20-30 cm agl to sometimes over 2.0 m agl. There appears to be no specific pattern of arrangement. However, these mounds appear to be enclosed by 21139B. The overall function was likely agricultural. The overall condition of the mounds is poor, apparently having been extremely weathered and eroded. Numerous pits were located in the area which may have been part of the integrated agricultural complex.

Feature D: Walls and Mounds

This feature consists of approximately 105 m of low inter-connected walls, a disconnected wall segment and numerous stone mounds, five of which are fairly sizable (see Figure 6). Feature D crosses Transect C at several locations from about 320-370 m southwest from the eastern border of the subject property. The construction of the walls and mounds are similar to Feature B and Feature C. Again, overall function was likely agricultural and/or, for the walls, possibly a boundary demarcation. There is no apparent pattern. The overall conditions of the walls and mounds are poor, apparently having been extremely weathered and eroded.

Feature E: Walls and Mounds

This feature consists of over 560 m of low walls and intermittent walls (most of which are inter-connected), and numerous stone mounds, 21 of which are fairly sizable (see Figure 6). Feature E crosses Transects C through E at approximately 85-200 m in from the eastern border of the subject property. The construction of the walls and mounds are similar to Feature B and Feature C. Again, overall function was likely agricultural and/or, for the walls, possibly a boundary demarcation. There is no apparent pattern. The overall conditions of the walls and mounds are poor, apparently having been extremely weathered and eroded. Numerous pits were located in the area which may have been part of the integrated agricultural complex.

Feature F: Beach Stone Manuport

This feature consists of a single, waterworn, basalt, beach-stone manuport. It is approximately 30 cm in diameter. It is located close to Transect D at the western side of Feature E in a level, less densely vegetated area. Function is unknown, although, it is

possible that this served as some form of marker. It was assigned a feature number because similar manuports are notably absent from the area and it likely represents a significant degree of intentionality in its placement, although its true significance is unknown.

Feature G: Modified Gully, Modified Outcrop and Mounds

This feature consists of a modified outcrop in a modified gully and numerous stone mounds, three of which are extremely large (5-10 m in diameter). This area is located to the west of Feature E and Feature F along Transects D and E (see Figure 6).

The modified outcrop appears to have been a crudely re-arranged area within a *pahoehoe* gully (perhaps a small collapsed lava tube segment) with a severely deteriorated wall segment built of stacked angular basalt cobbles. It is possible that this may have formed a small enclosure. However, due to the deteriorated condition, this cannot presently be confirmed, although, it is apparent that it is anthropogenic.

The area between Feature G and Feature E along Transects D and E appears to be more level with greater soil accumulation. It is possible that this entire area may have been enclosed, although this is not obvious from the plan view of the existing features. However, this area, due to its greater soil content, may have been utilized for agricultural practices. The function of Feature G was likely agricultural. Numerous pits were located in the area which may have been part of the integrated agricultural complex.

Features H-K: Walls and Mounds

These features are composed of over 820 m of low walls and intermittent walls, and numerous mounds, 18 of which are fairly large. These features cover a rather large area between Transects B and G see Figure 6). It was originally hypothesized that the walls may have formed enclosures possibly related to animal husbandry. However, based on the rather crude and low construction of the walls, this is unlikely. The construction of the walls and mounds are similar to Feature B and Feature C. Again, overall function was likely agricultural and/or, for the walls, possibly a boundary demarcation. There is no apparent pattern, although a greater density of large mounds appear to be clustered around the wall segments of Feature K on the southern aspect of Feature G. The overall conditions of the walls and mounds are poor, apparently having been extremely weathered and eroded. Numerous pits were located in the area which may have been part of the integrated agricultural complex.

Feature L: Wall

This feature is composed of a low wall which is approximately 140 m in length (see Figures 6 & 7). This feature is similar in construction with Feature Q. It was possibly part of a larger multi-component agricultural feature (see description of Feature

Q for further details). The overall condition of the wall is poor, apparently having been extremely weathered and eroded.

Feature M: Walls and Mounds

This feature consists of approximately 65 m of two low disconnected wall segments and numerous stone mounds, 15 of which are fairly sizable (see Figure 6). Feature M crosses Transect D and E near the eastern border of the subject property. The construction of the walls and mounds are similar to Feature B and Feature C. Again, overall function was likely agricultural and/or, for the walls, possibly a boundary demarcation. There is no apparent pattern other than a clustering of larger mounds at either end of the walls and in the section between the two wall ends along Transect E. The overall conditions of the walls and mounds are poor, apparently having been extremely weathered and eroded. Inside this feature, towards the eastern border of the subject property, numerous pits are also located in the *A'a/Hala Zone*.

Feature N: Modified Gully

This feature is a series of small gullies which appears to have been moderately and 'opportunistically' modified to form a terracing affect. Feature N is located along Transect E just to the southwest of Feature M (see Figure 6). A few locations have been modified with crudely built walls and stacked angular basalt pebble and cobble buttresses to form a terracing affect in the gullies. There are no true facings.

The walls and buttresses run perpendicular and parallel to the natural slope. This may have been intended to channel water and/or retain soil. The soil deposits along the inside and higher areas of these modifications are considerably deeper. It appears this was done in order to take advantage of the natural topographic features and conditions (e.g, slope). It is likely the overall function was agricultural. The existing modifications and features are severely deteriorated.

Features O-P: Modified Gully, Pits, Walls, and Ag. Terrace

Feature O is a series of four low parallel walls and one perpendicular wall (see Figures 4 & 6). Several anthropogenic pits are located in the vicinity averaging about one meter in diameter and 0.5 m deep. The pits are located at the southern opening of Feature O. The walls are crudely built and intermittent in several locations with the longest being less than 30 m in overall length. The parallel walls are spaced evenly at approximately 12-15 m spacings.

Feature P is a semi-circular modified low area or wide gully which has been modified by buttressing the inner and lower perimeter with angular basalt pebbles and cobbles ranging in diameter from 10-30 cm. Feature P opens to the south with a diameter of 20-25 m. This area contains a notable stand of *hala* as well.

These features have been modified and constructed to form a terracing affect (see Figures 4 & 6). Feature O and Feature P appear to be articulated, though this cannot be confirmed. It is just as likely that they may represent two separate construction episodes, though this interpretation does not exclude them having been intentionally articulated and subsequently used simultaneously. It appears these features were engineered to 'opportunistically' take advantage of the natural low topography. This may have been engineered in order to retain soil and/or channel water, especially Feature O, the walls. The modifications characterizing Feature P could also have been the result of clearing activities. Soil deposits in this area are considerably deeper due to the terracing affect.

The overall function is likely agricultural. However, these features are deteriorated and disturbed which complicates adequate interpretation.

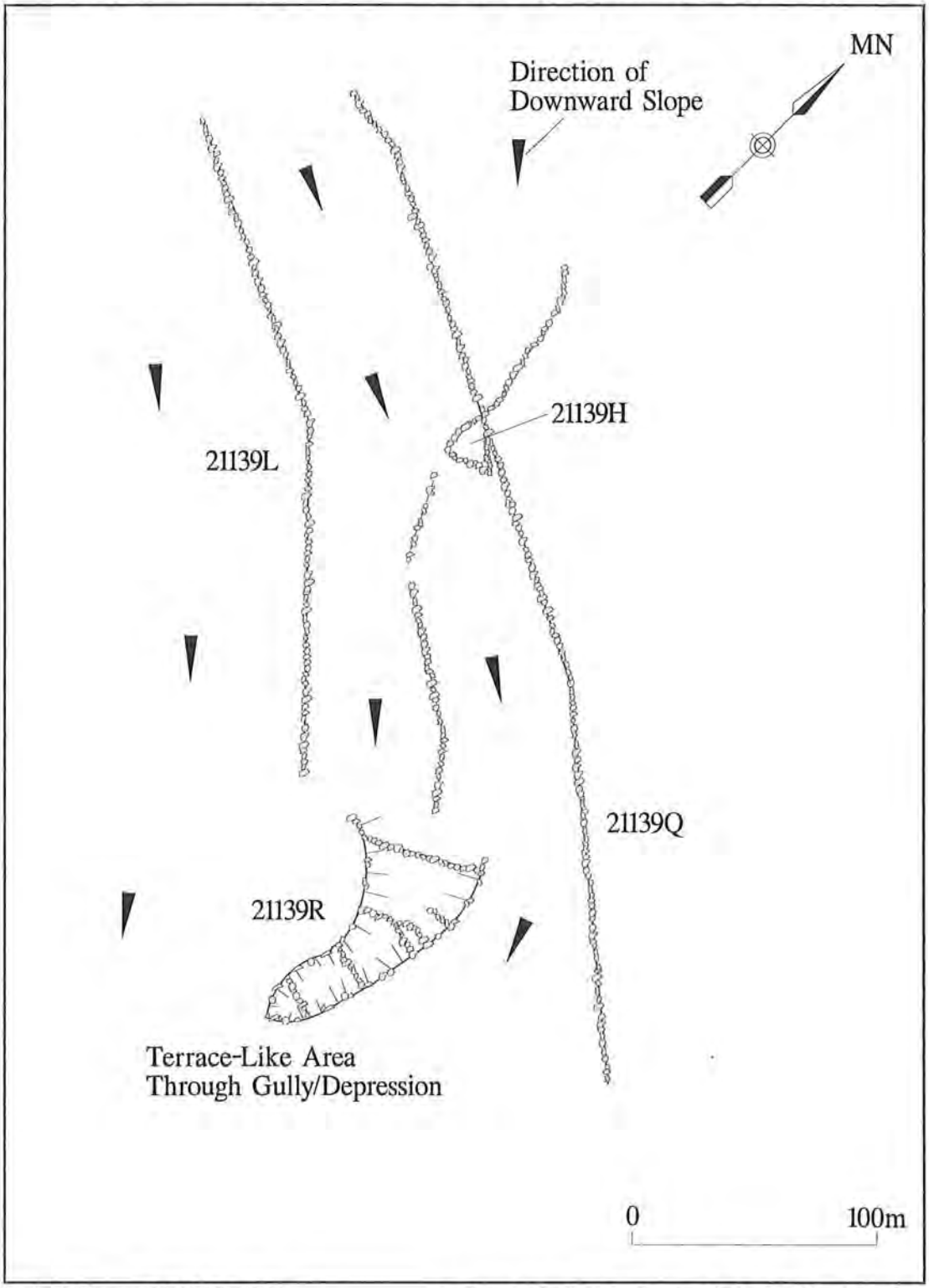
Feature Q: Wall

This feature is a single low wall which runs over 185 m in length (see Figures 6 & 7). Wall height inconsistently varies from 30-75 cm agl. Wall thickness varies from 50-150 cm. The walls were constructed with angular basalt pebbles, cobbles and boulders which range in diameter from 5 to 50 cm (sometimes larger). The wall appears to have been loosely constructed with no formal facings.

The wall is located towards the western end of the subject property and runs somewhat *mauka-makai* in orientation. The likely function was agricultural and/or delimiting a property boundary (e.g., land division). As mentioned previously, the agricultural potentials may have been numerous. Thus, the wall may have been a multi-functional agricultural feature. For example, the walls may have 1) resulted from clearing agricultural land, 2) have served as a medium for cultivating certain plant species (e.g., sweet potato), 3) retained soils for cultivating certain plant species and controlling soil movement and erosion, and 4) channeled water or retained moisture necessary for controlling the level of agricultural productivity. It might be hypothesized, though, due to its length and comparative straightness, this wall may have only served as a boundary.

However, unlike the previously described features, this wall segment is primarily located towards the eastern border of the *Pahoehoe Outcrop/Dispersed Strawberry Guava Zone*. This wall may have served an agricultural function as an articulated component of a larger system. A parallel wall, Feature L, is located near the western border of the *Pahoehoe Outcrop/Dispersed Strawberry Guava Zone*. Also, a third parallel wall segment (part of Feature H) is located in between these walls. Finally, located at the downslope end of these wall is Feature R, a terraced agricultural feature. It is plausible that these features may have formed an articulated agricultural system, possibly an exploitative response to a different type of area (e.g., an area with a variant substrate). This may have channeled water and/or soil during sheet flooding over a predominantly *pahoehoe* surface. However, this is merely speculation at this point and such an interpretation should be approached with caution.

Figure 7: Top Plan of Site 21139 (Features H, L, Q & R)



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The overall condition of the wall is poor, apparently having been extremely weathered and eroded.

Feature R: Modified Gully, Modified Outcrops, Walls and Ag. Terrace

This feature is composed of four walls, two wall segments, a modified gully, mounds, and some modified outcrops (see Figures 4 & 7). Only one mound was significantly large in size. These modifications and features appear to form a terracing affect through the channel of a natural gully. This feature is located in an overlap area between the *A'a/Hala Zone* at the far western portion of the subject property and the adjacent *Pahoehoe Outcrop/Dispersed Strawberry Guava Zone* along Transects E and G.

The walls range from 25 to 4 m in length and are spaced approximately 15 m apart. The walls are low and rather crudely constructed with no definite facings, though they are severely deteriorated and weathered. The walls run perpendicular to the slope of the gully in which they are located. Two short wall segments are located in the vicinity of the second wall from the top of the gully. These appear to form smaller terraced areas which likely articulated with the entire feature.

Portions of the sides of the gully and some outcrops appear to be roughly modified with angular basalt pebbles and cobbles. A rather sizable but informally constructed mound is located in the vicinity of the smaller wall segments.

Due to the terracing effect, this area has significantly deeper soil deposits. It is likely that the walls and modifications were constructed to facilitate soil retention/accumulation and/or to channel water flow. The overall function appears to have been agricultural.

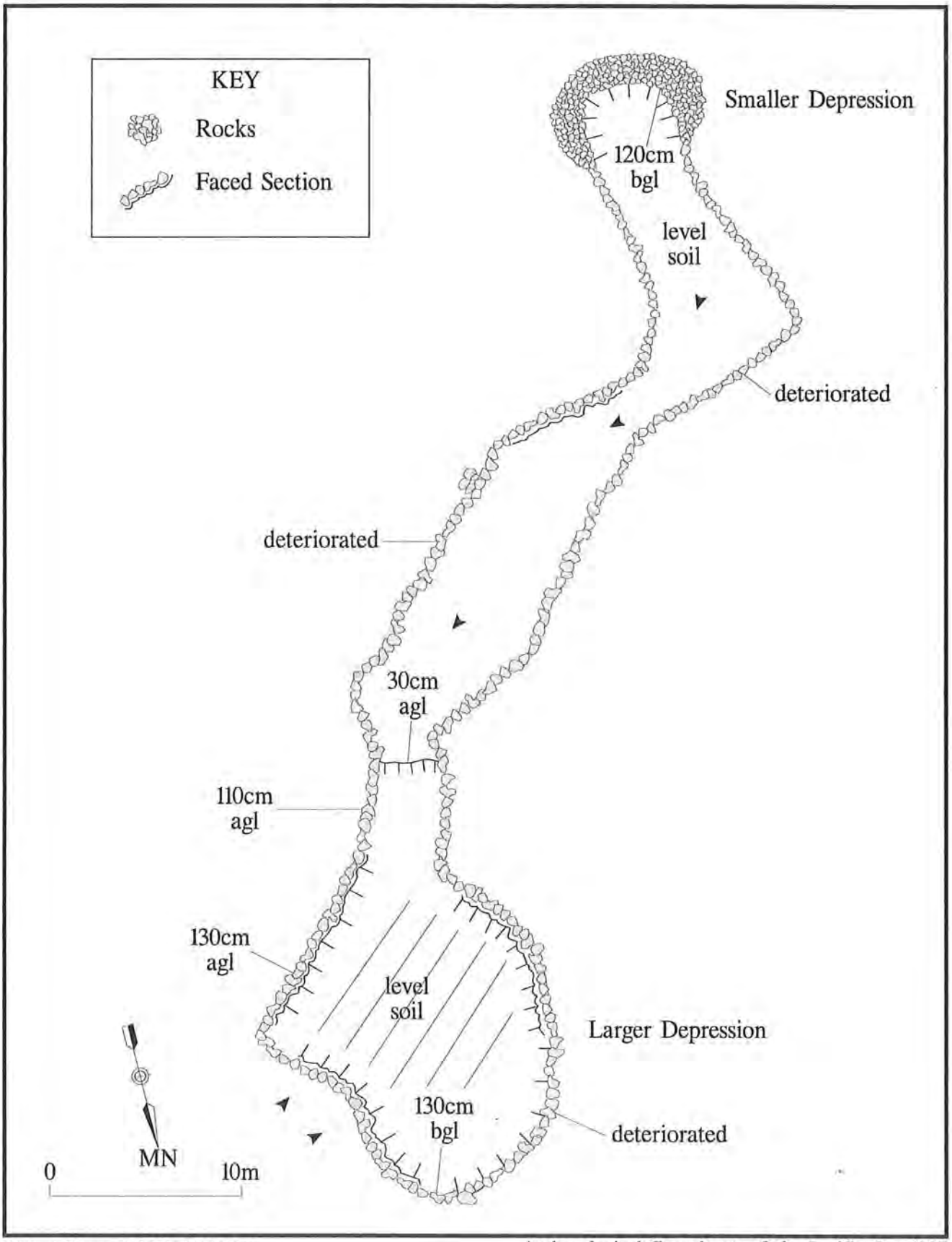
Furthermore, this feature may be articulated in some manner with Feature H, Feature L and Feature Q as a more complex agricultural feature.

Feature S: Modified Depressions

This feature is located approximately 20 m southeast of Transect H along the eastern boundary of the property (see Figure 4). It extends from the *hala* grove which runs along the eastern border of the property into a zone of mixed *a'a* and *pahoehoe* dominated by strawberry guava. The feature consists of a pair of modified depressions connected by a lined, ditch-like segment (see Figure 8).

The two modified depressions vary in size. The larger depression is roughly oval in shape measuring almost 15 m long by 10 m wide and reaching depths of up to 130 cm below the surrounding ground level. The ground within this depression is level and, for the most part, devoid of stone. The walls are lined with angular basalt stones measuring 25 to 50 cm in diameter which, in some places, form nicely faced, vertical retaining walls. In other places it is deteriorated, appearing more like a rubble revetment.

Figure 8: Top Plan of Site 21139S



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The smaller depression is circular in shape measuring approximately 5 m in diameter and reaching a depth of 120 cm bgl. This depression appears to be a larger example of the pits which are ubiquitous across the property in areas with *a'a* on the surface. There is a small area of level soil in the center of the depression which opens to the north into the connecting segment. The walls are lined with a sloping, rubble-like alignment of small angular basalt stones between 5 to 15 cm in diameter.

The connecting segment extends from the southern end of the larger depression crossing a step and curving to the west before bending back toward the south and opening into the smaller depression. It varies between 2 and 5 m in width and measures approximately 35 m in total length. Its walls are constructed of angular basalt stones measuring between 30 and 50 cm in diameter which in some places form nicely faced retention walls while in other places are rubble-like, probably due to deterioration. The floor of the connecting segment is also below the surrounding ground level, varying between 50 and 100 cm bgl. The step is constructed of angular basalt stones aligned as a single course standing approximately 30 cm agl.

It is suggested that this feature was constructed to take advantage of the natural topography and that it is representative of one type of agricultural feature found in the agricultural complex.

Feature T: C-Shape

This feature is located approximately 20 m northwest of Transect H within an area of mixed *a'a* and *pahoehoe* dominated by strawberry guava and containing numerous stone mounds (see Figure 4). The feature consists of a C-shape constructed out of angular basalt stones. It measures 6.5 m in length and 5 m in width with the wall standing up to 90 cm agl. The wall is nicely faced on its interior but is rubble-like sloping to ground level on the exterior. The aperture opens to the west.

Based upon a review of previous archaeological work conducted in Puna and on the Big Island, arguments can be made for two possible functions for this feature type, residential or agricultural. Ladefoged *et al.* cite Rosendahl (1972) and Clark (1983) in making a determination of function for morphologically similar feature types (Ladefoged *et al.* 1987:48-49). Rosendahl classified C-shaped structures at Lapakahi as residential features based on the presence of structural sub-components as well as midden and charcoal. Clark classified C-shaped structures within the Waimea-Kawaihae road corridor as agricultural features based upon the lack of midden and charcoal as well as the presence of more substantial residential features nearby. Ladefoged *et al.* go on to discuss a hierarchical model proposed by Clark (1987) which classifies residential structures into single-use, recurrent-use, extended-use and permanently occupied shelters (Ladefoged *et al.* 1987:101). Based upon this information, Ladefoged *et al.* classified the majority of simple stone alignments within the national park (including "walled shelters" as well as C-shapes, L-shapes, U-shapes) as agricultural features, although they recognize

that some of the larger alignments may have been associated with residential complexes (Ladefoged *et al.* 1987:48-49).

Feature T is located amidst numerous agricultural features in an area lacking residential structures. Furthermore, it is more well constructed than the surrounding agricultural features. These factors may indicate that it was utilized as a shelter rather than for agriculture. On the other hand, there was no evidence of midden, charcoal or other cultural remains which would be indicative of habitation. In addition, subsurface testing which took place at a similar feature (Feature AF) did not identify any cultural materials. While there is conflicting evidence as to this feature's function, the most probable utilization was as a recurrent-use temporary shelter. However, any definite functional assessment cannot be made due to the paucity of available evidence.

Feature U: Curb-Lined Walkway

This feature crosses Transect H approximately 215 m from the eastern boundary of the property (see Figure 4). It consists of a raised walkway which extends at least 20 m to the southeast and 10 m to the northwest. The walkway is constructed of angular basalt stones of varying size. The sides are lined with two to three coarses of stacked stones measuring 20 to 30 cm in diameter and standing approximately 40 cm agl. These alignments retain a filled core of small fragments of *a'a* measuring 5 to 10 cm in diameter. The raised walkway measures approximately 1.5 m in width. This feature is believed to be a walkway based upon its low, wide structure which may have meandered through the agricultural system located on the subject property.

Feature V: Modified Depression

This feature is located approximately 20 m southeast of Transect H and 270 m from the eastern boundary of the property (see Figure 4). The feature consists of a modified depression whose southeastern side opens into a natural gully which shows evidence of modification and possible terracing along its banks. The probable function of this feature was likely agricultural.

Feature W: Enclosure

This feature is located on Transect H between 270 and 275 m from the eastern boundary of the property (see Figure 4). It consists of a rectangular enclosure measuring 13 m in length by 7.5 m in width. The walls are roughly stacked having been constructed of angular basalt stones 5 to 80 cm in diameter, standing up to 80 cm agl and measuring 1 to 1.5 m wide. It is suggested that the function may have related to animal husbandry, but appears more like a soil filled garden plot. The construction does not appear to be as formal as other enclosures located on the subject property and the condition of the walls do not appear adequate to have hindered entry or exit of animals. However, the feature is somewhat deteriorated and the enclosure, at one time, may have delimited a garden plot

or prevented some animals from entry. Without further information, though, accurate function is difficult to assign.

Feature X: Cave Opening with a Waterworn Beach Stone Manuport

This feature consists of a small cave opening with a manuport. It is located approximately 10 m southeast of Transect I, 240 m from the eastern boundary of the property (see Figure 4). The manuport is a waterworn stone approximately 30 cm in diameter which had been placed in the mouth of a small cave opening. The cave opening measures approximately 1 m wide and only 50 cm high. The interior of the cave extends about 1.5 m before pinching down to ground level and is, thus, impassable to humans. No other cultural materials were identified. This feature may have been a marker of some sort. Definite function remains unknown.

Feature Y: Wall Segment

This feature is a wall segment which is partially faced in some sections. The wall crosses Transect I at 135 m from the eastern boundary of the property (see Figure 4). The wall segment measures only 6 m in length, 75 cm in width and stands 60 cm agl. Both ends have deteriorated and fallen. A mound is located immediately adjacent to the wall segment which appears to have been partially dismantled relatively recently.

Feature Z: Walkway Segment

This feature consists of a short walkway segment connecting two *pahoehoe* blisters. It is located approximately 5 m northwest of Transect I and 360 m from the eastern boundary of the subject property (see Figure 4). The walkway was constructed of angular basalt stones 30 to 50 cm in diameter which connected two natural, exposed blisters of *pahoehoe*. It measured approximately 2 m in length, 1 m in width and was raised about 70 cm agl at either end but only 30 cm agl in the middle. The edges of the walkway formed neatly stacked facings.

Feature AA: Modified Depression and Ag. Terrace

This feature consists of a natural depression formed at the leading edge of a *pahoehoe* lip which has been modified by the construction of a mound roughly in the center of the depression and terracing along its northern side. It is located approximately 10 m northwest of Transect I and 513 m from the eastern property boundary (see Figure 4).

The depression itself is only minimally modified with deteriorated earthen terracing supported by single course alignments of stone occurring on its northern side. The depression measures approximately 15 m long and 10 m wide, varying in depth between 70 and 200 cm bgl. The mound in the middle of the depression is constructed of large angular basalt stones 50 to 100 cm in diameter. The structure is loosely constructed

with gaps large enough to see the soil floor between components of the structure. The mound measures approximately 3 m long and 2 m wide, standing 120 cm agl. The function was likely agricultural.

Feature AB: Walkway Segment

This feature consists of a short, lined walkway segment which crosses Transect J approximately 93 m from the eastern boundary of the subject property (see Figure 4). The walkway is constructed from two roughly parallel alignments of angular basalt stones 30 to 50 cm in diameter, stacked in 1 to 2 courses, and standing 40 cm agl. Between the two stone alignments the walkway is filled with small pieces of *a'a* and broken stone forming a level surface approximately 1 m in width. The walkway segment measures approximately 10 m in length.

Feature AC: Walkway Segment

This feature consists of a short, lined walkway segment. It is located approximately 15 m northwest of Transect J and 350 m from the eastern boundary of the subject property (see Figure 4). The walkway is constructed from two roughly parallel alignments of angular basalt stones 30 to 50 cm in diameter, stacked in 1 to 2 courses, and standing 50 cm agl. Between the two stone alignments, the walkway is filled with soil forming a level surface approximately 1 m in width. The walkway segment measures approximately 15 m in length.

Feature AD: Modified Outcrop and Enclosure

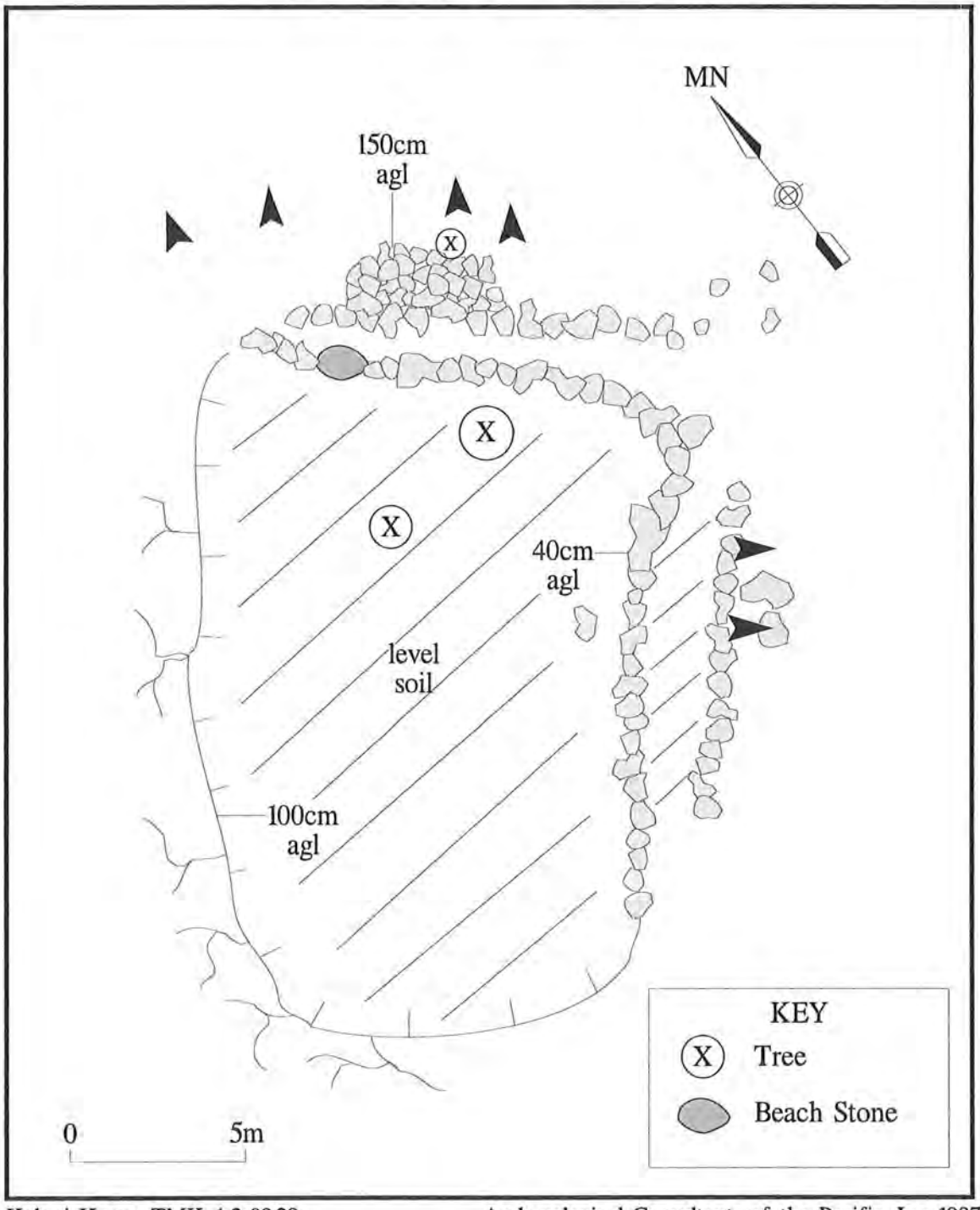
This feature consists of a tongue of *pahoehoe* which has been modified to form a rectangular enclosure with adjacent walkway segments and a small terrace. It is located approximately 20 m northwest of Transect K and 280 m from the eastern boundary of the property (see Figure 9).

The enclosure is bounded on two sides (northwestern and southwestern) by a 100 cm agl lip of *pahoehoe* on the other two sides (northeastern and southeastern) by alignments of stone which also line short segments of walkways. The enclosure measures approximately 16 m in length by 10 m in width and has a level, soil floored interior (see Figure 9).

A lined walkway borders the northeastern end of the enclosure which is level with the interior of the enclosure and is delineated by two, roughly parallel, single coarse alignments of angular basalt stones between 30 and 75 cm in diameter (see Figure 9). A single waterworn stone was identified incorporated into the southwestern alignment of the walkway (the northeastern boundary of the enclosure).

Along the southeastern boundary of the enclosure there is a lined, raised walkway segment that is constructed of two roughly parallel alignments of angular basalt stones 30

Figure 9: Top Plan of Site 21139AD



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to 75 cm in diameter and stacked 1 to 2 coarses high. The area between stone alignments is filled with soil. This walkway measures approximately 15 m in length, 75 cm in width, and stands 40 cm agl (see Figure 9).

At the northeastern end of the enclosure and along the northeast side of the lined walkway segment there is a small terrace constructed out of angular basalt stones 30 to 60 cm in diameter which measures 3 m long by 2 m wide (see Figure 9). The terrace is level with the enclosure on its southwestern side and stands 150 cm agl on its northeastern side.

It is likely that this feature was utilized agriculturally with the enclosure serving to collect and retain soil and moisture. It may have also been related to animal husbandry activities.

Feature AE: Terrace

This feature consists of a level, paved terrace elevated above ground level on three sides. It is located approximately 10 m southeast of Transect L and 85 m from the eastern boundary of the subject property (see Figures 4 & 10). The feature is constructed out of angular basalt stones between 30 and 60 cm in diameter which form a level, roughly paved surface and sloping rubble-like edges. It measures 7 m long and 5.5 m wide, standing 120 cm agl on its *makai* side and level with the natural ground surface on its *mauka* side (see Figure 10). The *makai* end of the terrace has been disturbed, likely having been dismantled by pot hunters.

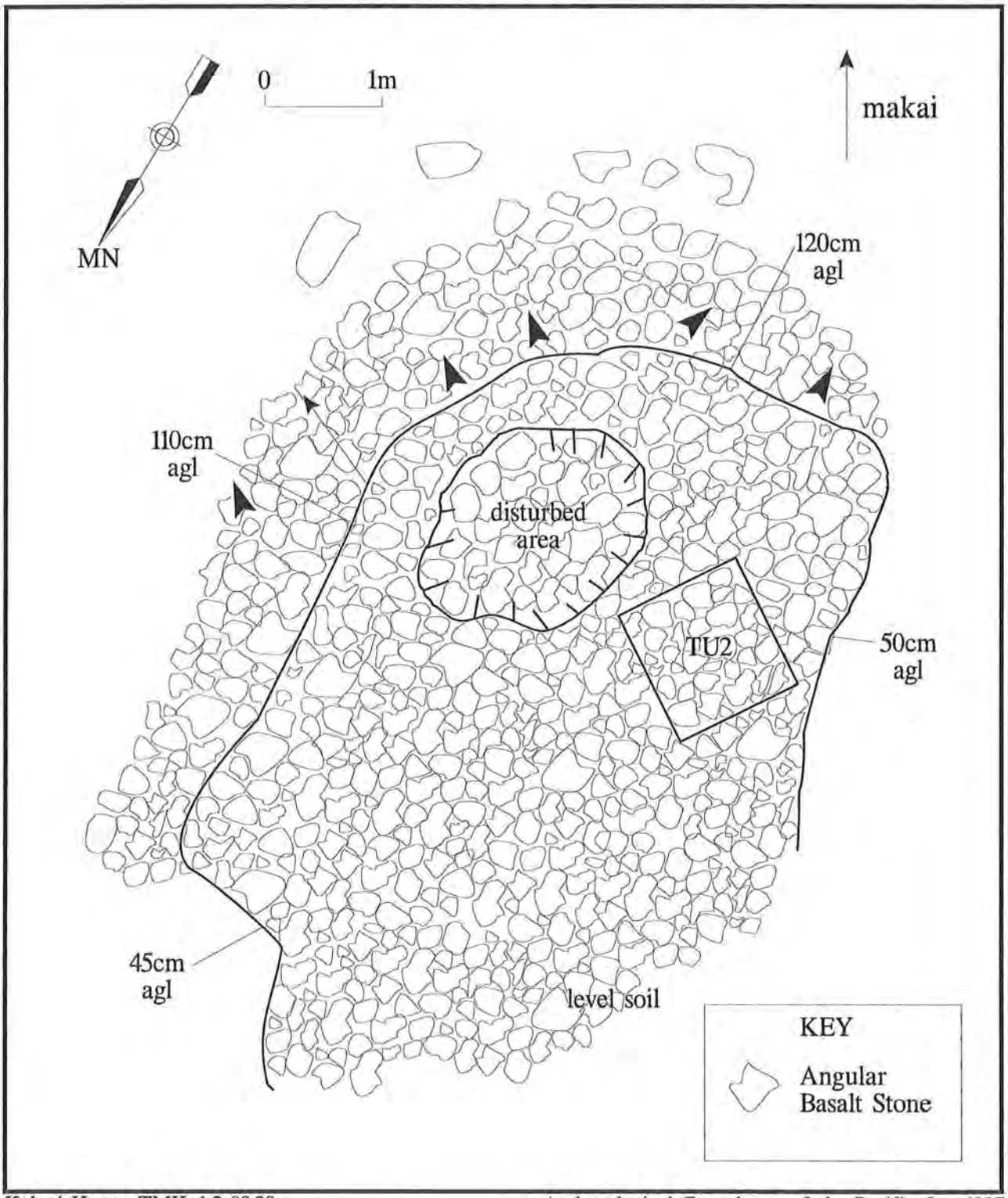
Test Unit 2: A test unit was placed in the terrace towards the center of its level surface (see Figures 10 & 11). The unit measured 1 m by 1 m. A level datum was established on a nearby tree. The corners of the unit were marked and their depths below datum measured. Excavation proceeded by removing structural fill from the unit. In Test Unit 2 detrital material was encountered between the stones of the structural fill from the surface to a depth 40 cmbd (see Figure 11). Detrital material collected was sifted through nested one quarter in one eighth inch screens. After removing the structural fill and detrital material which continued to a depth of approximately 40 cmbd (measuring 20 to 25 cm thick), structural fill continued but detritus was no longer present. Excavation reached a maximum depth of 93 cmbd without encountering any stratigraphic soil deposits. No cultural materials of any kind were encountered.

This feature may have been utilized as a habitation floor and/or for agricultural activities although current evidence neither supports nor refutes these possibilities.

Feature AF: C-Shape

This feature consists of a C-shape that almost forms a circular enclosure but for a small gap in its wall. It is located directly on Transect N approximately 410 m from the eastern boundary of the subject property (see Figure 4). The feature is constructed of

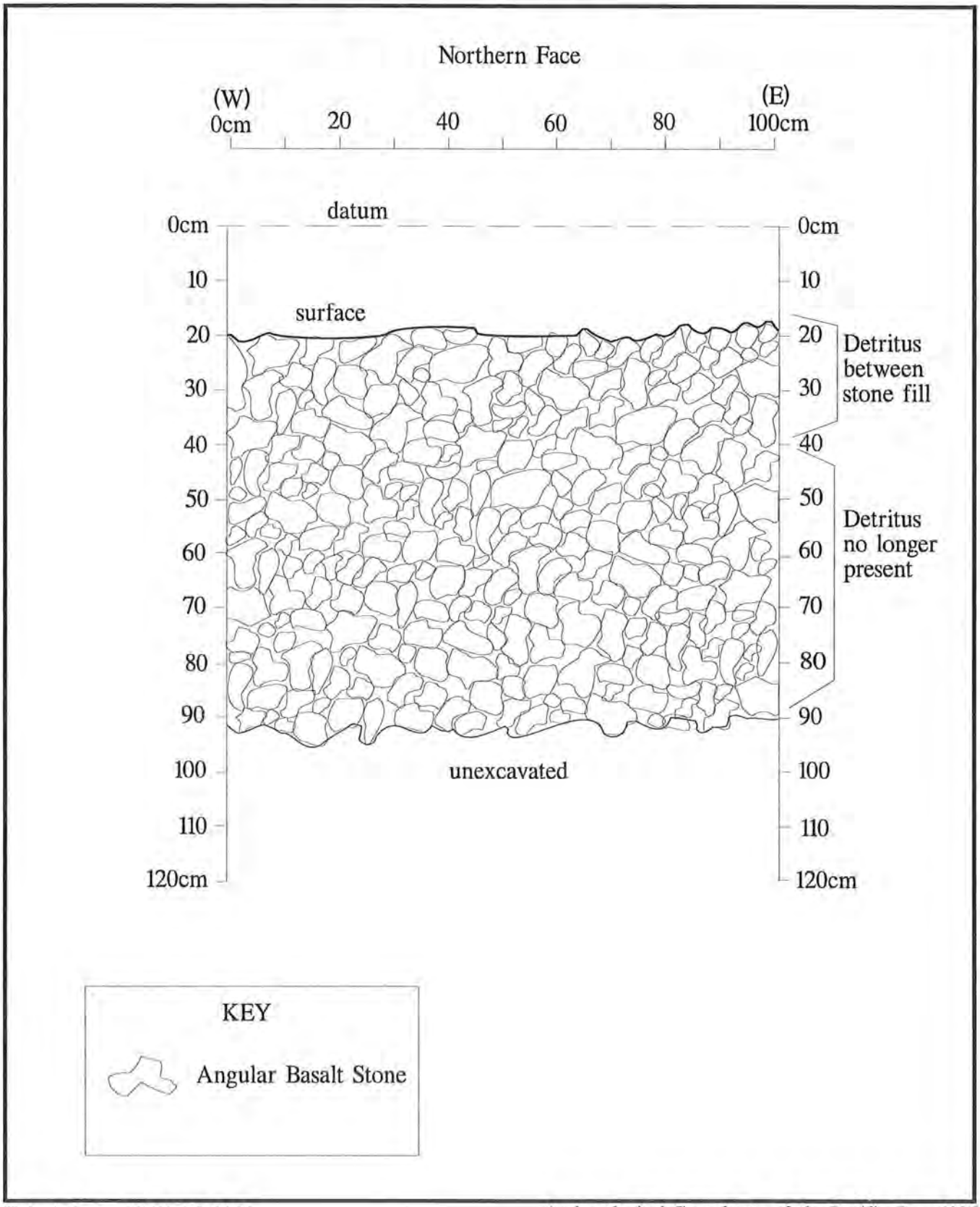
Figure 10: Top Plan of Site 21139AE



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Figure 11: Profile of Site 21139AE, Test Unit 2



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angular basalt stones 20 to 50 cm in diameter forming walls which are neatly stacked along the top and sloping towards its base. The walls stand approximately 80 cm agl and measure 50 cm in width. The soil interior is level and smooth. The aperture opens to the southwest and is actually a notch in the wall rather than a complete, unfilled opening.

A shovel test pit was placed within the level soil interior of the feature. This pit was excavated to a depth of 65 cm below surface and encountered a single stratigraphic layer consisting of a black (10YR 2/1) silty loam. No cultural materials were encountered in the shovel test pit.

This feature may be related to animal husbandry or to temporary habitation. A definite functional assignment cannot be determined without further information.

Enclosure: Site 21140

This feature consists of a relatively large enclosure constructed out of bifaced, core-filled walls. It is located crossing Transects K and L approximately 150 m from the eastern boundary of the property (see Figure 4). The facings of the walls are well built from angular basalt stones 25 to 75 cm in diameter stacked in 5 to 6 courses standing 100 to 120 cm agl. The core of the walls are filled with smaller pieces of angular basalt *a'a* measuring between 5 to 15 cm in diameter. In some places the wall is more deteriorated and no longer appears bifaced while in other spots the bottom of the wall appears to be roughly stacked rubble and the upper 60 cm is bifaced.

Differences in the wall's morphology appear to be related to topography and deterioration. The feature measures approximately 90 m in length and 30 m in width enclosing an area of around 2700 square meters. Mounds and pits are present both within and without the enclosure. It is likely that the function was related to animal husbandry and/or agriculture. The size and constructional morphology of the walls suggest that this feature may having been constructed during the historic period and related to animal husbandry (e.g., cattle ranching)(Yent & Ota 1982). However, without associated datable material or historic documents, assigning a definite temporal context is problematic. Morphologically, this feature resembles similar historic features common in Hawaii.

Enclosure: Site 21141

This feature consists of a rectangular enclosure with one wall which is bifaced and core-filled and the other three consisting of stacked alignments of stone. It is located in the area between Transects L and M approximately 200 m from the eastern property boundary (see Figure 4).

The walls are constructed of angular basalt stones 25 to 75 cm in diameter. The eastern wall is bifaced and core-filled standing between 80 and 120 cm agl and measuring approximately 75 cm thick. The remaining three walls are more simple in construction consisting of stacked alignments of stone standing between 30 and 70 cm agl and

measuring approximately 75 cm thick. The enclosure measures approximately 60 m long and 30 m wide. Vegetation is relatively sparse within the enclosure and there are several mounds scattered about the interior. It is likely that the function was related to animal husbandry and/or agriculture. The size and constructional morphology of the walls suggest that this feature may having been constructed during the historic period and related to animal husbandry (e.g., cattle ranching). However, without associated datable material or historic documents, assigning a definite temporal context is problematic. Morphologically, this feature resembles similar historic features common in Hawaii.

Enclosures: Site 21142

This feature consists of a pair of adjacent enclosures. It is located approximately 5 m southeast of Transect M and 300 m from the eastern boundary of the property (see Figure 4). The walls of these enclosures are bifaced and core-filled being constructed of angular basalt stones measuring between 30 and 60 cm in diameter. The walls measure between 60 and 120 cm in width and stand 150 cm agl. Each enclosure is roughly square measuring approximately 10 m on a side. Each enclosure also has a small entrance, one opening towards the north while the second opens towards the east so that the two are adjacent to each other and are oriented towards one another. These enclosures are believed to be small livestock holding pens constructed and utilized in the historic period. However, without associated datable material or historic documents, assigning a definite temporal context is problematic. Morphologically, this feature resembles similar historic features common in Hawaii.

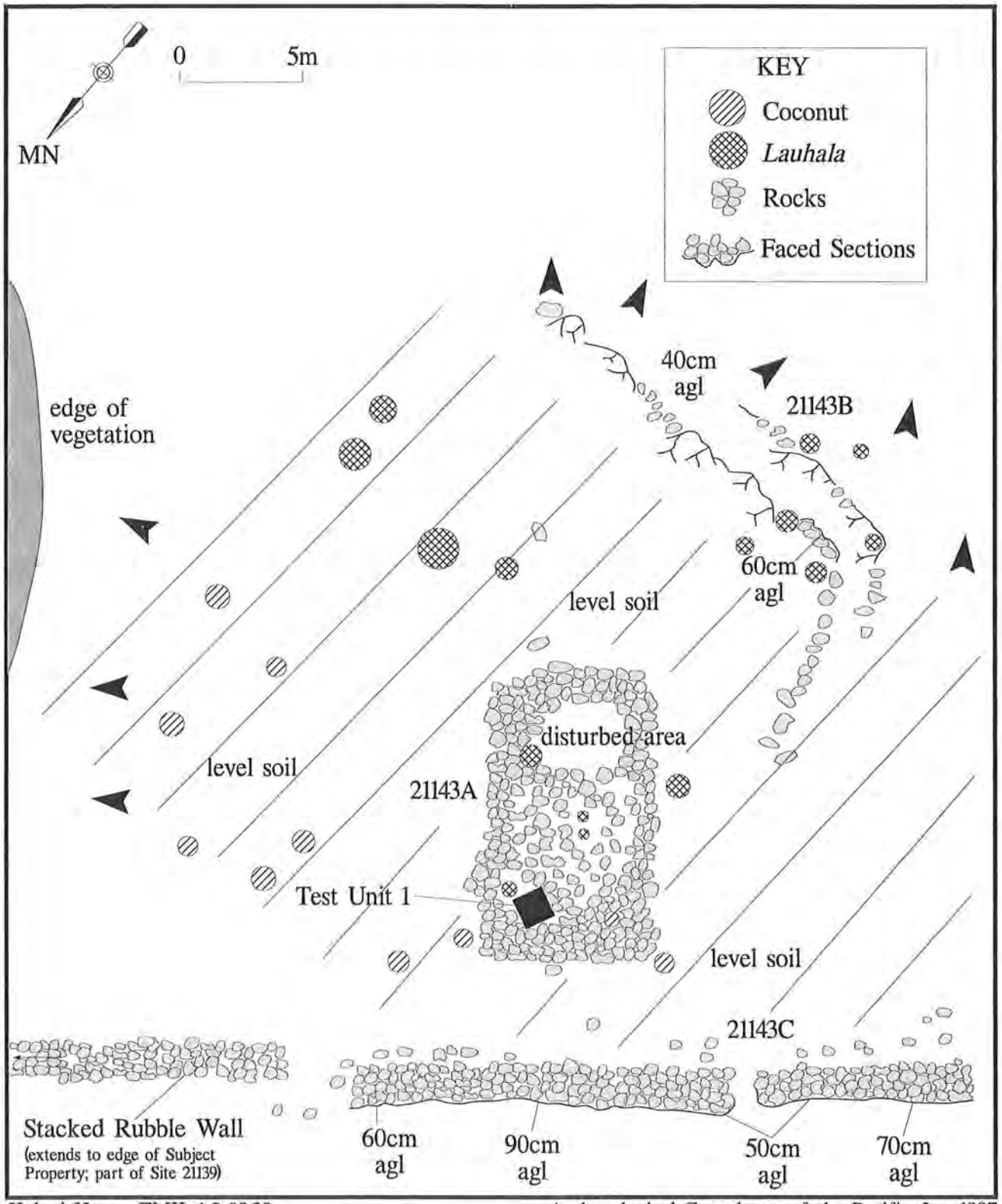
Probable Heiau: Site 21143

This feature consists of a platform (21143A) paved with waterworn stones which has a faced, core-filled wall (21143C) on its *mauka* side and bi-level, stone faced terracing (21143B) on its *makai* side. It is located approximately 25 m southeast of Transect L and 20 m from the eastern boundary of the subject property (see Figures 4 & 12).

The platform is constructed of angular basalt stones 25 to 75 cm in diameter and is paved with waterworn basalt stones 50 to 80 cm in diameter. It measures 12.5 m in length by 7.5 m in width and stands between 30 and 40 cm agl (see Figure 12). The structure is in a deteriorated condition with stones and rubble exposed through the former paving and fallen edges. The *makai* end of the platform is extremely disturbed.

The platform is situated in a level soil area which is bounded by a faced, core-filled wall on its *mauka* side and soil backed terracing on its *makai* side. The faced, core-filled wall is approximately 5 m *mauka* of the platform. The wall has two segments separated by a gap that may have functioned as an entrance way (see Figure 12). It is constructed out of angular basalt stones 30 to 60 cm in diameter and is nicely faced on its *mauka* side while sloping to the ground on its *makai* side. The wall extends 15.5 m from its northeastern end until reaching the gap, which measures approximately 1 m wide. The

Figure 12: Plan View of Site 21143 (Features A to C)



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structure then continues for an additional 8.5 m. The wall measures 75 cm wide at the top and 1.5m wide at the base.

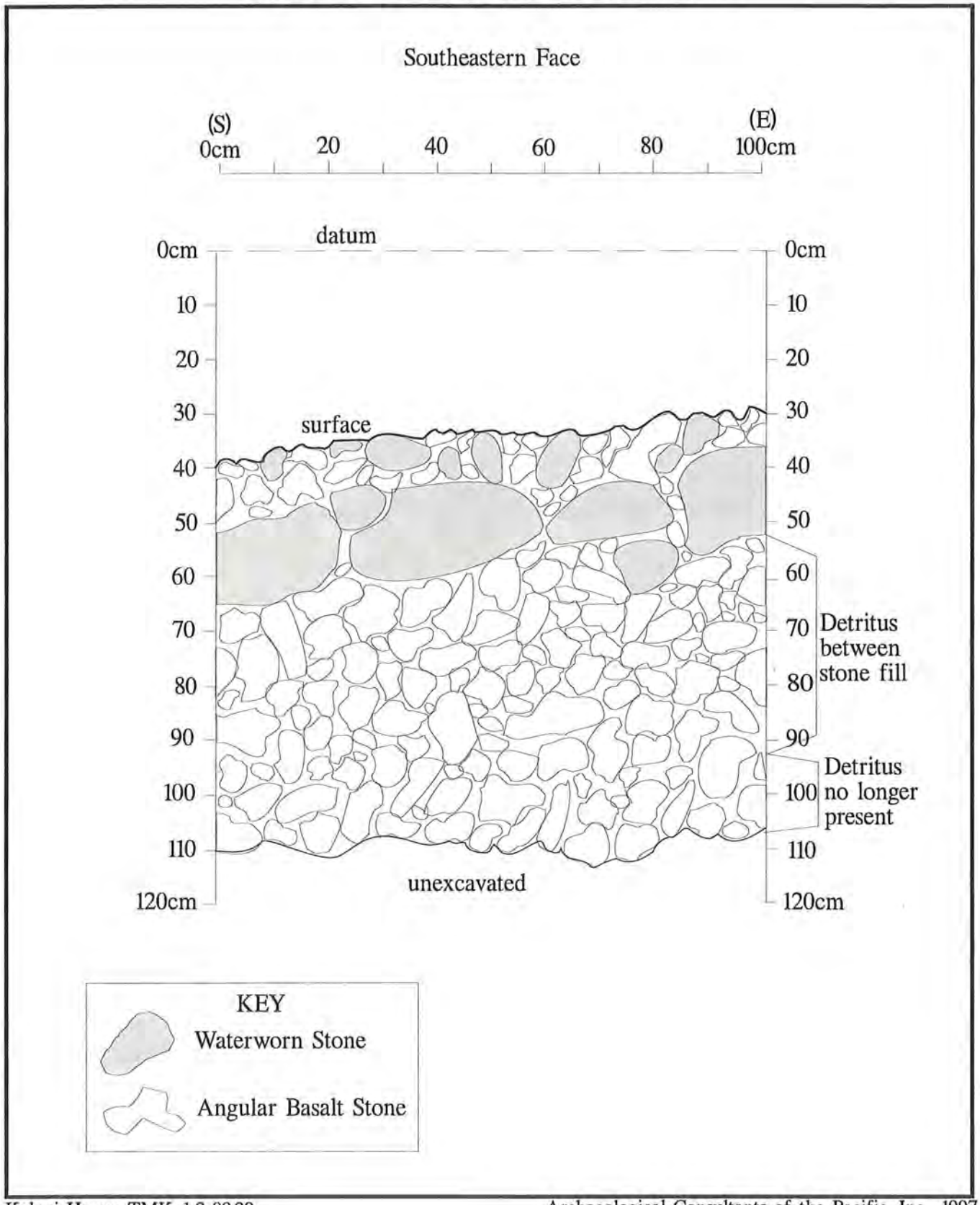
The terracing is located approximately 10 m *makai* of the southern corner of the platform (see Figures 4 & 12). It incorporates small, exposed outcrops of *pahoehoe* and is constructed out of waterworn basalt stones 50 to 80 cm in diameter. The terracing is constructed in two tiers, each of which is backed by thin layers of soil retained by 1 to 2 courses of stone which stand between 40 and 60 cm agl.

Kolb (1992:21) discusses 'terraced' *heiau* classes located on Maui. Kolb (1992:21) states, "In terms of architectural types, terraced *heiau* represent the least complex style because they always incorporate natural topographic features, such as bedrock outcrops." It is interesting to note the relationship between Site 21143 and terraced *heiau* discussed by Kolb (1992). Kolb further implies that similar classes of *heiau* represents the least complex of *heiau* design due to less complex overall design and limited numbers of component features. It is unknown whether this feature may have experienced multiple episodes of construction and/or fit within Kolb's category of combination *heiau* (Kolb 1992). There is some concern as to whether or not this feature truly resembles the class of terraced *heiau* discussed by Kolb. There has been few detailed studies of *heiau* in the Puna area. It is quite possible that *heiau* morphologies in Puna may be quite different from those noted in Kolb's study of Maui *heiau*.

Test Unit 1: A test unit was placed in the platform towards its northern (*mauka*) corner (see Figure 12 & 13). The unit measured 1 m by 1 m. A level datum was established on a nearby sapling, the corners of the unit were marked and their depths in centimeters below datum (cmbd) measured. Excavation proceeded by removing structural fill from the unit until reaching a depth at which detritus was identified in the spaces between the stones, about 55 cmbd (see Figure 13). This material was then sifted through nested one quarter in one eighth inch screens. After removing the structural fill and detrital material which continued to a depth of approximately 95 cmbd (measuring 40 cm thick), structural fill continued but detritus was no longer present. Excavation reached a maximum depth of 112 cmbd without encountering any stratigraphic soil deposits.

There was a small amount of cultural material recovered both *in situ* and from the sifted detrital material near the surface. This material was recovered from the upper 25 cm of the detrital deposit. Cultural material recovered included several small fragments of slate all weighing less than 0.5 g, one of which had apparently been modified in a traditional manner forming a small pick. In addition, a small rim fragment of ceramic missing the lip (relatively recent Chinese porcelain with a blue and white floral design on the inner surface) was recovered at a depth of 76 cmbd. Cultural material recovered from sifted detrital material consisted of a variety of marine shell remains, one small (<0.5 g) piece of echinoderm spine, a small amount (<0.5g) of charred floral material, and a cut strip of rubber (possibly bicycle tube). Marine shell midden included *opihi* (*Cellana* sp., <1.0 g), *pipipi* (*Nerita* sp., <0.5 g), *leho* (*Cypraea* sp., 2.0 g) and a small

Figure 13: Profile of Site 21143, Test Unit 1



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amount (<1.0g) of unidentified marine shell material. No additional cultural material was recovered.

Clearly, some of the remains are historic. However, most cultural remains were recovered from the upper 25 cm of the deposit and may have been relatively recently introduced to the site. It remains unknown whether or not this represents the initial construction episode of the site. Furthermore, many of these remains are indicative of habitation. It is possible that this site may have been subsequently utilized during a later episode as a habitation platform following a period of different use and perhaps abandonment. The Moa Heiau discussed by Ladefoged *et al.* (1987:58-59) demonstrate that features such as *heiau* were sometimes utilized for habitation platforms, but further note that secondary usage of sacred sites for residential or other non-sacred purposes likely occurred after the breaking of the *kapu* in 1819.

Site 21143 is currently believed to be the remains of a *heiau*. This is based upon the known distribution of archaeological sacred sites along the Puna coastline, the size and morphology of the structure, and the absence of substantial amounts of cultural materials recovered from subsurface testing.

Heiau are noted in many of the *ahupua'a* throughout Puna. However, no *heiau* have been recognized in Ke'eke'e Ahupua'a to date. If at least one *heiau* per *ahupua'a* can be expected, then this may lend support to classifying this feature as a *heiau*. Furthermore, the relatively exotic nature of the construction of this feature, which was constructed with waterworn beach stones, suggests that this feature was of a different class than all other features on the subject property. All other features identified on the subject property were generally constructed of locally available angular stones. Again, this may indicate a different or exotic quality which would add support to the current interpretation.

Ladefoged *et al.* (1987:20) reviewed 78 archaeological reports for studies conducted in the Puna region and determined that an, "...element of the coastal site clusters is the presence of at least one *heiau* or religious feature per settlement." Based upon the accounts of Ellis as he traveled around the Big Island, we know that a coastal settlement was present in the Kamaili area. This information is corroborated by the presence of a complex of features identified near the coast just east of the southeastern corner of the current subject property which likely represent residential features (Site 2536, Bevacqua & Dye 1972). In addition, historic accounts refer to a 'Kamaili School'. Although it is not depicted on any known maps, the owners of Kalani Honua claim that the site is located at the *makai* end of their property, adjacent to the 'Old Red Road'. This information indicates that there was a coastal community in the vicinity of Kamaili which likely dated from the pre-Contact period and lasted into the historic period. Therefore, it is also likely that a religious feature would have been present in this vicinity.

Ladefoged *et al.* discuss a hierarchy of *heiau* classification based upon the work of Valeri (1987:54). They group *heiau* identified during their survey into classes based

upon the structures' overall sizes. For their study, Luakini *heiau* were those whose area was greater than 900 square meters, Lono *heiau* varied between 100 and 350 square meters in size, and other religious features measured smaller than 100 square meters (Ladefoged *et al.* 1987:55, Figure 14).

Site 21143 measures approximately 700 m^2 (this measurement incorporates the area including the wall and terrace as well as the platform) in total size placing it below the size range of Luakini *heiau* and above the size range of Lono *heiau*. In addition, the platform itself measures approximately 94 square meters in size which is larger than typical habitation platforms.

Another morphological characteristic used to classify possible Lono class *heiau* is that they, "lack a surrounding enclosure, a criterion often used to distinguish Luakini *heiau* (Ladefoged *et al.* 1987:58). This characteristic is shared by Site 21143.

Lono class *heiau* are also associated with, among other things, agriculture. As the subject area appears to have once been a rather intensively cultivated and agriculturally productive area based on the numerous agricultural features present and the ethnographic accounts (see discussions above and below), interpretations of Site 21143 as being a Lono class *heiau* are supported by the 'intensive agricultural' context in which it resides.

Finally, it is apparent that Site 21143 was utilized sometime during more recent historic times. This is supported by the presence of the historic midden (e.g., Chinese porcelain and rubber). One possible interpretation, is that Site 21143 may have been utilized as a habitation platform sometime during the historic period after its abandonment as a religious structure. This has been known to occur elsewhere in the Hawaiian Islands (Ladefoge *et al.* 1987).

There is always the possibility that this site was only a habitation platform. However, no other habitation platforms were located in the vicinity or on neighboring properties which resembled Site 21143. Furthermore, the nearby residential structures described by Bevecqua and Dye (1972) did not appear to incorporate the same constructional quality. Finally, the historic cemetery (Site 2539) containing several platform features were all constructed of *a'a*. Undoubtedly, the cemetery is a sacred site as well, but was constructed using a locally available material. The large waterworn beach pebbles and boulders which were utilized for the construction of Site 21143 suggests that additional effort was undertaken to obtain a less easily procured construction material. This may indicate that Site 21143 may have been considerably more 'sacred' or valuable than less sacred sites and features constructed of more easily procured materials.

Cemetery: Site 2539

The cemetery site (Site 2359) was previously identified during the Kapoho-Kalapana Highway archaeological reconnaissance survey (Bevacqua & Dye 1972). The

cemetery is located approximately 100 m *mauka* of the Kehena Beach Trail sign which is on the *makai* side of the existing highway (see Figure 4). The cemetery is further located on the southwestern portion of the subject property between 300-600 ft from the coastline and approximately 75-200 ft from the western border of the subject property on the A.D. 1790 lava flow. The lava flow at this location is entirely composed of undulating black *a'a* boulders, cobbles and pebbles. This lava flow has formed a bluff where the cemetery is located which provides a rather commanding view of the coastal area below. Elevation is approximately 80-110 ft amsl. Vegetation is almost entirely composed of scattered *'ohi'a* trees and ferns.

All features in this site would necessarily have to have been constructed following the A.D. 1790 lava flow which clearly places them within an historic age. However, there appears to be no mention of a formal name in historic documents other than its registration by the Kanahele family (Marc Smith, pers. comm.), nor is the cemetery located on early maps of the Puna area. This may suggest that the cemetery remained unknown to early surveyors or that the cemetery was constructed in more recent times. No formal name is given to the cemetery in the 1972 survey. Recent offerings of flowers and *lei* were noted on some of the features.

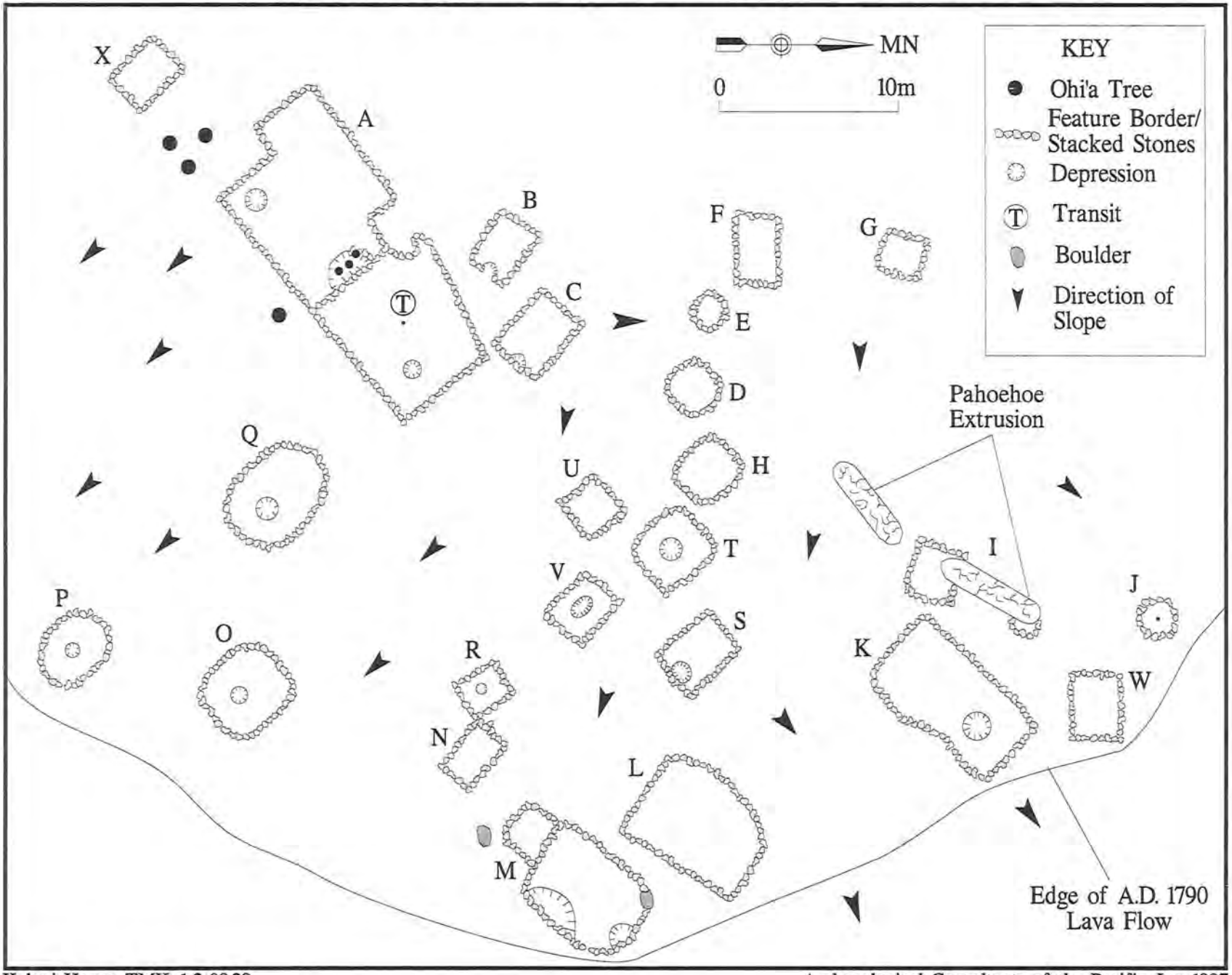
During the 1972 survey, 23 features thought to represent burial structures were identified. However, these were not mapped in detail nor described individually. Bevacqua and Dye (1972:21) suggested that several of these features were, "large enough for the interment of more than one individual."

During the course of current investigations, 24 features were identified (see Figure 14). It is likely that these are the same 23 features previously identified including one additional feature which was not previously identified. Although each feature was not confirmed to be burial feature containing human skeletal remains, it is highly likely that all of these features are indeed burial features based on positive identification of a few burials within some of the exposed/collapsed features and the general morphology of all features. Feature morphology conforms to design and variation within similar burial features throughout this region.

Marc Smith in consultation with the Kanahele family have further identified additional features consisting of non-platform burials and pavings. However, at the request of the Kanahele family, no further work was conducted on the site. The following descriptions cover features identified during the current survey.

All of the features are roughly rectangular in design, although some appear more oval than others. Thirteen of the features have depressions on the surface which are characteristic of burial platforms and mounds (usually collapsed inwards due to an internal cavity where a burial had been placed). All features generally fall into two morphological classes at a cursory level. These are platforms with a relatively level surface, and mounds (or mound-like platforms) with a relatively convex upper surface and no apparent facings. Two of the features have a more complex design (see below).

Figure 14: Top Plan of Site 2539 (Cemetary) -- Features A to X



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The construction of all features appear to be similar. Features were constructed with *a'a* boulders, cobbles and pebbles. The perimeters and facings of all features were built with larger cobbles and boulders. Facings were vertical or slumped. Slumping may have resulted from deterioration, although some features (e.g., mounds) may have been intentionally constructed with sloping faces. All features were subsequently constructed with smaller *a'a* fill within the borders. Fill was predominantly pebble-sized and smaller. Feature height varied considerably. As many of the features were constructed on sloping terrain, *makai* facings were generally higher above ground level than *mauka* facings. In some instances, the *mauka* border was merely an alignment of cobbles which was level with the ground surface. All features were constructed such that the *makai* facings were parallel to and faced the coastal area.

Below is a brief description of each feature. A future Burial Treatment Plan will need to be devised prior to any future activities planned for this area. This plan will need to accord with current local, State and Federal policy.

2539A:

2539A is a complex notched rectangular platform with two depressions (see Figure 14). Facings/borders were constructed with *a'a* boulders approximately 15-40 cm in diameter and filled with *a'a* pebbles approximately 5-10 cm in diameter. The facings/borders and fill designs of all other features are virtually identical and will not be repeated in the following descriptions unless there is an exception.

2539A may have been two separate large platforms which share a common border. This may represent two separate construction episodes. This conclusion is supported by the existence of an alignment of larger boulders and pebbles which bisects the platform at the mid-section.

Maximum platform dimensions are approximately 18 m in length (running 230° MN) and approximately 8 m wide. The *makai* facing is approximately 95 cm agl (centimeters above ground level). The *mauka* facing is approximately 85 cm agl while the eastern side facing is the highest at approximately 127 cm agl. The top surface of the platform is level. Facings on the southwestern section of the platform are less well constructed, possibly more deteriorated, and range from 10-90 cm agl.

There is a notch on the southwestern corner which measures approximately four by two meters. Approximately one meter in from this corner is a small circular depression on the platform which has a diameter of approximately 1.5 m. A second notch is located at the mid-section of the platform on the *mauka* side. This notch is roughly square in shape and measures approximately two by two meters, although there is a small indentation extending into the platform on the eastern border of this notch which gives it a rather enigmatic shape from the plan view. A second surface depression is located at the southeastern corner of the platform approximately 1.5 m from the *makai* facing. This depression has a diameter of approximately 1.4 m. The transit mark point (T) is located

approximately three meters directly west from this depression. In the mid-section of the platform, adjacent to the bisecting alignment, is a semi-circular arrangement of boulders and cobbles in which two medium sized *'ohi'a* trees are growing. The area surrounding 2539A for approximately two meters from all facings appears to relatively level and constructed with small fill.

2539B:

2539B is a low rectangular platform. 2539B is located just *mauka* of 2539A (see Figure 14). The mid-point of 2539B is located 4.3 m (321°) from transit point T. Maximum dimensions are 3.4 m in length and 2.4 m in width. Facings range from 50-75 cm agl. Some facings are deteriorated or were not well constructed in some locations. The top of the platform is somewhat convex which gives the feature a mound-like appearance. A depression on the surface is located at the mid-section of the *makai* border. The depression is square to oval in shape and measures approximately 75 by 100 cm. Facings/borders have been constructed with larger *a'a* boulders and cobbles while the fill is composed of smaller *a'a* pebbles and cobbles.

2539C:

2539C is a low rectangular platform (see Figure 14). It is located less than one meter from the northeastern corner of 2539A. The mid-point of 2539C is located 5.0 m (21°) from transit point T. Maximum dimensions are 4.0 by 3.0 m while the highest facing is 70 cm agl. Facings are deteriorated or were not well constructed in some locations. 2539C has a virtually identical construction plan compared to 2539B although the upper surface is more level. A similar surface depression located at the mid-section of the *makai* facing is also present.

2539D:

2539D is a small, low, oval mound (see Figure 14). The midpoint is located 16.3 m (16°) from transit point T. There are no definite alignments or facings. The condition is rather deteriorated or the original construction was not as well formed as some of the other features. Maximum diameter is approximately 3.0 m. Height ranges from 20-50 cm agl. The highest border faces *makai*.

2539E:

2539E is a small, low, square platform (see Figure 14). The midpoint is located 16.5 m (0°) from transit point T. The maximum dimensions are approximately 2.0 by 2.0 m with the highest facing approximately 30 cm agl located on the *makai* side. The condition is somewhat deteriorated or the original construction was not as well formed as some of the other features. The top surface is somewhat convex rather than level.

2539F:

2539F is a low, rectangular platform (see Figure 14). The midpoint is located approximately 19.5 m (350°) from transit point T. The orientation is variant from all other features, except 2539W (TF 122), and runs almost exactly north-south and east-west. The east-west length is approximately 4.0 m while the north-south width measures approximately 2.4 m. The facings are in good condition with a maximum height of 80 cm agl.

2539G:

2539G is a low, square to oval shaped, mound (see Figure 14). The midpoint is located approximately 27.4 m (353°) from transit point T. Maximum dimensions are approximately 3.0 by 3.0 m and approximately 85 cm high. There is no definitive shape or facings. If there were facings in the past, they have been severely deteriorated. Overall condition is fairly deteriorated.

2539H:

2539H is a small, square-like platform (see Figure 14). The midpoint is located approximately 18.8 m (29°) from transit point T. The maximum dimensions are 3.0 by 3.5 m. The highest facing is located on the southwestern side and is approximately 1.4 m high. The overall condition appears to be fairly deteriorated and facing heights range considerably.

2539I:

2539I is a small oblong platform built around part of a lengthy natural extrusion of *pahoehoe* lava (see Figure 14). The midpoint is located approximately 33.0 m (26°) from transit point T. This feature is roughly square with maximum dimensions of 4.0 by 3.7 m. The *pahoehoe* extrusion is located in the middle of the feature and extends northeast. At the far end of this extrusion, an additional small alignment with *a'a* fill has been constructed. This section is also considered to be a section of 2539I. Facings range from 50-75 cm agl.

2539J:

2539J is a small deteriorated platform (see Figure 14). The midpoint is located 45.0 m (20.5°) from transit point T. The maximum dimensions are approximately 2.0 by 2.0 m while height ranges from 20-50 cm agl. This feature has no definitive shape as it appears to be fairly deteriorated. It is likely that facings were more perpendicular in the past though they are slumped at present.

2539K:

2529K is a rectangular platform with a circular depression (see Figure 14). The midpoint is located 37.0 m (36°) from transit point T. The maximum dimensions are 8.8 m in length (the *makai* facing) and 4.5 m in width. Height ranges from 45-75 cm agl with the highest facing on the *makai* face. The far western corner is less than 1.0 m from 2539I. The midpoint of the depression is located approximately 3.0 m from the midpoint of the northeastern side. The depression is 1.0-1.5 m in diameter. The depression appears to be an opening to a small collapsed cavity. The surface of the platform is relatively level.

2539L:

2539L is a well constructed rectangular platform (see Figure 14). The midpoint is located 32.6 m (61.5°) from transit point T. Maximum dimension are 7.5 by 5.0 m. Facings range from 60-100 cm agl with the highest facing on the *makai* side. The *mauka* side is convex from the plan view and bows in to its narrowest width on the northeastern side. There is a 1.5 m gap between 2539L and 2539M. The surrounding area appears to have a small pebble fill for approximately 1.0-2.0 m around the perimeter. The overall condition appears to be relatively well preserved and seems to have not suffered the deterioration typical of many other features located in this site.

2539M:

2539M is a complex dual-leveled platform with two possible depressions (these may be slumped facings rather than true depressions)(see Figure 14). The midpoint is located approximately 34.0 m (73.5°) from transit point T. Unlike 2530A (TF 100), 2539M (TF 112) appears to be an articulated single construction dual leveled feature. It is possible that the smaller side platform was added after the construction of the main platform, although the construction pattern suggests that this smaller side platform was manufactured to articulate with the construction of the main platform.

Both platforms are fairly level. The main platform is 6.7 by 4.2 m. The plan shape is trapezoidal with a shorter length along the *makai* facing (approximately 4.5 m in length). The maximum facing height ranges from 110-150 cm agl along the *makai* facing. Although this may appear to be relatively high, it should be noted that the topography in front of the *makai* side of the platform drops dramatically in elevation and the slope is fairly steep.

A smaller rectangular side platform is located on the southwestern side. This smaller side platform is approximately 35 cm below the upper platform surface of the larger platform. The dimensions of the smaller platform are 2.0 by 2.7 m. The ground area on this half of the platform appears to be filled with small pebbles for 1.0-2.0 m around the circumference. A rather large boulder is located about one meter from the

southwestern corner of the smaller platform. The northern corner of the larger platform also contains a relatively large boulder (located on the *mauka* side).

Two depressions are evident. The first is located at the midpoint of the larger platform on the *makai* facing. However, this may be a slumped deteriorated facing in which the slumping extends well into the platform. The second depression is located along the midpoint of the northeastern border of the larger platform. This depression may also be the result of slumping and deterioration. The upper surfaces of both the main and the side platforms are relatively level.

2539N:

2539N is a small rectangular platform (see Figure 14). The midpoint is located 25.3 m (81.5°) from transit point T. The maximum dimensions are 3.3 m in length (running *mauka-makai*) and 2.1 m in width. Facings range from 50-70 cm agl with the highest facing on the *makai* side. The overall condition of the platform is good. There is little evidence of deterioration or slumping.

2539O:

2539O is a rectangular to oval burial platform with a central opening into a burial chamber (see Figure 14). The midpoint is located 23.0 m (113°) from transit point T. The maximum dimensions are 5.0 by 4.4 m with a maximum height of 1.1 m agl. The only true facing is on the *mauka* side which is 80 cm agl. The upper surface is convex which gives this feature a mound-like appearance. The opening is approximately 1.0 m in diameter.

The interior was only briefly inspected with a flashlight through the exposed opening. Human skeletal remains were identified in the inner chamber. Only a few long-bone fragments were identified. There was no apparent burial orientation of the remains. The inner chamber did not appear to be a formally constructed crypt, but rather a modified lava blister or bubble. Further investigation was not attempted and the opening was immediately closed.

2539P:

2539P is an oval burial platform with a central opening covered with wooden planks (see Figure 14). The midpoint is located 26.6 m (135°) from transit point T. The maximum diameter is approximately 4.1 m with a maximum height of 75 cm agl. The minimum diameter is 3.7 m. The only facing is located on the *makai* side and is fairly slumped. The upper surface is convex which gives the feature a mound-like appearance. The overall condition is somewhat deteriorated. The central opening is collapsed and sealed. The similarity in construction with 2539Q and 2539O coupled with the use of wooden planks to further seal the opening strongly suggests that this feature contains a human burial.

2539Q:

2539Q is an oval burial platform with a central opening to a burial chamber (see Figure 14). Human remains were positively identified in a central burial chamber. The midpoint is located 13.0 m (125°) from transit point T. The maximum diameter is approximately 6.3 m while the minimum diameter is approximately 4.4 m.

The *makai* facing slopes considerably but is approximately 175 cm agl. The *mauka* facing is more perpendicular and is approximately 60 cm agl. Larger blocks of *a'a* cobbles were used to construct the facings and borders while the central area was constructed of smaller pebbles, cobbles, coral and fill. The upper surface of the platform is convex which gives the feature a mound-like appearance. The overall condition is slightly deteriorated. The surrounding area around the platform is constructed of small pebble fill.

A central depression with an opening into an internal chamber is located 0.6 m from the *mauka* border. Deteriorated wooden planks were scattered over the top of the mound, apparently intended to seal the opening at one time. From ten to twenty gray coral blocks are scattered over the top of the mound. The concentration of coral is greater around the perimeter of the opening. The presence of coral suggests that this burial feature may have been associated with an individual(s) of different status of wealth in comparison to the other features which did not contain coral.

As the interior of the burial chamber was partially exposed through the small opening, a brief observation of the contents of the chamber was made before the wooden planks were arranged so as to reseal the opening. Although limited light was available, a positive identification of a few scattered human long bones was made. The remains are not positioned in any readily identifiable pattern. Hanging on the interior *mauka* wall is a metal chain with a crucifix and a ring attached to it. This suggests that the burial was a Christian (Roman-Catholic) post-Contact burial. No other burial goods were identified, although more may be present. Again, it is reiterated that only a brief observation was made with limited light.

Fairly recent offerings in the form of flowers and *lei* (fairly desiccated at the time of survey) are located on top of the platform. This suggests that one or more individuals may periodically frequent this cemetery to pay respects. However, when questioned as to whether there was any additional information concerning the cemetery and/or specific burial features, local employees at the Kalani Honua Resort and Conference Center had no additional information to offer. Additional information should be collected in a future Burial Treatment Plan which will need to be devised. More will be discussed on this in the following report.

2539R:

2539R is a square platform with a central depression (see Figure 14). The midpoint is located 22.5 m (80.0°) from transit point T. The eastern corner of the platform almost connects with the western corner of 2539N. The maximum dimensions of 2539R are 2.8 m in length (running *mauka-makai*) and 2.5 m in width. Facings range from 30-40 cm agl. A small central depression is located at the midpoint of the platform. The maximum diameter of the depression is approximately 75 cm. The overall condition is slightly deteriorated.

2539S:

2539S is a rectangular platform with a depression located at the *makai* border (see Figure 14). The midpoiny is located 25.6 m (50.0°) from transit point T. The maximum dimensions are 3.8 m in length (running *mauka-makai*) and 3.0 m in width. A square depression lined with larger *a'a* cobbles is located at the midpoint along the *makai* facing. This is also the highest facing which measures 50 cm agl. The depression dimensions are approximately 1.2 X 0.9 m. The overall condition of the platform is moderately deteriorated.

2539T:

2539T is an oval platform with a central depression (see Figure 14). The midpoint is located 19.7 m (42.0°) from transit point T. The maximum dimensions are 3.8 X 4.2 m. The facings are fairly slumped while the upper platform surface is convex giving the feature a mound-like appearance. The highest facing is located on the *makai* border and is approximately 85 cm agl. A central circular depression is located at the midpoint of the feature. The maximum diameter of the depression is approximately 1.2 m. The overall condition is moderately deteriorated.

2539U:

2539U is a low square platform (see Figure 14). The midpoint is located 15.0 m (47.5°) from transit point T. The maximum dimensions are 2.5 m in width and 2.7 m in width. The only true facings are located along the *mauka* and the *makai* borders and measure approximately 25-30 cm agl. The overall condition of TF 120 is fairly deteriorated.

2539V:

2539V is a rectangular platform with a central depression (see Figure 14). The midpoint is located 19.1 m (61.0°) from transit point T. The maximum dimensions 3.4 m in length (running *mauka-makai*) and 2.7 m in width. The *makai* facing is approximately 70 cm agl. The southwestern facing ranges from 20-50 cm agl. The *mauka* facing ranges from 10-20 cm agl. The northeastern facing appears to be a surface alignment of larger

a'a cobbles and only reaches a height of 5-10 cm agl. The depression is located at the midpoint of the feature and has a maximum diameter of 1.6 m. The overall condition is slightly deteriorated.

2539W:

2539W is a rectangular platform (see Figure 14). The midpoint is located 44.0 m (30.0°) from transit point T. Like 2539F, the orientation of 2539W runs almost exactly north-south by east west. The east-west length is approximately 3.9 m while the north-south length measures 2.6 m. Facings range from 50-60 cm agl. The overall condition is slightly deteriorated.

2539X:

2539X is a rectangular platform with a central depression (see Figure 14). The midpoint is located 20.0 m (221.0°) from transit point T. The maximum length measures 3.6 m (running *mauka-makai*) while the maximum width measures 2.4 m. Only the *mauka* and northeast facings are in decent condition and reach a maximum height of 65 cm agl. The depression is located at the midpoint of the feature and reaches a maximum diameter of 1.1 m. The southwest side appears to be relatively heavily deteriorated and the overall condition is fairly deteriorated.

Section 8: Discussion

A large number of site and feature classes were identified on the subject property. These include a number of features related to the agricultural complex (Site 21139), a probable *heiau* (Site 21143), an historic cemetery (Site 2539), numerous walls (which may be part of large agricultural complex and/or may be boundary walls), enclosures and walls similar to historic features (Sites 21140-21142), C-Shape structures and terrace(s) (one of which may have been an agricultural and a temporary habitation feature), mounds, pits, walkways and manuports. As demonstrated by the more detailed representative sample of three transects, there are literally hundreds and perhaps thousands of articulated archaeological features which are part of the 21139 agricultural complex. This supports the interpretation that the subject area was once articulated with an intensified agricultural complex.

Most of the features on the subject property functionally and temporally articulate with the 21139 agricultural complex. The temporal context of the agricultural complex remains unknown, although it is suggested that it is likely early historic and/or prehistoric. However, the temporal context of the 21139 agricultural complex likely does not fall into a single event or episode, but rather was a processual development over some time; perhaps decades, generations and centuries of development. More will be discussed on the genesis and demise of the agricultural complex below.

The most numerous agricultural features present were mounds and pits. These were likely utilized for cultivating a variety of products, although dominated by sweet potato and taro. Historic accounts (see above) support the interpretation that some resources were cultivated in the mounds while taro was cultivated in the pits by a unique mulching and 'firing' or burning practice.

The practice of cultivating taro may have followed a multi-step process which included; 1) clearing a depression or pit, 2) mulching the depression or pit, 3) planting taro, 4) subsequently cutting the taro stalks, 5) 'firing' or burning the area, 6) allowing the taro to further develop, and 7) harvesting the taro. This is significantly unique when compared to slash and burn cultivation in which plots are generally 1) cleared, 2) fired, 3) planted, and 4) harvested. This unique practice may have allowed an area of limited soil deposits to be intensively cultivated, the area to be intensively cultivated over a long duration of time, and contributed to increasing the quantity and quality of the product. However, this agricultural practice was perhaps significantly more labor intensive than cultivating sweet potato.

Informally manufactured mounds that were perhaps minimally mulched, were an adequate growing medium to produce desirable sweet potatoes. Many of the mounds on the subject property may have been utilized in this manner. Some of these mounds may have resulted from clearing activities. By comparison to taro production, this agricultural practice was likely less labor intensive. The vast quantity of mounds indicate that large yields may have been important.

There are indications that agricultural terracing and modifications to gullies, depressions and outcrops played a significant role in agricultural production. These features likely had been created to take advantage of naturally occurring topographic features. The purpose may have been to channel water, and retain moisture and soil needed for cultivating certain plant species. It is also possible that many of these classes of features, like the mounds, merely resulted from clearing activities.

Informally constructed low walls are numerous on the subject property. From the sample transects alone, over 2.3 kilometers of walls were noted. Some of these appear to adhere to specific patterns. However, most of the walls seem somewhat haphazardly dispersed. It is possible that some of these walls were boundary walls demarcating specific plots. However, it is likely that many of these walls were functionally similar to the mounds in that they provided adequate growing mediums for cultivation. It is also possible that many of the walls are related to water channeling and soil retention practices. Also, as with the other informal features, it is likely that some of the walls may have resulted from clearing activities. Finally, some of these walls may have been deteriorated walkways.

No enclosures relating to the agricultural complex yielded information that verified they were related to animal husbandry practices, although the current deteriorated condition of these features precludes indisputable conclusions. This may indicate that animal husbandry was, 1) not an important feature of the agricultural complex, 2) was generally practiced elsewhere, 3) or was not characterized by formal features such as pens or walled off gardens to prevent loss due from animal foraging. If the latter is the case, perhaps more informal animal husbandry practices were typical of the area.

By contrast, the enclosures thought to be historic may have been related to animal husbandry. The walls defining these enclosures are similar in construction to walls known to relate to animal husbandry (e.g., cattle ranching)(Yent & Ota 1982, see also Bevaqua & Dye 1972). Furthermore, these enclosures form 'pen'-like features. However, these features may have prevented the entry of animals, thus serving to protect garden areas rather than containing livestock. Finally, the limited amount of these features may reflect the limited development and use of the area for these activities during the historic period.

There is an historic cemetery (Site 2539) composed of 24 platforms (and/or mounds) located on the subject property which rests on top of the A.D. 1790 lava flow. The fact that it is built on the 1790 lava flow clearly indicates that the cemetery was not constructed prior to this date. However, the general paucity of information concerning the cemetery, suggests that its construction may be of significant antiquity. Additional features may exist in the cemetery boundaries, but it has been requested that no additional archaeological work be conducted at this site.

Of particular interest, is the possible *heiau* (perhaps a Lono 'class' *heiau*) that was identified. The Lono class of *heiau* is often associated with creation, production, fertility,

agricultural production, etc.. In a sense, this class of *heiau* would be expected in an area of intensified agriculture. The context of production and fertility correlate rather well between the agricultural system and this class of *heiau*. The *heiau* itself can even be viewed as a symbol for the local inhabitants, or a ceremonial/religious feature, representing and connected to the agricultural system. It may have acted as a semiotic and spiritual connection to the ethereal forces which would have aided in the success of the agricultural production. The probable *heiau* and the field system may have both been material manifestations of productive potential or productive agricultural potential. The agricultural features were the locations at which physical energies were transformed into very real agricultural products. At a different level, the *heiau* was a location where spiritual energies were transformed into these products. The religious/ceremonial aspects of the *heiau* may have also aided to consolidate the labor and unify the community in order to tap into the potential productivity of the area. Although these two distinct material sites (the probable *heiau* and the agricultural complex) can be interpreted in a variety of ways, it seems apparent that they may have been inter-connected.

An additional aspect concerning the probable *heiau*, was the presence of historical remains in the test unit. This may indicate that the probable *heiau* was utilized for a different purpose in the historic period after its abandonment as a religious site. The probable *heiau* may have been utilized as some form of habitation site.

One of the most noteworthy aspects of the investigation, was the correlation between different zones of vegetation and the distribution of feature types on the subject property. The manufacture of certain agricultural feature types may have been, at least in part, a response to specific geologic/floral zones. Furthermore, the floral community (ecological community) replacing the area after abandonment, may be dependent on the previous geologic/floral zone and the resulting modifications to the area following its intensified agricultural use. Subsequently, it may be possible to predict the distribution of feature types by examining the current geologic/floral zone distribution in the Lower Puna region. If these correlation's are consistently verified through additional research, it may prove to be a useful predictive tool. Furthermore, this approach, used at a larger scale, may be refined to more accurately predict more distributions.

The communities of vegetation on the subject property vary based upon the geological or geo-morphological surface on which they are growing. Within these zones of vegetation, the distribution of cultural feature types also varies. On the subject property, there appears to be a direct correlation between the vegetative zone and the distribution of cultural features. There is some overlap in zonation and distributions are not necessarily clearly and exclusively bounded. However, we have used the term 'zone' and discuss the variation and patterns to highlight some general trends which may be useful for future research.

A'a/Hala Zone-This type of geologic/floral zone contains a surface cover of undulating *a'a*. Vegetation on the *a'a* surface is dominated by groves of *hala*. Beneath the *pu hala*, most of the ground is covered with several layers of fallen leaves (*lau hala*) although in

some spots a ground cover of ferns and vines exists. In addition, in some areas, occasional coconut trees or groups of several coconut trees occur within the *hala* grove. In places, *hala* has spread beyond the edge of the *a'a* into adjacent zones. In other places, strawberry guava has intruded into the *a'a* from adjacent zones. However, this transitional area was generally less than 10m in width.

There are two sections of the subject property that are representative of this zone type. Along the eastern border of the subject property lies a section measuring between 30 and 100 m wide and at least 500 m long (see Figures 3 & 5). This section is believed to be a portion of the lava flow which dates to between 440 and 490 +/- 60 B.P.. The second section of this type of zone exists along the western boundary of the property forming a strip approximately 400 m long and between 30 to 120 m in width. This section is located at the base of the A.D. 1790 lava flow and is believed to be the remaining exposed section of the lava flow dated to between 750 and 1500 B.P.. This section was distinguish from the *A'a/Hala Zone* located along the eastern side of the property in that there were a greater number and variety of trees and secondary growth scattered among the stands of *hala*.

Cultural features within the *A'a/Hala Zone* consist predominantly of pits, although several mounds and walls were encountered within this zone as well as the transitional area between this zone and adjacent zones. One unique individual feature, the probable *heiau* (Site 21143), was also identified within this zone.

Mixed Pahoehoe and A'a/Strawberry Guava Zone-This type of geologic/floral zone contains an undulating surface cover of mixed *pahoehoe* and *a'a*. This zone of mixed surface cover is believed to fit within Lipman and Banks' 'transitional lava' class of lava flows (1987). Vegetation on the mixed surfaces is dominated by strawberry guava which grow tall and thin reaching a height of about 10 m and a diameter of just a few centimeters. These trees can grow extremely close to one another and, in some places, form thickets in which trees are only centimeters apart. In other sections of this zone the density of the strawberry guava trees is less thick and occasional larger trees such as mango, *milo* and banyan are found. Ground cover between and within the thickets of strawberry guava consists of a variety of ferns, vines and small flowering plants.

This zone extends the entire *mauka-makai* length of the property covering the eastern half of the parcel with the exception of the strip of *A'a/Hala* on the property line (see Figure 5). This section measures approximately 700 m in length and between 100 and 200 m in width. This section is believed to be a portion of the lava flow which dates to between 440 and 490 +/- 60 B.P.

Cultural features within the *Mixed Pahoehoe and A'a/Strawberry Guava Zone* consist predominantly of mounds with occasional pits, alignments and wall segments. Two relatively large enclosures (Sites 21140 & 21141) which are thought to date from the historic period are located in the *makai* section of this zone.

Pahoehoe Outcrop/Dispersed Strawberry Guava Zone-This type of geologic/floral zone contains an undulating surface of *pahoehoe* blisters and outcrops. This area appears to be entirely composed of *pahoehoe* with no exposed portions of *a'a* evident. Vegetation within this zone is still dominated by strawberry guava although its density in this zone never approaches that of the *Mixed Pahoehoe and A'a/Strawberry Guava Zone*. In addition, the occurrence of larger trees such as monkey pod, mango, banyan, *milo* and *noni* becomes more frequent. Ground cover remains similar to that of the *Mixed Pahoehoe and A'a/Strawberry Guava Zone.*

This *Pahoehoe Outcrop/Dispersed Strawberry Guava Zone* extends the entire *mauka-makai* length of the property covering a large portion of the western half of the parcel except the areas covered by the flow of A.D. 1790 and the flow dated to between 750 and 1500 B.P. (see Figure 5). The zone measures approximately 700 m in length and between 200 and 400 m in width. This section is believed to be a portion of the lava flow which dates to between 440 and 490 +/- 60 B.P.

Cultural features within the *Pahoehoe Outcrop/Dispersed Strawberry Guava Zone* consist predominantly of modified outcrops with occasional mounds, pits, wall segments and modified depressions/gullies.

A'a/Ohia Zone-This type of geologic/floral zone contains a surface cover of undulating *a'a*. Vegetation on the *a'a* surface is sparse consisting of single *'ohi'a-lehua* scattered at intervals of 10 m or more. Ground cover consists of small clumps of lichen and ferns clinging to the broken stones in the exposed sun.

This zone extends the entire *mauka-makai* length of the property along its western boundary (see Figure 5). This zone is on the A.D. 1790 lava flow which extends off the subject property both to the west and *mauka*.

Only one site was located in this zone on the subject property, the cemetery (Site 2539). Because the lava flow is known to have occurred in A.D. 1790, this site is known to be historic. No features which could be attributed to the adjacent agricultural complex (Site 21139) were located within this zone.

For the property in whole, between most of the zones described above there is a transitional zone which measures from 5 to 15 m wide and contains a mixture of the flora described within the adjacent zones. This is not the case, though, for the boundary between the A.D. 1790 lava flow and the lava flows covering the remainder of the property. At this interface there is a distinct transition in the flora as well as a vertical wall of rock approximately 5 to 7 m in height. As with the distribution of flora, between the zones identified the distribution of cultural features tends to form transitional bands rather than having a distinct boundary.

In summary, the distribution of cultural features clearly follows patterns in geology and floral communities. In essence, ecological communities, geological

formations (geo-morphological formations), and environmental factors are to a high degree responsible for certain areas to be selected for certain activities and site formation. Subsequently, specific ecological communities may replace these areas over time in a consistent pattern after sites fall into disuse or are abandoned. Therefore, it should be possible to predict the types of cultural features likely to be encountered in an area based upon the floral communities occupying that area. This hypothesis would provide a valid basis for formulating interesting research questions for further study in the coastal Puna region as well as other areas within the Hawaiian archipelago. Furthermore, from an ecological and evolutionary perspective, additional hypotheses could be formulated (e.g., if it takes X amount of years for a specific ecological community to develop to a specific composition given certain conditions, how long would a once agriculturally utilized area have been abandoned or fallen into disuse in order for a specific floral community to have developed?).

As mentioned previously, the development of the agricultural complex (Site 21139) did not likely occur as a single event. Its development likely occurred over several generations. Thus, a single articulated system was not likely originally planned. Features may have been modified, re-utilized in various ways, and reconstructed over time. Sets of features may have been re-articulated and re-engineered over time as well. However, what resulted was a complex mosaic of agricultural features which formed the agricultural complex.

This agricultural complex which may have further articulated with a larger 'field system' clearly indicates that intensified agriculture was important to the inhabitants. Based on the number of features and the complexity at which the subject property was utilized, it is also evident that this area may have had the potential for massive production and large quantity yields. Some features may indicate that even less productive areas were significantly developed as well (e.g., the terracing).

What would drive the need for such massive production of agricultural products? Was the local population at a density such that large quantities of food were in demand? This may be a factor. However, early historic accounts do not describe a massive population. Instead, it seems that the Puna area was rather sparsely populated at the time of western contact, although Puna may have appeared to be sparsely populated as it may have been an infrequently visited area.

Were there outside demands for Lower Puna agricultural products (e.g., by chiefs and inhabitants in Kona)? There are some indications that the Kona chiefs periodically influenced the South Hilo and Puna populations. In fact, during the late 1700's, Kona had tremendous influence to the point of almost total control over the Puna region. Non-local forces may have even utilized Puna as an agricultural resource zone through trade, influence and/or force. It remains to be determined whether this was done to feed a large non-local population, to feed the 'conspicuous consumption' noted for many Kona chiefs, to compensate for the lack of agricultural potential in some non-local regions, to trade for resources not available in the local region, etc.. It could even be hypothesized that Puna

agricultural products had achieved an elite or luxury status based on the quality which placed these products in high demand elsewhere. It was noted in some historical accounts that some of the agricultural products from Puna were among the highest quality. Some of these questions may be difficult to research, but nevertheless, are interesting issues to pursue.

Likewise, the demise of the agricultural complex is also intriguing. A number of factors may be responsible for the abandonment of intensive agricultural production. Population decreases may have been a significant contributing factor. It is known that epidemics and demographic shifts (e.g., religious revivals, etc. which drew people from Puna to Hilo) left the Puna area almost uninhabited for various reasons. Consequently, the unstable volcanic nature of the region, having been impacted by numerous lava flows during human occupation of the region, may have resulted in demographic shifts as well as the destruction of agriculturally productive lands.

Outside demands for Puna agricultural products may have decreased over time for a variety of reasons. Non-local areas may have 1) lost their control over the Puna and South Hilo regions, 2) developed agricultural systems elsewhere capable of sustaining their needs, therefore, not needing to rely on Puna products, 3) found other sources to supply their needs, or 4) simply not needed to rely on Puna products for economic reasons (e.g., it became to economically demanding to utilize Puna as a resource zone), etc..

After western contact, an increasing number of historical trends and pressures may have contributed to the further demise of intensive agricultural production in the area. This list is too exhaustive to go into significant detail but may relate to some of the following issues; disease, demographic shifts, new economic pursuits and goals, changing technologies, changing power structures, shifting demands, new resource networks and sources, new resource exploitation environments and practices, etc..

There is always the possibility that the agricultural complex had gone beyond its ability to maintain a continually productive area. This may have resulted in a collapse of the system due to insufficient energy, nutrients, etc.. The resources may have been exhausted and the environment 'burnt out'. What we see today, may be an environment which is recovering from human induced depletion and destruction.

There may not be a single driving force at either end of the evolutionary development and degeneration behind the agricultural complex. It is likely dependent on a number of variables which played their roles in a complex and enigmatic symbiotic manner. All of the above issues may be prove to be interesting directions to pursue during the course of future archaeological research.

Section 9: Conclusions

An archaeological Inventory Survey was conducted for a 94 acre lot (TMK:1-2-09:29) located at Ke'eke'e Ahupua'a, District of Puna, Island of Hawaii. Identified features were mapped in the field, tagged and assessed for functional and temporal information. It was possible to conduct sub-surface testing on a small number of features. A sample of the agricultural complex (Site 21139) was also given additional attention.

A unique aspect of the subject property is that it was determined to be part of a sizable agricultural complex which may have articulated with a larger intensified dryland agricultural system. However, detailed analysis of the agricultural complex as part of a larger agricultural system has not been attempted in comparison to other field systems noted in Hawaii.

Numerous mounds, modifications, low walls and other agricultural features are located on the subject property which characterize the agricultural complex. The total number of features characterizing this field system literally number in the hundreds and perhaps the thousands. A sample approximating 25-30% of the total area of the subject property yielded over 2,320 m of informal walls and 88 significantly large mounds. Hundreds of additional smaller mounds and pits also relating to agricultural production were noted in the sample area. Also identified were modified gullies, modified outcrops and terraces which again relate to agricultural production. This density of features covers virtually the entire subject property. It is apparent that agricultural production had reached a very intensive state prior to the demise of the field system. The eventual abandonment and/or replacement of the agricultural complex may relate to a number of factors.

Additional archaeological features and sites of importance included the identification of a probable *heiau* (Site 21143), the identification of several enclosures which may have related to historic animal husbandry practices (Sites 21140-21142), and additional assessment of a previously recognized historic cemetery (Site 2539). Numerous additional agricultural features and other features (e.g., walkways and C-shapes) were also identified. Most of these likely fall into the context of the agricultural complex (Site 21139), although several features were clearly related to different functional and temporal contexts. Both traditional (perhaps prehistoric) and historic archaeological features exist.

During the investigative and interpretive work conducted, it was noted that archaeological feature type and density may be correlated to specific substrate and vegetation zones. Following further research,, this correlation may prove to be a useful tool to predict archaeological feature types based on the nature of the geologic/flora zone. In other words, given a specific geologic/flora zone, it may be possible to predict that a certain class of archaeological features will predominate the area.

During the course of investigations, additional attention was given to mapping and testing the *heiau* (Site 21143) as this is an extremely important cultural resource. In addition, the cemetery (Site 2539) was mapped in further detail as there were some discrepancies between the original description and the current survey results. Additional features may exist within the cemetery boundaries. However, it has been requested that no further archaeological investigations be conducted at this site.

Section 10: Significance Evaluations and Recommendations

The following section contains significance evaluations and recommendations for further archaeological investigations and mitigation concerning sites and features located on the current 94 acre subject property located at TMK:1-2-09:29 located at Ke'eke'e Ahupua'a, District of Puna, Island of Hawaii (Refer to Table 3a & 3b).

Site 21143 is believed to represent the remains of a significant ritual/religious site and is likely a *heiau*. The exotic nature of its design in comparison to surrounding features, overall morphology, and distributional patterns of *heiau* in the region among other factors discussed above lends support to these conclusions. Archaeological subsurface testing further indicates that the platform feature of this site may have subsequently been utilized as a habitation platform. Site 21143 is likely to yield important scientific data (Criterion D) and has cultural significance (Criterion E). Furthermore, it is conceivable that Site 21143 may reflect major trends in history (Criterion A), although additional research would be required to better place its temporal context and relation to historical trends. Due to the deteriorated condition, however, Site 21143 does not at present represent an excellent example of a site type (Criterion C). ACP, Inc. recommends the Site 21143, a probable *heiau,* be preserved. This will require a Preservations Plan, and the execution of this plan which will also need to meet State and Local policies. This may require additional archaeological attention and fieldwork as well.

Site 2539 is a historic cemetery composed of at least 24 separate features. Site 2539 potentially could meet Criteria A-E. The cemetery and its component features are an excellent example of a site type (Criterion C), is likely to yield important scientific data (Criterion D), and has significant cultural value (Criterion E). However, the cemetery is at present not associated with a significant person, thus excluding Criterion B. Furthermore, without additional temporal information, it is difficult to relate the site to major trends in history (Criterion A) other than very general patterns. ACP, Inc. recommends that the cemetery (Site 2539) be preserved. This will require a Burial Treatment Plan (which will include plans for preservation) according to State and Local policies. Furthermore, at the request of the Kanahele family and DLNR/SHPD, it is recommended that no further current archaeological investigations be conducted at Site 2539.

Site 21139 represents the partial remains of a large agricultural complex which likely extends beyond the subject property boundaries. Site 21139 has the potential to yield important scientific information (Criterion D). ACP, Inc. recommends that some additional archaeological investigations will be necessary concerning the agricultural complex (Site 21139). These should be detailed in a Data Recovery Plan. The extent and nature of future archaeological investigations concerning archaeological features located on the subject property and relating to the agricultural complex will be dependent on the nature of the research questions and approaches presented in the Data Recovery Plan.

Sites 21140-21142 likely represent the remains of historic enclosures. These may be related to animal husbandry practices. Sites 21140-21142 may have to potential to yield important scientific data (Criterion D). ACP, Inc. recommends that additional archaeological investigations may be necessary for Sites 21140-21142. Although these archaeological features have been adequately mapped and assessed, further mapping and subsurface testing where possible may be necessary to render these sites no longer significant and/or no further archaeological work required.

Table 3a: Significance Criteria Table: Summary of Site Significance Evaluations

Site #	Description	Function	Temporal Context	Significance Criteria
21139	Agricultural Complex	Agricultural	Prehistoric/ Early Historic	D
21140	Enclosure	AH/Ag.	Historic	D
21141	Enclosure	AH/Ag.	Historic	D
21142	Enclosure	AH/Ag.	Historic	D
21143	Probable *Heiau*	Rel./Cer.	Prehistoric/ Early Historic	D & E
2539	Cemetery	Cemetery	Historic	C, D & E

Key:

Tentative Function: Ag.=Agricultural, H=Habitation, TH=Temporary Habitation, AH=Animal Husbandry.

Rel./Cer.=Religious/Ceremonial

Code For Significance Evaluation Criteria

NS	-	Not Significant
NLS	-	No Longer Significant
A	-	Site Reflects Major Trends in History
B	-	Site is Associated with the Life of a Significant Person
C	-	Site is and Excellent Example of a Site Type
D	-	Site Likely to Yield Important Scientific Data
E	-	Site has Cultural Significance (e.g., shrine, burial, etc.)

Table 3b: Significance Criteria Table: Summary of Site Significance Evaluations (Features Included)

Site/Feature #	Description	Function	Temporal Context	Significance Criteria
21139	**Agricultural Complex**	**Agricultural**	**Prehistoric/ Early Historic**	**D**
21139A	Walls & Mounds	Ag.		
21139B	Walls	Ag.		
21139C	Mounds	Ag.		
21139D	Walls & Mounds	Ag.		
21139E	Walls & Mounds	Ag.		
21139F	Manuport	Marker/?		
21139G	Modified Gully, Modified Outcrop & Mounds	Ag.		
21139H	Walls	Ag.		
21139I	Walls & Mounds	Ag.		
21139J	Walls & Mounds	Ag.		
21139K	Walls & Mounds	Ag.		
21139L	Wall	Ag.		
21139M	Walls & Mounds	Ag.		
21139N	Modified Gully	Ag.		
21139O	Walls & Terraces	Ag.		
21139P	Modified Gully	Ag.		
21139Q	Wall	Ag.		
21139R	Modified Gully, Modified Outcrops, Walls & Terraces	Ag.		
21139S	Modified Depression	Ag.		
21139T	C-Shape	Ag./TH		
21139U	Walkway	Walkway		
21139V	Modified Depression & Possible Terrace	Ag.		
21139W	Enclosure	AH/Ag.		
21139X	Cave Opening & Manuport	Marker/?		
21139Y	Wall Segment	Ag.		
21139Z	Walkway Segment	Walkway		
21139AA	Modified Depression, Mound & Terrace	Ag.		
21139AB	Walkway Segment	Walkway		
21139AC	Walkway Segment	Walkway		
21139AD	Modified Outcrop & Enclosure (w\ adjacent walkway segments & small terrace)	Ag.		
21139AE	Terrace	Ag./H/?		
21139AF	C-Shape	Ag./TH		
21140	**Enclosure**	**AH/Ag.**	**Historic**	**D**
21141	**Enclosure**	**AH/Ag.**	**Historic**	**D**
21142	**Enclosures**	**AH/Ag.**	**Historic**	**D**
21143	**Probable *Heiau***	**Rel./Cer.**	**Prehistoric/ Early Historic**	**D & E**
21143A	Platform	Rel./Cer.		
21143B	Terrace	Rel./Cer.		
21143C	Wall Segments	Rel./Cer.		

Key at end of Table 3

Table 3b: Significance Criteria Table: Summary of Site Significance Evaluations (Continued)

Site/Feature #	Description	Function	Historic Association	Significance Evaluations
2539	Cemetery	Cemetery	Historic	**C, D & E**
2539A	Burial Platform	Burial		
2539B	Burial Platform	Burial		
2539C	Burial Platform	Burial		
2539D	Burial Platform	Burial		
2539E	Burial Platform	Burial		
2539F	Burial Platform	Burial		
2539G	Burial Platform	Burial		
2539H	Burial Platform	Burial		
2539I	Burial Platform	Burial		
2539J	Burial Platform	Burial		
2539K	Burial Platform	Burial		
2539L	Burial Platform	Burial		
2539M	Burial Platform	Burial		
2539N	Burial Platform	Burial		
2539O	Burial Platform	Burial		
2539P	Burial Platform	Burial		
2539Q	Burial Platform	Burial		
2539R	Burial Platform	Burial		
2539S	Burial Platform	Burial		
2539T	Burial Platform	Burial		
2539U	Burial Platform	Burial		
2539V	Burial Platform	Burial		
2539W	Burial Platform	Burial		
2539X	Burial Platform	Burial		

Key:

Tentative Function: **Ag.**=Agricultural, **H**=Habitation, **TH**=Temporary Habitation, **AH**=Animal Husbandry.

Rel./Cer.=Religious/Ceremonial

Code For Significance Evaluation Criteria

NS	-	Not Significant
NLS	-	No Longer Significant
A	-	Site Reflects Major Trends in History
B	-	Site is Associated with the Life of a Significant Person
C	-	Site is and Excellent Example of a Site Type
D	-	Site Likely to Yield Important Scientific Data
E	-	Site has Cultural Significance (e.g., shrine, burial, etc.)

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Appendix A: Site/Feature Number and Temporary Feature Number Correlations

Site 2539	
Fea.	Temp. Fea.#
A	100
B	101
C	102
D	103
E	104
F	105
G	106
H	107
I	108
J	109
K	110
L	111
M	112
N	113
O	114
P	115
Q	116
R	117
S	118
T	119
U	120
V	121
W	122
X	123

Site 21139	
Fea.	Temp. Fea.#
A	36
B	38
C	39
D	41
E	45
F	46
G	47
H	48A
I	48B
J	48C
K	48D
L	49
M	50
N	51
O	53
P	54
Q	55
R	56
S	200
T	203
U	204
V	205
W	206
X	207
Y	208
Z	209
AA	210
AB	211
AC	212
AD	214
AE	217
AF	221

Site #	Temp. Fea.#
21140	213
21141	218
21142	220
21143	215