Appendix F

Avifaunal and Feral Mammal Field Survey

AVIFAUNAL AND FERAL MAMMAL FIELD SURVEY OF

MOLOKAI RANCH, LA'AU POINT PROPERTY, MOLOKAI

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INTRODUCTION

This report presents the findings of a two day (21, 22 December 2005) field survey of approximately 1500 acres of Molokai Ranch at La'au Point, Molokai. In addition to the field data this report also notes pertinent published and unpublished sources of birds and mammals to provide a broader view of the potential species known from this region of Molokai. The two objectives of the field survey were to:

1-Document the birds and mammals presently found on or near the property.

2-Locate and examine all habitats on the site and note their importance, if any, for native and migratory birds.

SITE DESCRIPTION

This site runs along the coast on either side of La'au Point (Fig.1). The topography is generally flat with some ravines and cliffs along the shoreline. The vegetation is dominated by Kiawe (*Prosopis pallida*) with an understory of alien weeds and grass. Some small patches of native, dry land plants, such as Ma'o (*Gossypium sandwicense*) and 'Ilima (*Sida fallax*), can also be found scattered throughout the property. No wetland habitat was found, however, ephemeral streams occur in the ravines following periods of extended, heavy rain. The shoreline contains a mixture of wave swept sandy beaches and rocky cliffs.

METHODS OF THE FIELD SURVEY

The survey was conducted by walking the site. Observations were focused during early morning, late afternoon and early evening hours when birds and mammals are most active and observable. All habitats (Kiawe thickets and shoreline) on the property were investigated. All birds seen and heard were tallied. Census stations were established approximately 100-200m apart throughout the site and eight minute counts of all birds seen or heard were tallied. These data were used to estimate the relative abundance of each bird species on the property. Rare or infrequently seen species were tallied whenever they were observed, not just on the census stations. Data on mammals were obtained by visual observations only. No trapping of mammals was conducted. The duration and nature of the field survey did not warrant trapping. A Petterssson Elecktronik AB Ultrasound Detector D-100 was used on the evening survey (21 December) to listen for the echolocation calls of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). The weather during the survey period was generally fair with some cloud cover late in the day. The winds were light. Large swells generated by storms north of Hawaii produced strong surf on both days of the survey.

Scientific and common (vernacular) names of birds and mammals referred to in this report follow the taxonomy of Pyle (2002) and Honacki et al. (1982). Plant names are those given by Pratt (1998).

RESULTS OF THE FIELD SURVEY

Native Land Birds:

No native land birds were recorded on the survey. The only likely species that is known to forage in this area is the Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*). This species is listed by the State of Hawaii as endangered on Oahu but not elsewhere in the State. They hunt in grasslands, agricultural fields and forests (Pratt et al. 1987, Hawaii Audubon Society 2005. This species nests on the ground in habitats with tall grass. I recorded Pueo during an earlier survey (Bruner 1989) of a 7000 acre parcel that included this site.

Native Waterbirds:

No native waterbirds were recorded nor were any expected on this property due to an absence of wetland habitat. I recorded Hawaiian Coot (*Fulica alai*) at a man-made pond at Kalua Koi golf course during my 1989 field survey (Bruner 1989).

Seabirds:

No seabirds were recorded on the survey. None would be expected to nest at this site due to the presence of ground predators and human disturbance. Some species on occasion may fly over the property.

Migratory Birds:

Four species of migratory shorebirds were observed on the survey: Pacific Golden-Plover or Kolea (*Pluvialis fulva*); Ruddy Turnstone or 'Akekeke (*Arenaria interpres*); Wandering Tattler or 'Ulili (*Heteroscelus incanus*); and Sanderling or Hunakai (*Calidris alba*). A total of four Kolea, three 'Akekeke, two 'Ulili, and one Hunakai were tallied over the duration of the survey. The most common migratory shorebird in Hawaii is the Pacific Golden-Plover. They forage on lawns, pastures and in agricultural fields as well as along shorelines. Kolea have been extensively studied both here in Hawaii and on their breeding grounds in western Alaska (Johnson et al. 1981, 1989, 1993, 2001a, 2001b). None of these migratory shorebirds are listed as threatened or endangered.

Introduced (Alien) Birds:

Thirteen species of alien birds were tallied on the survey. Table One gives the names and relative abundance of these birds recorded on the survey along with those found on the Bruner 1989 survey. None of these species are listed as threatened or endangered. The array of alien birds at this location is typical of the lowlands on Molokai (Hawaii Audubon Society 2005).

Mammals:

Four cats (*Felis catus*), six Small Indian Mongoose (*Herpestes auropunctatus*), and eleven Axis Deer (*Axis axis*) were observed over the duration of the survey. Two endangered Hawaiian Monk Seals (*Monachus schawinslandi*) were observed resting on Sam Wights Beach north of La'au Point on 21 December. Monk Seals haul out to rest on beaches as deserted as this beach or as heavily used as public beaches on Oahu. They have even given birth and raised their pups. The most recent example was June – July 2006 at Turtle Bay Resort on the North Shore of Oahu. Mice (*Mus musculus*) and rats *(Rattus spp.*) undoubtedly occur on the site but were not observed. The native endangered Hawaiian Hoary Bat was not detected. This finding was not unexpected given the low numbers of bats reported to occur on Molokai (Tomich 1986, Kepler and Scott 1990). This species forages in a wide variety of habitats including: forests, agricultural lands, and urban areas. They are most abundant on Kauai and the Big Island.

Jacobs (1991, 1993) and Reynolds et al. (1998) provide information on the occurrence and natural history of this species on the Big Island.

SUMMARY AND CONCLUSIONS

The purpose of this report was to present the findings of a bird and feral mammal field survey. No native land birds were recorded but the endangered Hawaiian Owl (Pueo) has been seen foraging on the property. No native water birds were recorded due to an absence of suitable habitat. No seabirds were seen. The four common migratory shorebirds that winter in Hawaii were observed along the shoreline. The array of alien birds recorded was typical of this region. No unexpected species were recorded. The presence of feral mammals (cats, mongoose, Axis Deer) was expected at this site. The absence of the endangered Hawaiian Hoary Bat was not unexpected given the low numbers of bats reported to occur on Molokai. The endangered Hawaiian Monk Seal has been seen on the beaches of the main Hawaiian Islands with increasing frequency in the last ten years (pers. observ.). The appropriate protocol if one encounters a monk seal on the beach is to notify National Marine Fisheries so they can check to see if the animal is injured or entangled. They will then put tape around the site to keep people from approaching too close. If a birth is occurring or the female has a pup volunteers will watch over the site as was done at Turtle Bay Resort, Oahu this past June – July (2006).

The La'au Point project should not significantly impact alien bird and mammal populations in this region. The expanded protection area along the shoreline will help minimize effects upon migratory shorebirds and the Hawaiian Monk Seal. The proposed residential lots will be setback a minimum of 200 feet from the shoreline (average 385 feet) and the closest building construction will be an additional 50 feet into the lot.

TABLE 1

Relative abundance estimates in appropriate habitat: A=abundant (ave. 10+ on census stations; C=common (ave. 5-9 on census stations); U=uncommon (ave. 1-4 on census stations); R=recorded but not on census stations (number which follows is total found on the survey). A dash indicates this species was not recorded on that survey.

Common Name	Scientific Name	2005	1989
Barn Owl	*Tyto alba*	-	R=3
Cattle Egret	*Bubulcus ibis*	-	R=2
Red Junglefowl	*Gallus gallus*	R=6	-
Wild Turkey	*Meleagris gallopavo*	R=9	R=37
Ring-necked Pheasant	*Phasianus colchicus*	-	R=1
Gray Francolin	*Francolinus pondicerianus*	U=2	C=8
Black Francolin	*Francolinus francolinus*	C=6	A=14
Spotted Dove	*Streptopelis chinensis*	U=2	U=5
Zebra Dove	*Geopelia striata*	A=10	A=12
Common Myna	*Acridotheres tristis*	U=2	U=2
Japanese White-eye	*Zosterops japonicus*	C=5	C=9
Northern Cardinal	*Cardinalis cardinalis*	C=9	C=6
Red-crested Cardinal	*Paroaria coronata*	C=7	A=13
Northern Mockingbird	*Mimus polyglottos*	C=8	A=12
Skylark	*Alauda arvensis*	R=3	U=4
House Finch	*Carpodacus mexicanus*	C=8	A=15
Nutmeg Mannikin	*Lonchura punctulata*	-	C=8
Warbling Silverbill	*Lonchura malabarica*	-	C=6

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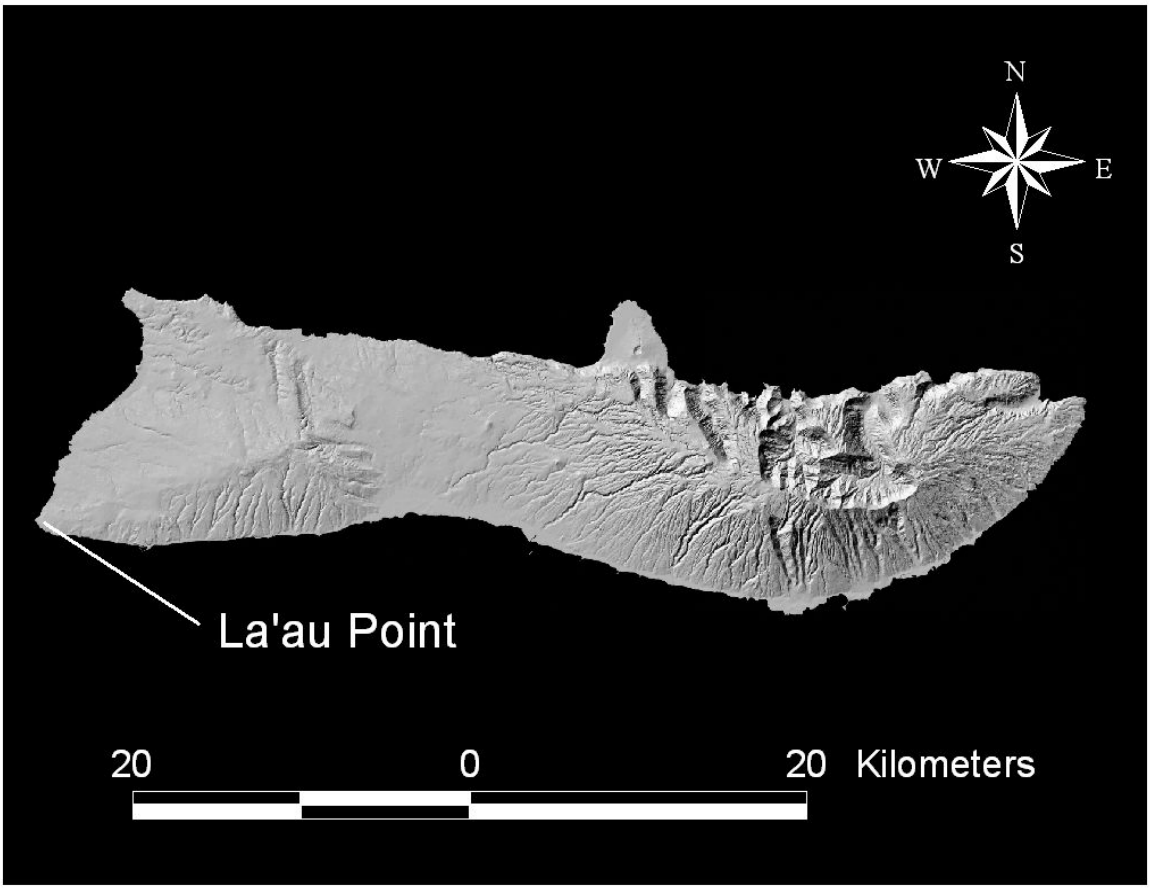
Appendix G

Marine Biological and Water Quality Baseline Surveys

Marine Biological and Water Quality Baseline Surveys
La‘au Point, Moloka‘i



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1. Marine Biological Baseline

1.1 Introduction

These survey results are to be used to support a description of the existing environment in an environmental impact statement being prepared for the La'au Point residential community proposed by Moloka'i Properties Limited, and to provide a baseline for comparison with the results of future similar surveys. La'au Point is on the southwest point of the island of Moloka'i, 30 km west of Kaunakakai Harbor and 65 km east of Honolulu.

Background Information

From *Moloka'i Island Coastal Resource Inventory* (US Army Corps of Engineers, Pacific Division, unpublished report; 1984):

> ***"Physiography***
>
> *The inshore area consists of irregular basalt formations and boulders of moderate size and relief. A fairly steep profile extends to a depth of 6 m and is cut with deep grooves and channels. Live corals here are diverse, but have less than 10% coverage. A base made up of older dead coral rock encrusts the surfaces of many of the basalt boulders. Extending seaward to depths of 11-12 m and beyond is a wide, gently sloping basalt terrace which exhibits little relief. Occasional platforms, 5 to 8 m wide and 2 m high, break up the otherwise flat substrate and support substantially more coral cover than the surrounding plain. Some cracks and crevices are etched into the basalt floor and oriented perpendicular to the shoreline. Occasional boulders or knolls protrude from the flat surface. Other than a few small sand patches, little sediment is evident.*
>
> *South of La'au Point – The inshore area near the rocky, lava headlands consists of a steep talus boulder slope at the cliff (shoreline) base that descends to a depth of 6 to 10 feet. Beyond the talus is found a very irregular high relief terrace upon which rests 2-4 m diameter basaltic boulders. The terrace slopes gradually to deeper water seaward. Live coral cover is less than 5%, with occasional small sand patches existing between the large boulders. Approximately 90 m offshore, in 4-5 m of water, the solid basalt substrate is covered with algal turf and some sand channels. Nearshore areas fronting the sandy beaches exhibit sand flats extending from shore to 8 m deep and beyond. Further offshore, in depths of 9-11 m, scoured basalt rock projections form dome-like tables 2 m above wide sand channels. The network of sand channels interconnect and undercut the worn basalt formations."*
>
> ***Marine flora and fauna***
>
> ***Inshore***
>
> *Algae are quite diverse in this area. Several species of edible algae found in abundance include limu lipoa (*Dictyopteris australis*), limu kohu (*Asparagopsis taxiformis*), and limu alani (*Dictyota acutiloba*). Live coral coverage is approximately 10% in this area, generally growing atop dead coral on a boulder base. The bottom*

profile is quite dramatic with the encrusting coral Pavona varians *concentrated on vertical surfaces and the encrusting corals* Montipora capitata *and* M. flabellata *growing on the upper surfaces. Twenty meters offshore, the branching reef corals* Pocillopora meandrina *and* P. damicornis *and the rounded or encrusting reef coral* Porites lobata *grow in abundance.*

*The other invertebrates observed during surveys consisted of purple octocoral (*Anthelia edmondsoni*) and the soft zoanthid coral* Palythoa tuberculosa *both in large quantities. A variety of mollusks were found including an abundance of top shell (*Trochus intexus*), an occasionsl leopard cone (*Conus leopardus*) and the rare humpback cowry (*Cypraea mauritiana*). A few sea cucumbers,* Actinopyga mauritiana *and* Holothuria atra*, and sea urchins, the black rock-boring urchin (*Echinometra oblonga*), may also be seen in this area. The fish population, in general, is rather diverse and fairly abundant. Surgeonfish are the most abundant group, especially large schools of the Achilles tang (*Acanthurus achilles*), manini or convict tang (*A. triostegus*) and maikoiko or Jenkin's surgeon (*A. leucopareius*), and also the nenue or rudder fish (*Kyphosus *sp.). Several species of commonly-caught food fish here consist of uhu or parrotfish (Scaridae), the goatfish weke and moano (Mullidae), and small jack or papio (Carangidae). A few damselfish (Pomacentridae) and wrasses (Labridae) also exist here.*

Offshore

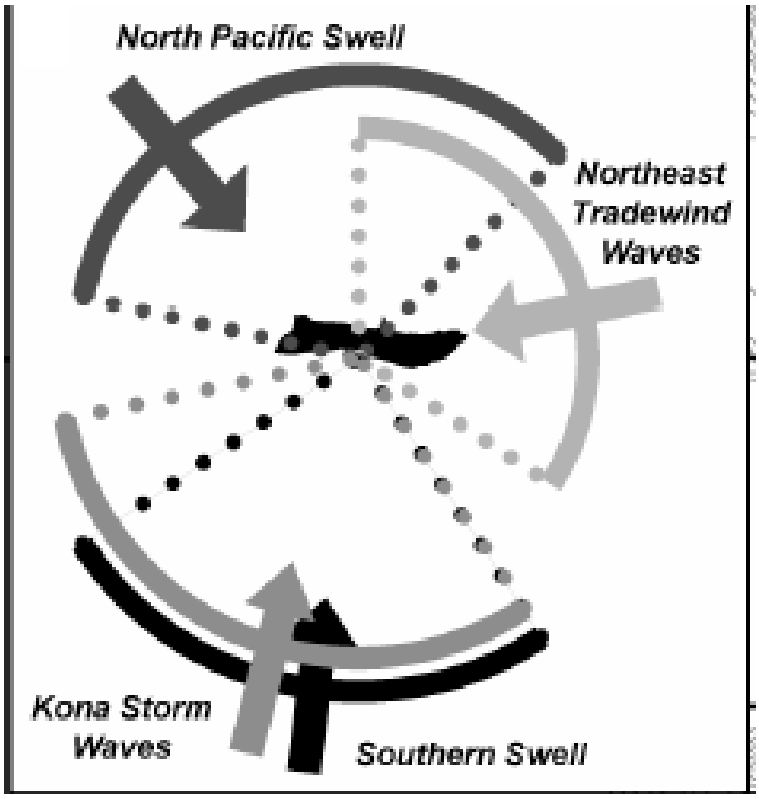
Six species of algae were found in the area, but only edible alga Dictyopteris australis *(limu lipoa) and the red alga* Liagora *sp. are dominant, covering a good portion of the bottom. The sand producing green algae* Halimeda opuntia *and* Neomeris annulata *are abundant as well. In waters of 11-12 m depth, very little live coral grows on the gently sloping basalt floor. Small coral heads, 10-15 cm in diameter, of the branching reef corals* Pocillopora meandrina *and* P. damicornis *are the most abundant. The only other invertebrates offshore are sponges and hydroids. Since the substrate is mainly flat, the fish population was very small. In general, the surgeonfish and damselfish are the most abundant with a few humuhumu or triggerfish (Balistidae), uhu or parrotfish (Scaridae) and aawa or table boss (*Bodianus bilunulatus*) inhabiting this area.*

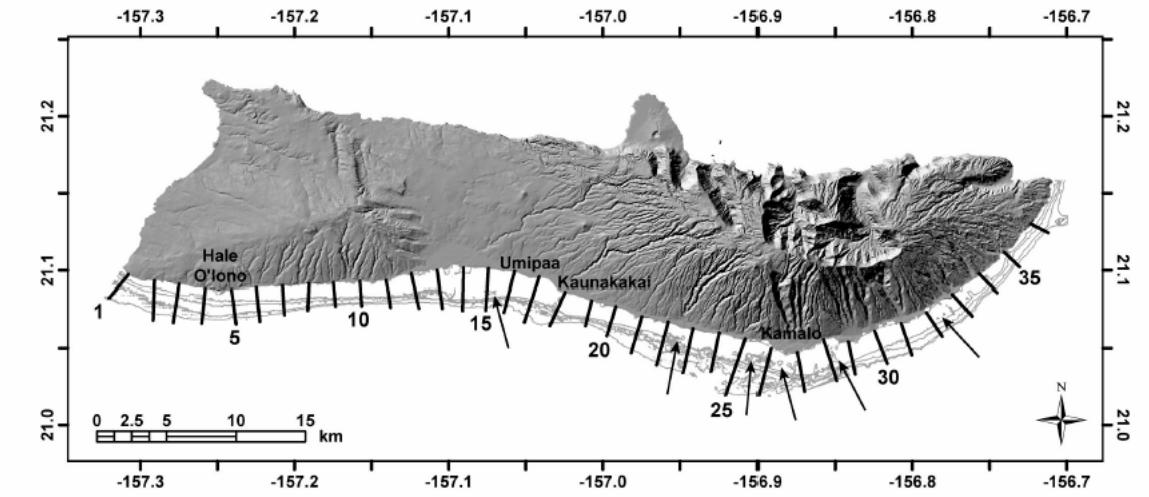
Human Uses

La'au Point and the surrounding coastal areas can be accessed only by four-wheel drive vehicle. One-half square mile of the point area was administered by the U.S. Coast Guard which maintains a lighthouse there. The coastal area may occasionally be closed-off to visitors by Moloka'i Ranch, owners of the adjacent property. Some of the Coast Guard land not required for lighthouse operation at La'au is in the process of being sold off by the Federal government.

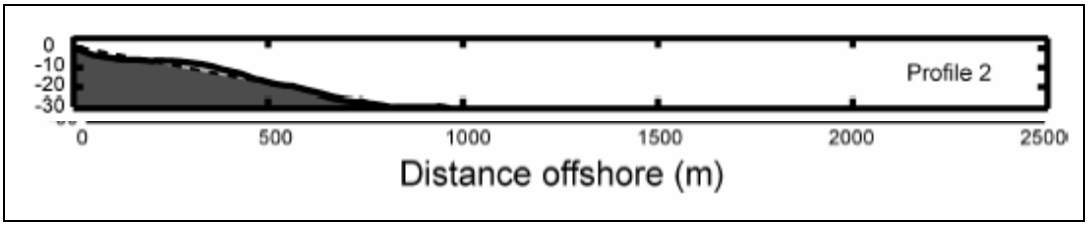
Strong rip currents, high waves, and rough conditions persist at La'au Point throughout the year except on rare occasions when kona conditions prevail. Pole and line fishing is done from the point and adjacent beaches. Fishing boats may troll the waters for aku, ahi, and ulua. Because of rough conditions of the inshore zone, entering the water to dive or spearfish should be considered quite dangerous."

Recent work (Storlazzi et al. 2005; figures below) provide further context for the wave climate and reef morphology for the island of Moloka'i.





Morphology of the reef and insular shelf off southern Molokai from the SHOALS and National Ocean Service bathymetric data overlaid with the locations of the 36 shore-normal transects used for analysis. The shore-normal transects were spaced roughly every 1.5 km along shore; the isobaths are every 10 m from the shoreline out to 40 m. Arrows denote the location of some prominent "blue holes" on reef flat; note their correlation to onshore drainages. (From Storlazzi et al. 2005)



Selected shore-normal reef profiles showing the variation in the development of the reef complex along shore. The dashed lines are a projection of the slopes of the volcanic cone (dark gray) through the reef profiles to provide some insight to the likely crosssectional area of the reef complex (light gray). Note that the reef is almost nonexistent at the ends of the island (profiles #2 and #36) and extends more than 1500 m offshore of the island's central portion (profiles #13 though #27). (From Storlazzi et al. 2005)

1.2 Methods—Present Study

1.2.1 Benthic Habitat Mapping

The National Oceanic and Atmospheric Administration (NOAA) acquired and visually interpreted orthorectified aerial photography for the near-shore waters (to 25 meters depth) of parts of the main Hawaiian Islands (Coyne et al. 2003, NOAA/NOS 2003). Features visible in the aerial photographs were mapped directly into a geographic information system (GIS). Visual interpretation of the photographs was guided by a hierarchical classification scheme that defined and delineated benthic polygon types based on insular-shelf zones and habitat structures of the benthic community. Zones describe the insular-shelf location (inner lagoon, outer lagoon, bank-shelf), whereas habitat structure (hereafter "structure") includes the cover type (reef, submerged vegetation, unconsolidated sediments, etc.) of the benthic community. The major product of this effort is a series of GIS-based benthic habitat maps that are characterized by a high degree of spatial and thematic accuracy. The hierarchical spatial structure underlying the habitat classifications were explicitly designed to include ecologically-relevant locational (backreef, forereef, lagoon, etc.) and typological (patch reef, spur and groove, colonized pavement, etc) strata, thereby creating an analytical construct within which nuances of community structure, such as resource distribution, abundance, and habitat utilization can be tested and resolved.

1.2.2 Benthic Methods

Monitoring methods for coral reef habitats were based on those of the Global Coral Reef Monitoring Network (GCRMN; http://coral.aoml.noaa.gov) and Green (2002). These methods were aimed at providing a baseline for detection of significant changes in reef habitat as a result of land-based development activities. Assessment methods included:

Line intercept surveys to identify and estimate relative abundance of benthic substratum type (by genus, species, growth form, or other bottom type).

Visual censuses of fishes to quantify numerical abundance, biomass, diversity, and species richness).

1.2.3 Monitoring Site Locations

Information from the Moloka'i Island Coastal Resource Inventory and NOAA's marine benthic habitat maps were used to determine approximate locations for sampling sites. GPS points were generated in ArcView. Six sites, three north and three east of La'au Point, were surveyed over a 2-day period (Table 1, Figure 1). Sites were identified relative to estimated location for the proposed development. Baseline surveys were conducted on November 19-20, 2005. Transects were located along a depth profile where coral density was highest—approximately 8-11 m--with consideration of adjacent coastline features and reef structure at each site.

1.2.4 Sample Design

Three 25 x 5 m transects, each separated by ca. 5 m were conducted at each sampling location. Transects were "permanently" marked using heavy cable ties. Transects were orientated along bathymetry contours and conducted within homogeneous microhabitat types.

1.2.5 Quantitative Benthic Surveys and Analysis

Surveys assessed the biological diversity and abundance of algae, coral and other macroinvertebrates at each reef site (Sites 2-5). Surveys were also conducted at control sites (Sites 1 and 6), away from the zone of anticipated impact yet close enough to represent similar reef environments.

Three 25 m long transects were surveyed along a single depth gradient (8-11 m depth) parallel to the shoreline at each site, with 1-3 m between the end of one transect and the start of the next. The substratum type (coral, algae, invertebrate, sand, etc) was recorded at one meter intervals directly under the transect tape and at one meter to each side of the tape, giving a total of 225 points per site (3 transects x 25 meters/transect x 3 points/meter interval). The relative percentages of each substratum type were calculated as the mean ($\pm$ S.E.) of three replicates for the three transects (n=9).

1.2.6 Fish Sampling Methodology

Fish assemblages at each location were assessed using standard underwater visual belt transect survey methods (Brock 1954, Brock 1982). A SCUBA diver swam each 25m x 5m transect at a constant speed (~ 15 min/transect) and identified to the lowest possible taxon, all fishes visible within 2.5 m to either side of the centerline (125 m^2 transect area). Nomenclature followed Randall (1996). Total length (TL) of fish was estimated to the nearest centimeter. Length estimates of fishes from visual censuses were converted to weight using the following length-weight conversion: $W = aSL^b$ - the parameters a and b are constants for the allometric growth equation where SL is standard length in mm and W is weight in grams. Total length was converted to standard length (SL) by multiplying standard length to total length-fitting parameters obtained from FishBase (www.fishbase.org). Length-weight fitting parameters were available for 150 species commonly observed on visual fish transects in Hawaii (Hawaii Cooperative Fishery Research Unit unpublished data). These data were supplemented by information from other published and web-based sources. In the cases where length-weight information did not exist for a given species, the parameters from similar bodied congeners were used. All biomass estimates were converted to metric tons per hectare (t/ha) to facilitate comparisons with other studies in Hawaii. Finally, fish

taxa were categorized into three trophic categories (herbivores, secondary consumers, and apex predators) according to various published sources and FishBase (www.fishbase.org).

1.2.7 Statistical Methods

Because transects within sites were spatially autocorrelated, mean values for all transects at each site were used in all analyses. Species diversity was calculated from the Shannon-Weaver Diversity Index (Ludwig and Reynolds 1988): H'=S (pi ln pi), where pi is the proportion of all individuals counted that were of species i. The evenness component of diversity was expressed as: J = H'/ln(S), where S is the total number of species present (Pielow 1977).

Table 1: Site locations and associated meta-data around La'au Point. Lat. = latitude, Long. = longitude. Latitude and longitude are in WGS 84. X and Y UTM coordinates are for UTM Zone 4.

Date	Site	Lat.	Long.	Y	X	Depth (ft)	Habitat Descriptions
19-Nov-05	1	21.14	-157.29	2338656	677251	24	Flat reef pavement; scattered *P. meandrina, P. lobata, Asparagopsis*; abundant branching/encrusting calc. algae; green sponge
19-Nov-05	2	21.13	-157.30	2337355	676511	33	Spur and groove reef pavement; abundant *P. meandrina, Asparagopsis;* scattered *P. lobata, P. evermanni*
19-Nov-05	3	21.11	-157.31	2335644	676050	24	Flat reef pavement;scattered small *P. lobata, P. meandrina*; abundant branching coralline algae
20-Nov-05	4	21.09	-157.30	2333093	676873	36	Flat, sand covered reef pavement; scattered small *P. lobata, P. meandrina, P. eydouxi;* abundant *Halimeda*
20-Nov-05	5	21.09	-157.28	2332962	678897	24	Flat reef pavement, spur and groove to south; some sand; scattered *P. meandrina, P. lobata*, green sponge
20-Nov-05	6	21.09	-157.26	2332748	680444	24	Flat, sand-covered reef pavement; abundant small *P. lobata, M. capitata;* abundant *Asparagopsis, Halimeda*

1.3 Results—Present Study

1.3.1 Large-scale Habitat Features

The shelf zone accounted for 84% of the total study area (<60 feet), followed by reef flat (8%), forereef (6%), and shoreline intertidal (2%) (Table 2). Large-scale habitat types within the study area (<60 feet) were dominated by uncolonized volcanic rock/boulder (45%), followed by uncolonized pavement (24%), sand (7%), linear reef (7%), colonized pavement (6%), aggregated coral (6%), and macroalgae (5%).

1.3.2 Benthic Flora and Fauna

Turf algae dominated benthic cover at all locations, accounting for a grand mean of 57%, followed by sand (22%), and macroalgae (10%) (Tables 2, 3 and Figure 2). Hard coral cover was slightly more than 6% overall (range 3.56-11.56%). Table 4 provides more detail on the relative abundance of the most common taxa and Figures 3 and 4 illustrate the relative percentages of coral and macroalgae at each site.

There was an inverse relationship between coral and macroalgae at all sites, as seen in comparison of Figures 3 and 4. Macroalgae were dominant on exposed areas; percent coral and sand cover were more abundant at lee sites, protected from northwest swells. Algae and coral species were qualitatively similar in both the 1975 and 2005 surveys.

Octocorals, molluscs and echinoderms noted in a previous study (AECOS 1975) were not seen during the November, 2005 surveys. Rather, the collector urchin, *Tripneustes gratilla*, was the most abundant macroinvertebrate. Density of this urchin at the six sites is summarized in Table 5.

Figure 1: Sampling locations and NOAA benthic habitat map.

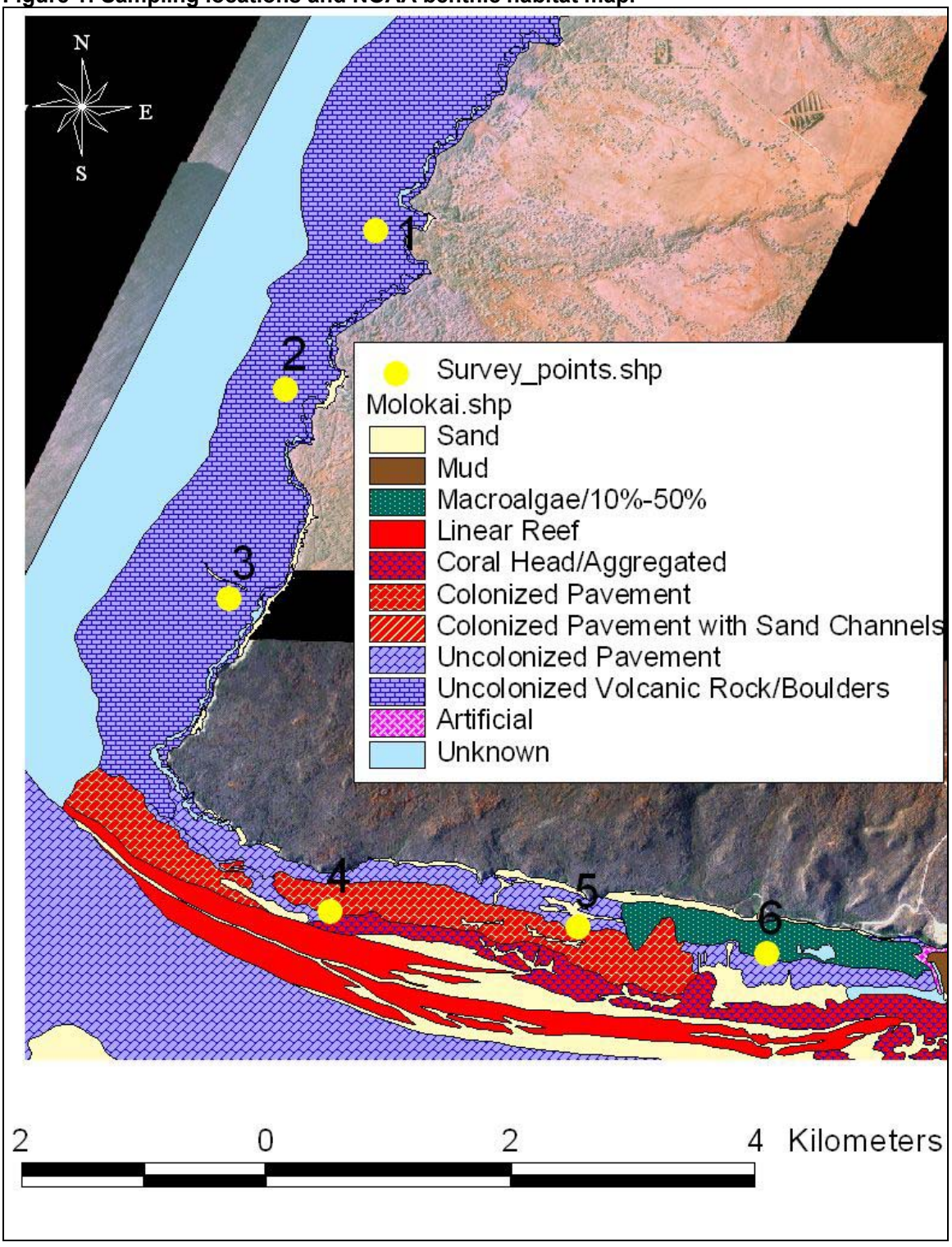


Table 2: Zone and habitat types within the general study area to a depth of ca. 60 feet. Zone and habitat classifications based on NOAA benthic habitat maps (Coyne et al. 2003, NOAA/NOS 2003)

Zone	Habitat	Acres	Percent
Forereef	Hardbottom/Uncolonized Pavement	85.85	1.36%
	Reef/Colonized Pavement	256.78	4.05%
	Sand	61.13	0.97%
Reef Flat	Hardbottom/Uncolonized Pavement	168.10	2.65%
	Hardbottom/Uncolonized Volcanic Rock/Boulders	1.08	0.02%
	Macroalgae/10-50%	309.78	4.89%
	Sand	12.75	0.20%
Shelf	Hardbottom/Uncolonized Pavement	1275.68	20.14%
	Hardbottom/Uncolonized Volcanic Rock/Boulders	2726.41	43.05%
	Reef/Aggregate Coral	387.97	6.13%
	Reef/Colonized Pavement	131.33	2.07%
	Reef/Linear Reef	429.12	6.78%
	Sand	330.78	5.22%
Shoreline Intertidal	Hardbottom/Uncolonized Volcanic Rock/Boulders	96.37	1.52%
	Sand	60.18	0.95%
Total		6333.31	100.00%

Table 3: Percent cover of major benthic groups.Values are means of three transects with standard deviation of the mean in parentheses. Groups ranked from high to lower grand mean cover.

Groups	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Grand mean
Turf algae	44.89 (14.64)	53.33 (11.71)	83.56 (24.14)	30.67 (12.23)	75.66 (12.65)	56.00 (9.85)	57.33 (14.21)
Sand	20.00 (8.90)	21.78 (8.55)	0.89 (1.54)	54.22 (15.30)	11.56 (5.39)	22.67 (6.43)	21.85 (7.69)
Macroalgae	14.67 (10.09)	17.33 (13.91)	9.78 (15.86)	6.67 (7.92)	1.33 (1.54)	8.00 (5.89)	9.63 (9.20)
Hard Coral	4.00 (6.16)	4.00 (5.39)	3.56 (6.16)	4.89 (6.62)	9.78 (12.80)	11.56 (12.11)	6.30 (8.21)
Calcareous algae	16.00 (8.88)	3.11 (3.55)	1.33 (2.31)	1.78 (2.31)	1.33 (2.31)	0.89 (1.54)	4.07 (3.48)
Sponge	0.44 (0.77)	0.44 (0.77)	0.89 (1.54)	3.11 (4.62)	1.78 (2.10)	0.89 (0.77)	1.26 (1.76)

Table 4: Mean percent cover (sd) at each site around Laʻau Point. Taxon ranked from highest to lowest grand mean cover.

Benthic Group	Taxon	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Grand mean
Turf algae	Turf algae	44.89 (14.64)	53.33 (11.71)	83.56 (24.14)	30.67 (12.23)	75.56 (12.65)	56.00 (9.85)	57.33 (14.21)
Sand	Sand	20.00 (8.9)	21.78 (8.55)	0.89 (1.54)	54.22 (15.30)	11.56 (5.39)	22.67 (6.43)	21.8 (7.69)
Macroalgae	*Lobophora variegata*	7.56 (4.35)	8.44 (5.85)	6.22 (10.78)	2.67 (3.08)	1.33 (1.54)	4.00 (1.54)	5.04 (4.52)
Calcareous algae	Calcareous algae	16.00 (8.88)	3.11 (3.55)	1.33 (2.31)	1.78 (2.31)	1.33 (2.31)	0.89 (1.54)	4.07 (3.48)
Macroalgae	*Halimeda opuntia*	4.89 (3.64)	4.44 (3.44)	3.56 (5.08)	4.00 (4.84)	0.00 (-)	3.11 (3.58)	3.33 (3.43)
Hard Coral	*Pocillopora meandrina*	0.89 (1.54)	1.33 (1.54)	1.33 (2.31)	2.67 (3.55)	5.78 (6.85)	1.78 (2.31)	2.3 (3.02)
Hard Coral	*Porites lobata*	0.89 (0.77)	1.33 (1.54)	1.78 (3.08)	0.89 (1.54)	1.33 (2.31)	5.33 (4.62)	1.93 (2.31)
Macroalgae	*Asparagopsis taxifolia*	2.22 (2.10)	4.44 (4.62)	0.00 (-)	0.00 (-)	0.00 (-)	0.89 (0.77)	1.26 (1.25)
Sponge	Green sponge	0.44 (0.77)	0.44 (0.77)	0.89 (1.54)	1.78 (3.08)	0.44 (0.77)	0.89 (0.77)	0.81 (1.28)
Hard Coral	*Montipora patula*	0.44 (0.77)	0.00 (-)	0.44 (0.77)	0.00 (-)	0.44 (0.77)	2.22 (2.87)	0.59 (0.86)
Hard Coral	*Montipora capitata*	0.44 (0.77)	0.44 (0.77)	0.00 (-)	0.00 (-)	0.00 (-)	1.78 (1.54)	0.44 (0.51)
Sponge	Orange sponge	0.00 (-)	0.00 (-)	0.00 (-)	1.33 (1.54)	1.33 (1.33)	0.00 (-)	0.44 (0.48)
Hard Coral	*Porites evermanni*	0.89 (1.54)	0.89 (1.54)	0.00 (-)	0.00 (-)	0.00 (-)	0.00 (-)	0.30 (0.51)
Hard Coral	*Pocillopora ligulata*	0.00 (-)	0.00 (-)	0.00 (-)	0.00 (-)	0.44 (0.77)	0.44 (0.77)	0.15 (0.26)
Hydroid	*Pennaria disticha*	0.00 (-)	0.00 (-)	0.00 (-)	0.00 (-)	0.44 0.77)	0.00 (-)	0.07 (0.13)
Hard Coral	*Pocillopora eydouxi*	0.44 (0.77)	0.00 (-)	0.00 (-)	0.00 (-)	0.00 (-)	0.00 (-)	0.07 (0.13)

Table 5: Sea Urchin (Tripneustes gratilla) density

Site	Number (per 150 m^2)	Density (no. m^{-2})
1	20	0.1333
2	5	0.0333
3	1	0.0067
4	0	0.0000
5	0	0.0000
6	0	0.0000
Mean	4.33	0.0289

Figure 2: Percent cover of major benthic groups at the six survey sites around Laʻau Point. Mean represents values of three transects at each site.

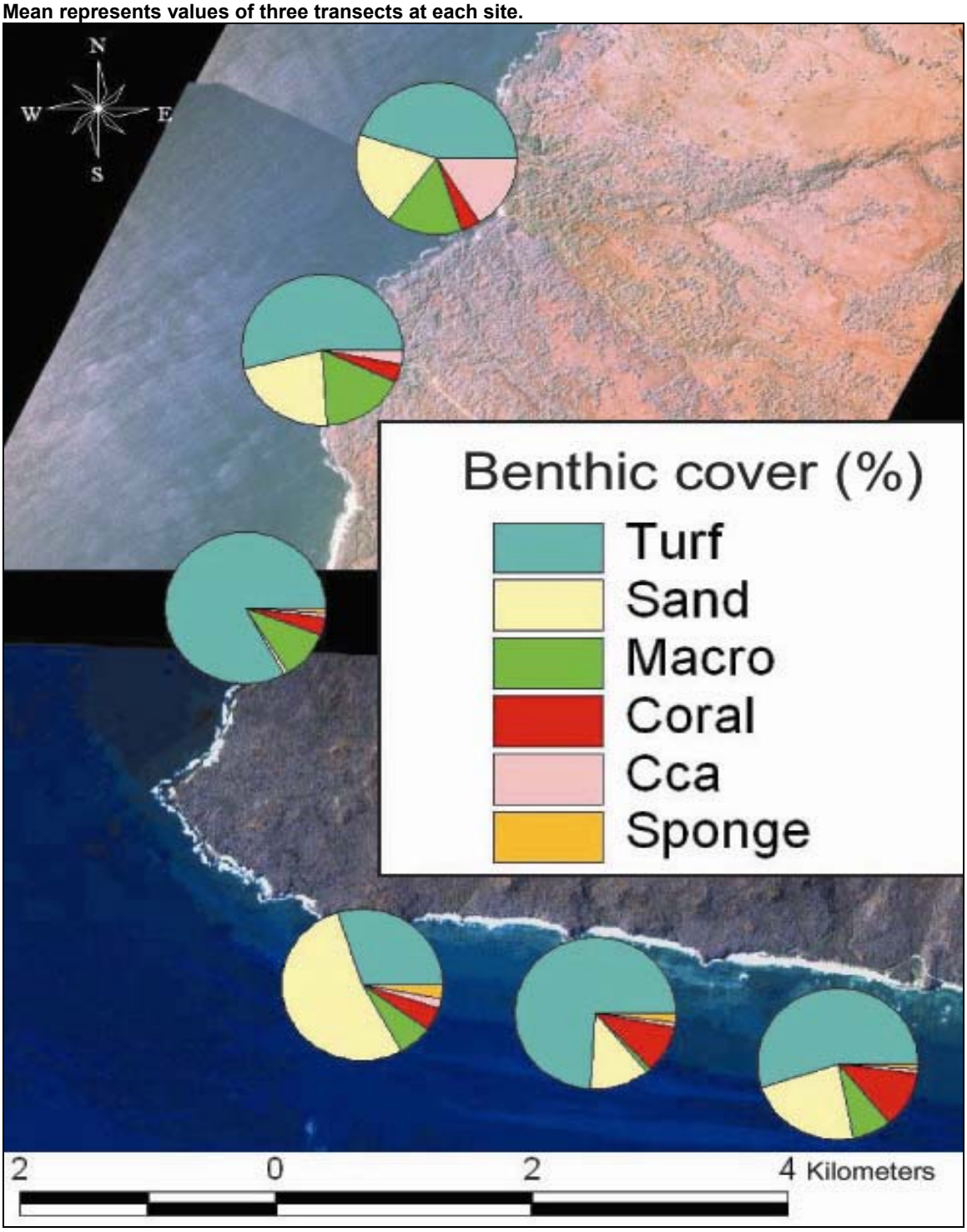


Figure 3: Percent live hard coral cover at the six survey sites around Laʻau Point. Mean represents values of three transects at each site.

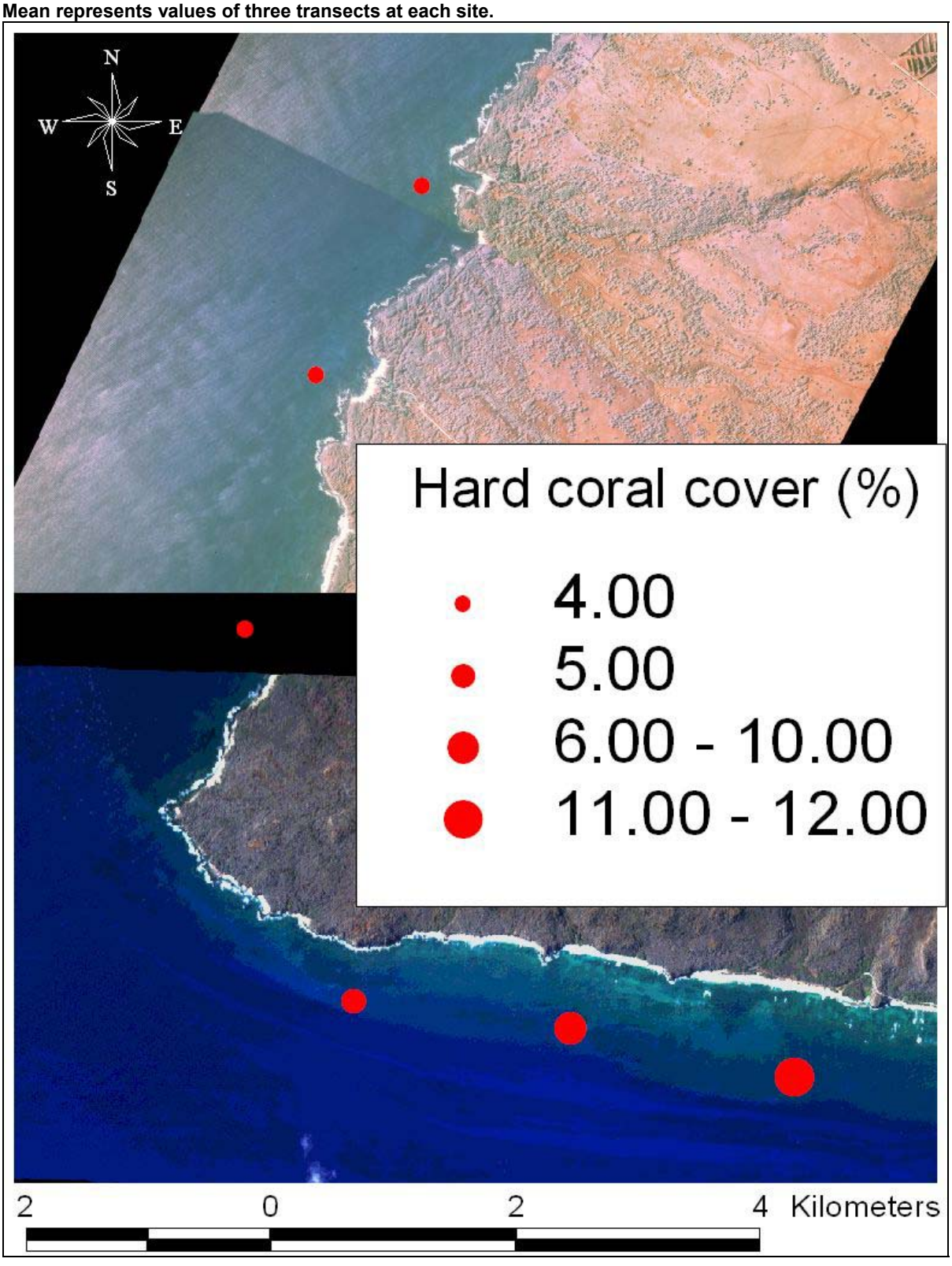
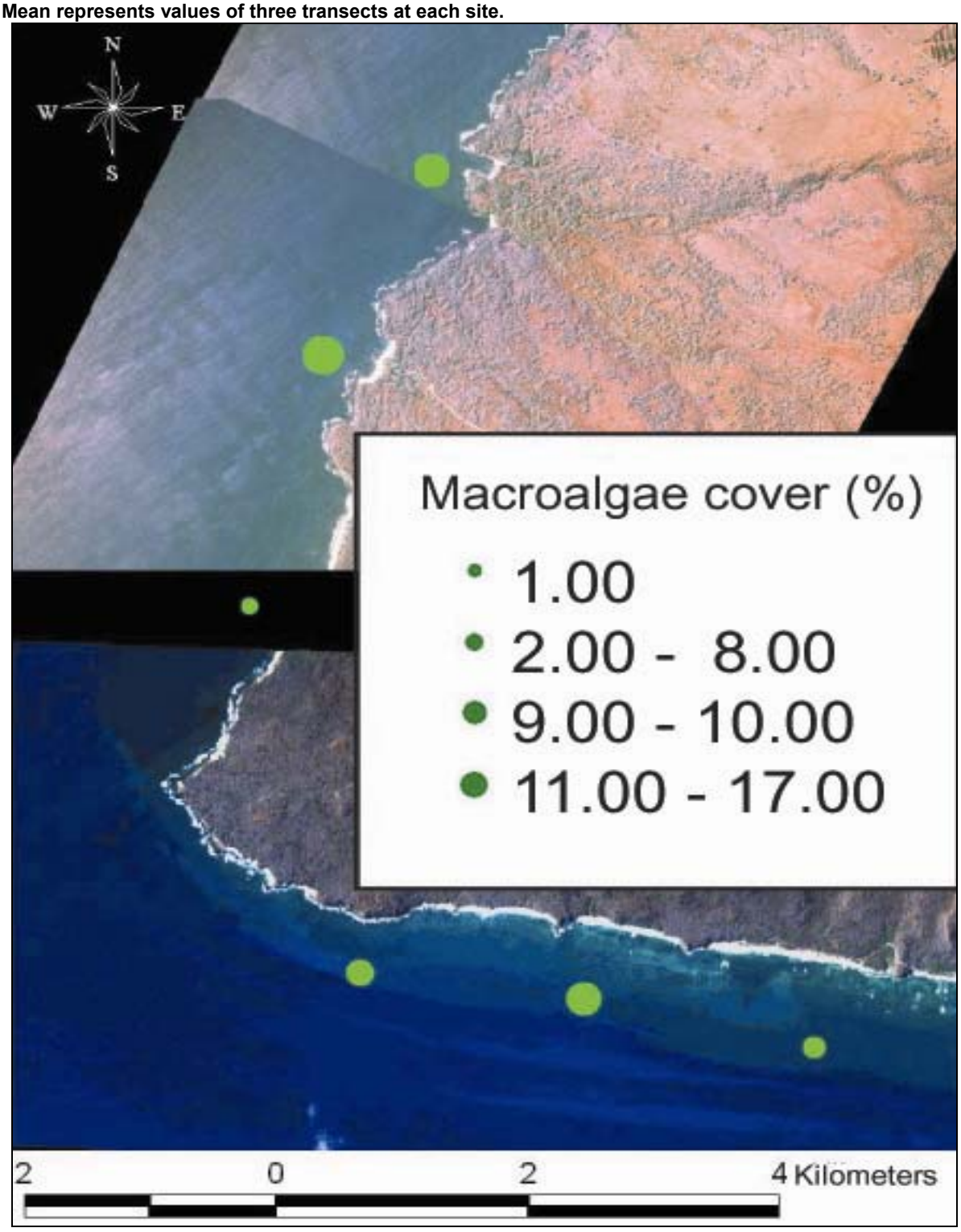


Figure 4: Percent macroalgae cover at the six survey sites around Laʻau Point. Mean represents values of three transects at each site.



1.3.3 Fish Assemblage Characteristics

Numbers of individual fishes per transect were 20% higher north than east of La'au Point (Table 5, Figure 6). Diversity, evenness, and species richness were 59%, 55%, and 9% higher, respectively, north of the point as well (Table 5, Figure 5). Biomass, however, was more than 130% higher east of La'au Point (Table 5, Figure 7). Site 3 had the lowest rank for all assemblage characteristics pooled while sites 5, 4, 2, and 1 had similarly high total rankings (Table 6).

Overall fish biomass was low. Small schools of surgeonfishes (manini – *Acanthurus triostegus, kala lolo – Naso brevirostris*, na'ena'e – *A. olivaceus)* comprised much of the weight of the assemblages. Secondary consumers (planktivores and triggerfishes) accounted for 50% of the fish biomass overall, followed by herbivores (43%), and apex predators (7%). Three of the six sites had no apex predators present. More than 30% of the biomass at site 1 consisted of apex predators, primarily a single island jack (ulua – *Carangoides orthgrammus*) and two individuals of the introduced peacock grouper (roi – *Cephalopholis argus*).

Table 6: Fish assemblage characteristics. Means (S.D.)

Site	Species	Number ha^{-1} (÷ 1000)	Biomass (t ha^{-1})	Diversity	Evenness
1	13.33 (3.79)	4.43 (2.54)	0.11 (0.11)	1.90 (0.61)	0.73 (0.17)
2	15.00 (5.57)	5.92 (2.70)	0.24 (0.18)	1.82 (0.67)	0.67 (0.17)
3	10.00 (1.73)	4.16 (0.56)	0.05 (0.01)	1.58 (0.11)	0.69 (0.02)
4	13.00 (4.00)	3.55 (1.45)	0.20 (0.15)	2.21 (0.27)	0.87 (0.01)
5	13.33 (4.04)	4.72 (2.00)	0.79 (0.50)	1.86 (0.16)	0.73 (0.04)
6	11.00 (2.00)	2.29 (1.17)	0.08 (0.06)	2.02 (0.14)	0.85 (0.12)
Grand mean	12.61 (3.52)	4.18 (1.74)	0.24 (0.17)	1.90 (0.33)	0.76 (0.09)

Table 7: Ranking of fish assemblage characteristics among sampling sites. Highest rank represents highest values for assemblage characteristics.

Site	Number	Biomass	Diversity	Evenness	Species Richness	Total rank
5	5	6	3	3	4	21
4	2	4	6	6	3	21
2	6	5	2	1	6	20
1	4	3	4	4	5	20
6	1	2	5	5	2	15
3	3	1	1	2	1	8

Figure 5: Fish species richness at the six survey sites around Laʻau Point.
Values = mean of three transects at each site.

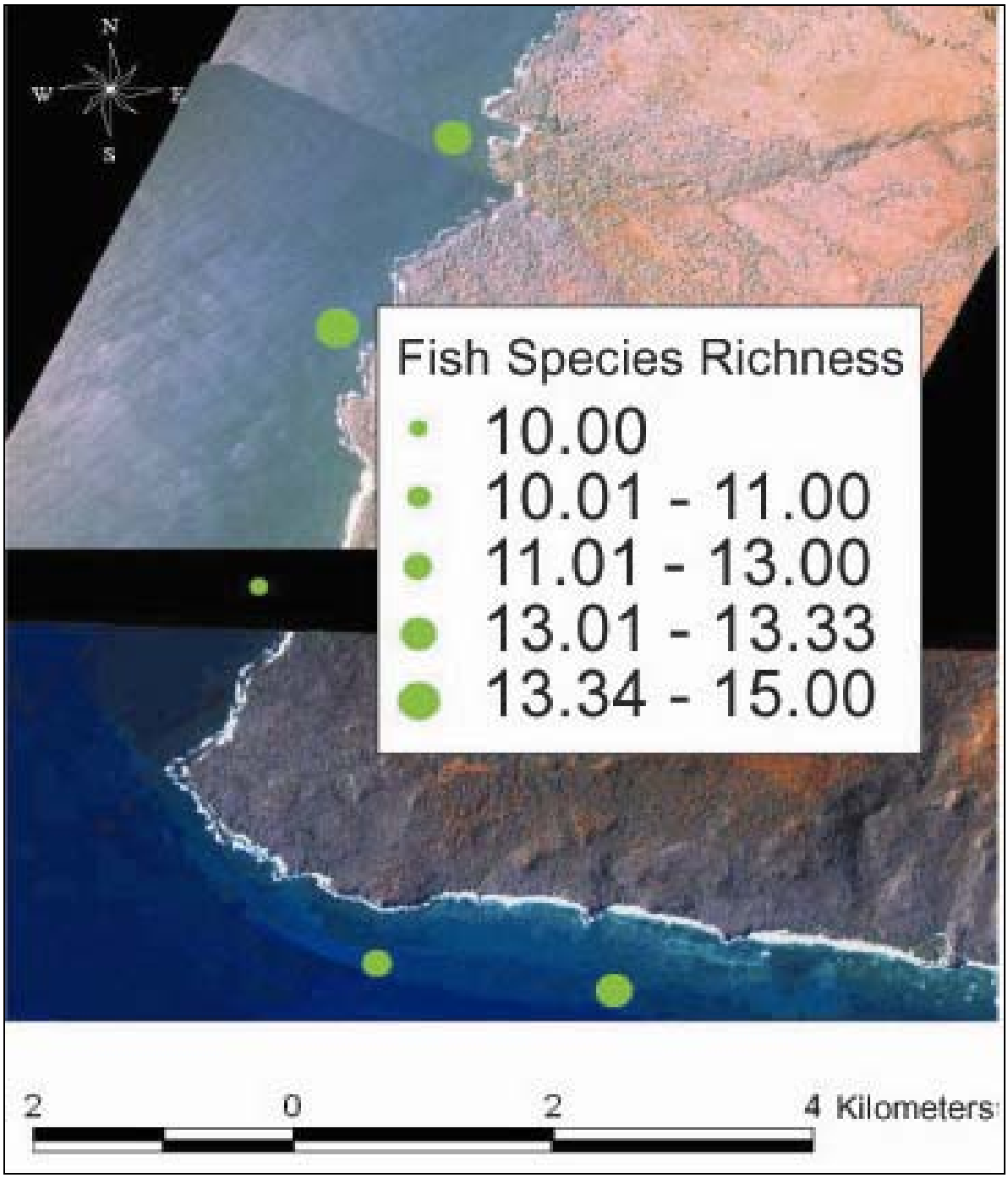


Figure 6: Fish numerical abundance at the six survey sites around Laʻau Point.
Values = mean of three transects at each site. Values are number of individuals (÷ 1000) ha^{-1}.

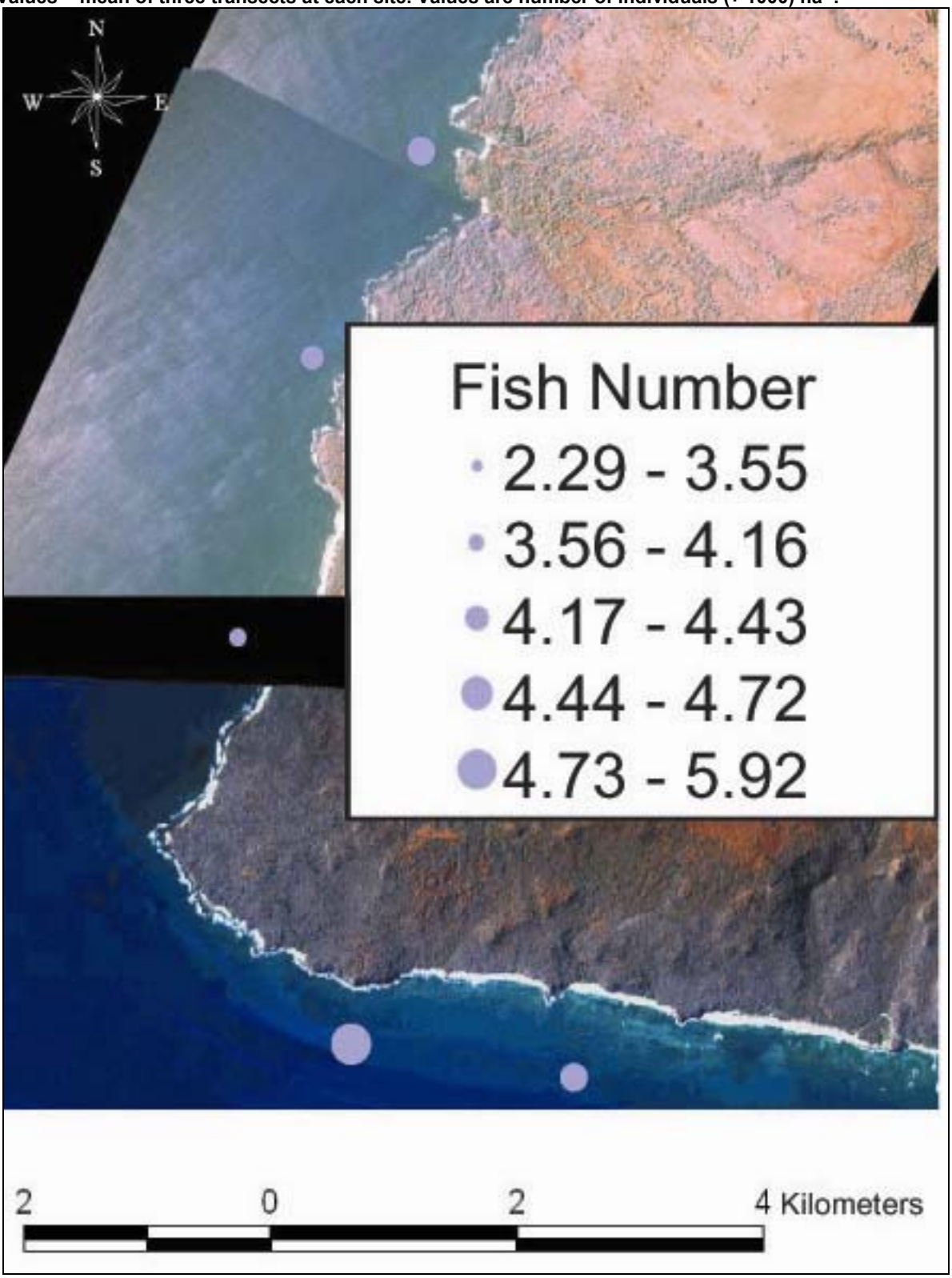


Figure 7: Fish biomass (t ha-1) at the six survey sites around La'au Point.
Values = mean of three transects at each site. Values are number of individuals (÷ 1000) ha^{-1}.

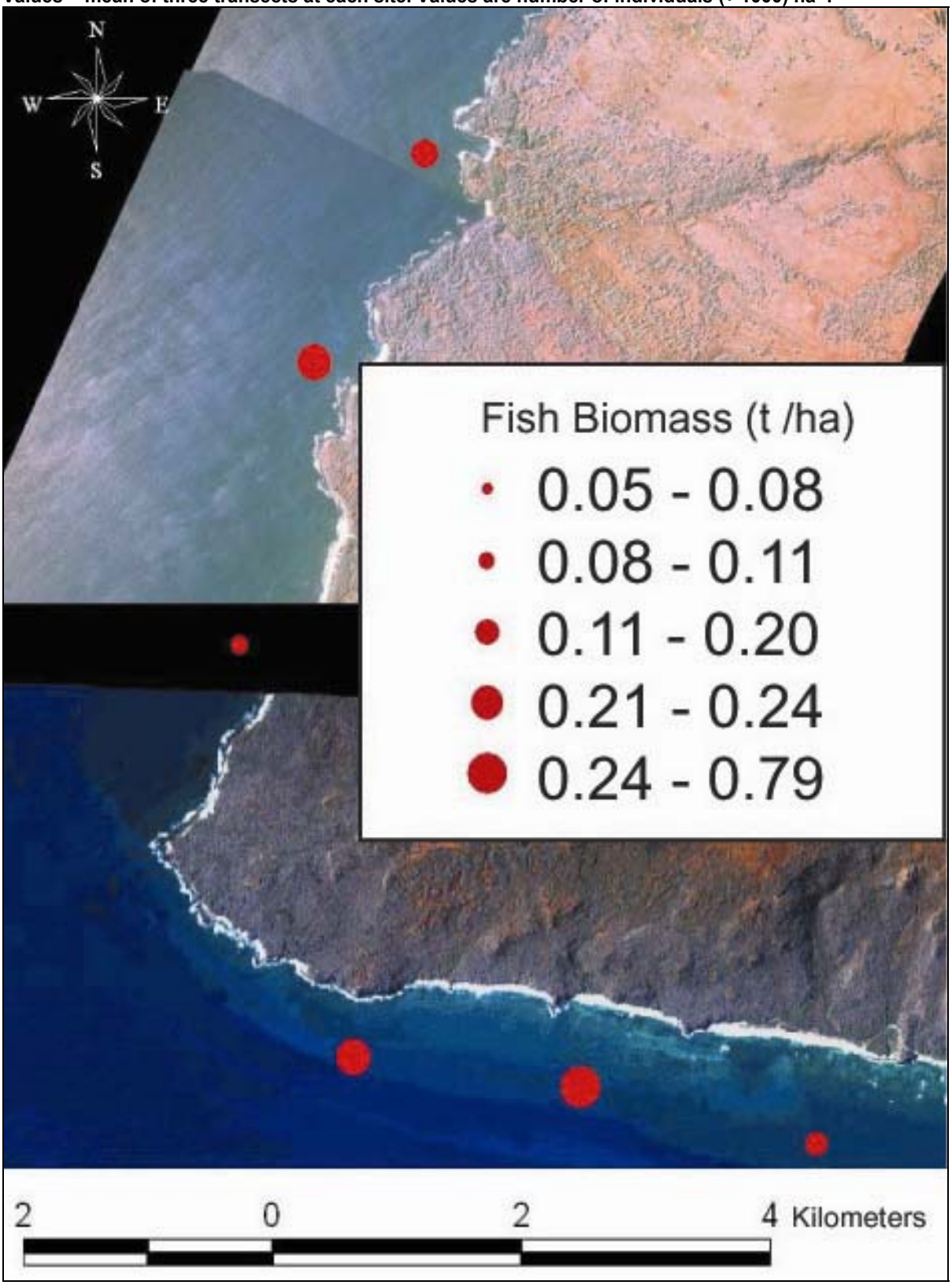


Figure 8: Mean fish diversity at the six survey sites around La'au Point.
Values = mean of three transects at each site.

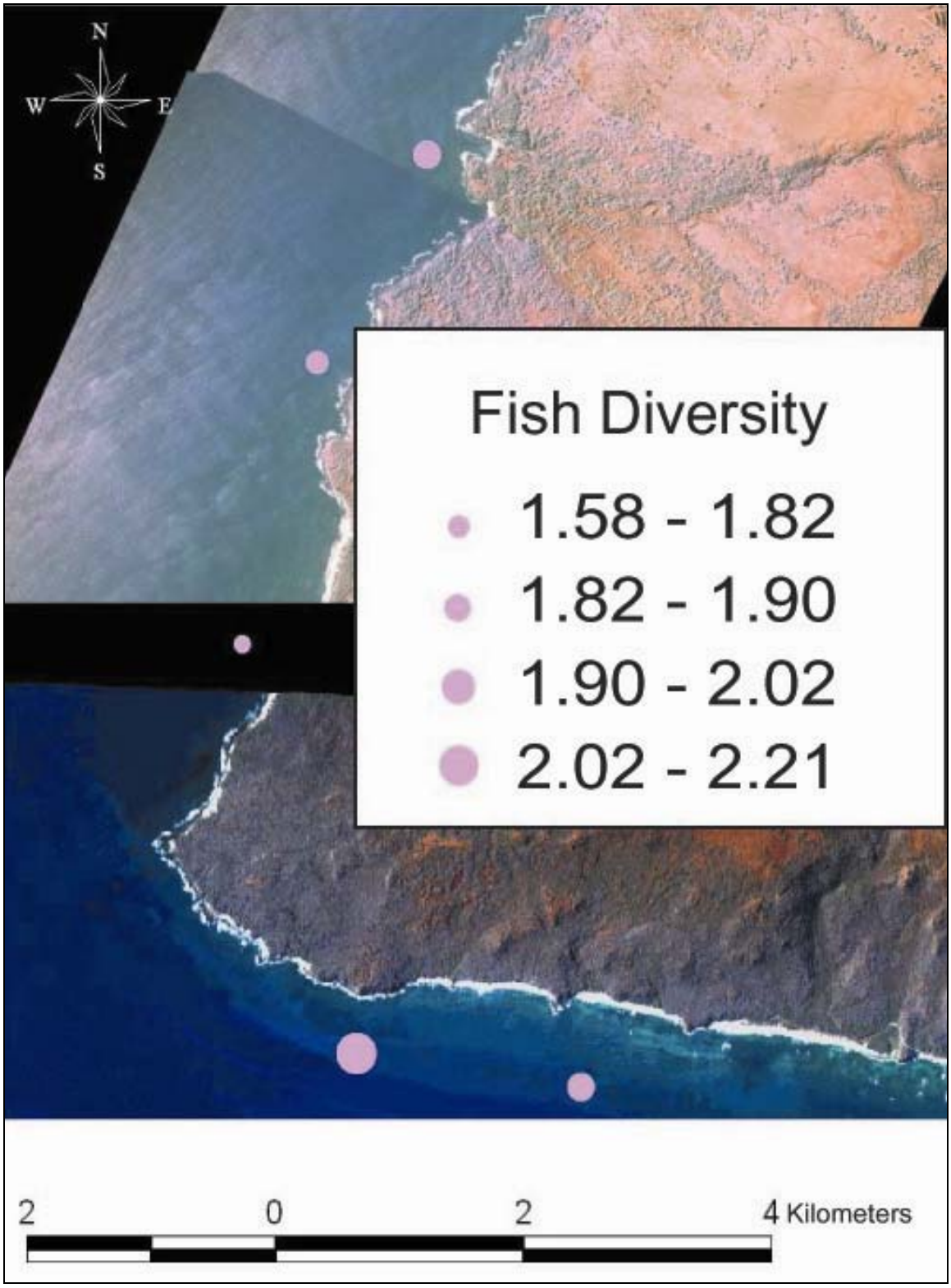
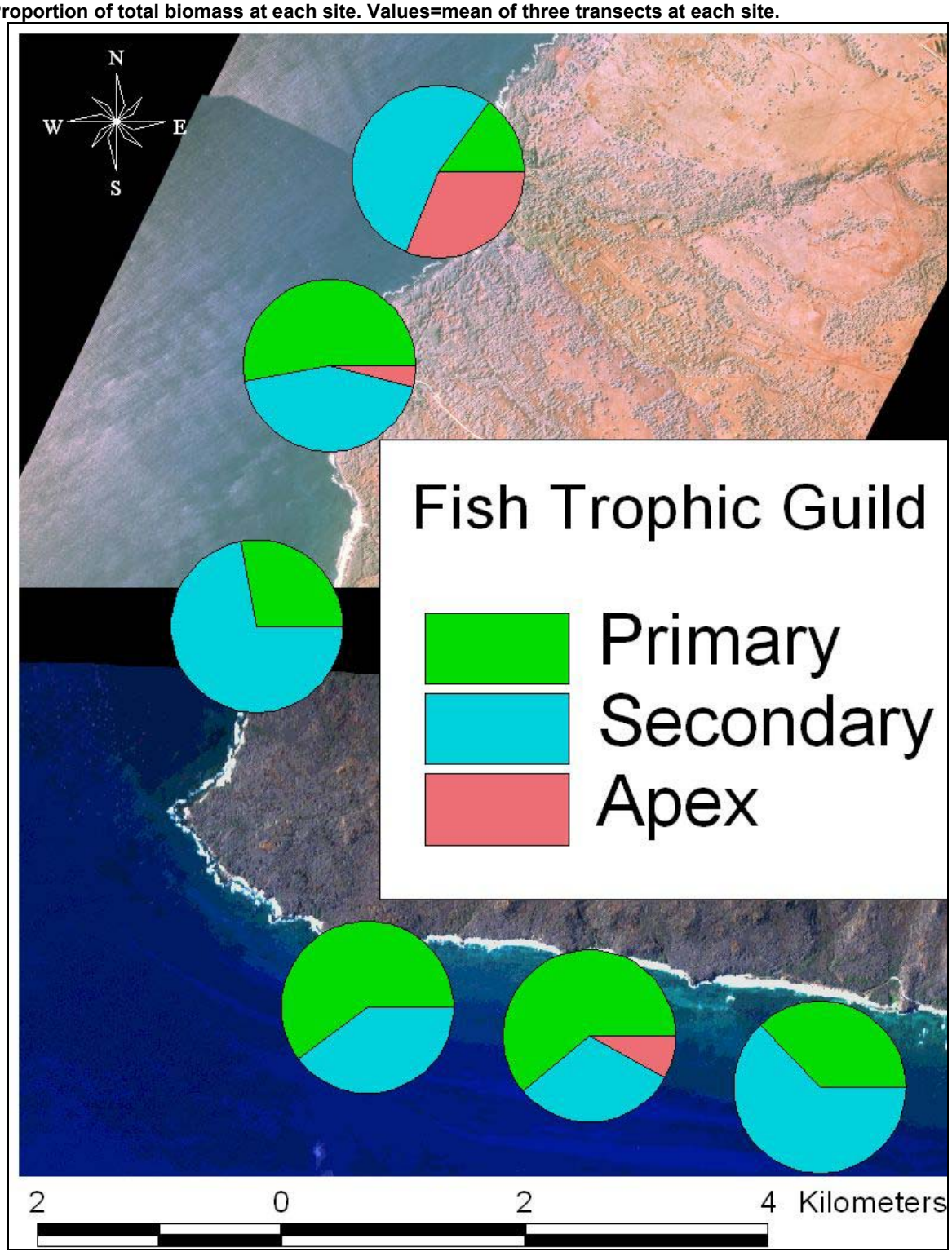


Figure 9: Fish trophic guilds at the six survey sites around Laʻau Point.
Proportion of total biomass at each site. Values=mean of three transects at each site.



1.3.4 Comparisons with Other Locations Around Hawaii

Benthic habitat characteristics described a typical wave-exposed, low-relief reef with generally low coral cover.

Table 8: Benthic components

Site	Coral cover (%)	Macroalgae cover	Source
La'au Point	6.30 (8.21 sd)	9.63 (9.20 sd)	This study
60 sites statewide	25.07% (21.8 sd)		Jokiel et al. 2004
30 sites in wave exposed habitats	20.67% (16.4 sd0		Jokiel et al. 2004

Fish assemblage characteristics at La'au Point were generally lower than average values reported from large-scale studies statewide (Table 8). Biomass was more than four times lower at La'au compared to no-take Marine Life Conservation Districts (MLCDs) and 42% lower than open access areas across multiple habitat types statewide. Diversity and evenness were the only assemblage metrics that showed similar or greater values at La'au.

Anecdotal information from fishermen (including our dive charter boat captain) report that the westernmost tip of La'au Point harbors lobster populations and serves as productive fishing ground for ulua (giant trevally; *Caranx ignobilis*). However, strong currents and swell conditions during this baseline survey period precluded our diving in this area.

Table 9: Comparison of fish assemblage characteristics between La'au Point and recent large-scale surveys conducted around the main Hawaiian Islands. Means with standard deviations in parentheses.

Site	Species	Number ha^{-1} (÷ 1000)	Biomass (t ha^{-1})	Diversity	Evenness	Source
La'au Point	12.61 (3.52)	4.18 (1.74)	0.24 (0.17)	1.90 (0.33)	0.76 (0.09)	This study
All MLCDs	19.10 (7.44)	9.70 (6.42)	0.87 (0.91)	2.11 (0.50)	0.75 (0.12)	Statewide MLCDs Friedlander et al. 2006
Open areas adjacent to all MLCDs	13.84 (7.94)	7.22 (6.53)	0.34 (0.38)	1.77 (0.68)	0.72 (0.22)	Statewide MLCDs Friedlander et al. 2006
No-take MLCDs	24.98 (4.65)	11.70 (4.81)	1.27 (0.42)	2.52 (0.25)		Friedlander et al. 2003
Open areas	17.60 (4.65)	8.98 (4.68)	0.57 (0.10)	2.15 (0.25)		Friedlander et al. 2003
Wave exposed open areas	17.75 (5.65)	10.73 (5.74)	0.	2.15 (0.35)		Friedlander et al. 2003

Note:
Friedlander et al. 2003 = 56 sampling locations (239 transects) on Kauai, O'ahu, Maui, Moloka'i, Lanai, Kahoolawe, and Hawai'i.
Friedlander et al. 2006 = 973 transects along the coasts of O'ahu, Maui, Lanai, and Hawai'i

1.3.5 Summary

Six representative sites offshore of the vicinity of the proposed residential community at Laʻau Point, southwest Molokaiʻi, were characterized to serve as a baseline for comparison with future surveys.

At the time of these surveys (November, 2005), fish diversity and biomass, and coral diversity and cover, were fairly low at the selected sites, reflecting a generally typical, low-relief, wave-structured, shallow water habitat. These sites are exposed to high wave energy, moderate sand movement/scour, and fairly low fishing pressure relative to other nearshore areas in the main Hawaiian Islands.

2. Water Quality Baseline

2.1 Methods

Baseline water quality measurements were made on November 19 and 20, 2005 in conjunction with the marine biological surveys at six stations around La'au Point, three south of the point and three west of the point. *In situ* measurements were made at five-foot intervals through the water column with a YSI Model 85 water quality meter. Parameters measured included temperature, salinity, dissolved oxygen concentration, percent oxygen saturation, conductivity, and specific conductance. Conductivity and specific conductance were used to post-calibrate the conductivity sensor against a YSI secondary standard solution of 50,000 microsiemens/cm ±1% at 25°C. Salinity values were corrected as necessary, based on the conductivity calibration.

At each station, discrete water samples were collected on replicate casts with a horizontal Van Dorn bottle from a depth of approximately 15 feet. The collection depth varied somewhat between stations because variable water currents caused some differences in the line angle at different stations. The lack of vertical stratification in water quality parameters through the water column, however, rendered inconsequential any resulting minor differences in sampling depth. Water samples were stored on ice until delivery to Hawaii Food and Water Testing for analysis of turbidity, pH and total suspended solids concentrations.

2.2 Results

The water column at every station was clear; the bottom was visible at our anchorages in 25-35 feet of water. Winds were light and from the south to southwest on both days, with the second day being somewhat calmer. Swells were generally small and the tide was ebbing throughout sampling. Water quality results are shown in Table 10.

No significant stratification of the water column was seen in the temperature or salinity data. Water temperature varied over a narrow range from 25.7 °C to 26.4 °C over all stations and depths, with surface temperatures rising slightly over the sampling period. The applicable State standard is that "temperature shall not vary more than one degree Celsius from ambient conditions." This standard is really intended to limit the thermal impacts of discharges; the natural ambient temperature, whatever that may be, is the standard, so by definition natural baseline conditions cannot be in violation of the standard.

Salinity varied even less, generally being in the 34.4 ppt to 35.0 ppt range. With the single exception of Station 1 at the surface, all sampling points were within the very narrow range 34.8 ppt to 35.0 ppt. The applicable State standard is that "salinity shall not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors. Like the temperature standard, the salinity standard is defined in terms of natural ambient conditions, and baseline conditions cannot be in violation of the standard, by definition.

Dissolved oxygen (DO) concentrations were generally slightly higher at the surface, but sometimes showed a near-bottom maxima, presumably due to algal production. DO concentrations averaged around 90% saturated. The applicable State standard for dissolved oxygen is "not less than seventy-five per cent saturation," and was not violated at any sampling location.

Total suspended solids concentrations were low, varying between 1.0 and 1.5 mg/l. Turbidity values varied over a narrow range, 0.33-0.39 NTU. The geometric mean of all samples is 0.36 NTU. These values are low, but they would exceed the State standard for "dry" open coastal waters – which is that the geometric mean is not to exceed 0.20 NTU.

pH values ranged from 8.1-8.2. The limit of detection of the instrument used is ±0.1 unit, so these values are essentially constant. The applicable State water quality standard is that "pH units shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain or groundwater discharge may depress the pH to a minimum level of 7.0." Values were thus within the State standard.

Table 10: Baseline Water Quality Data, Laʻau Point, Molokaʻi

Station No.	Date	Start Time	Depth (ft)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Saturation)	Total Suspended Solids (mg/l)	Turbidity (NTU)	pH
1	11/20/05	1020	0	25.8	34.4	5.91	89.2			
			5	25.8	34.8	5.82	86.5			
			10	25.7	34.9	5.81	86.0			
			15	25.7	34.9	5.89	88.1	1.3	0.39	8.2
			20	25.7	35.0	5.92	87.7			
2	11/20/05	1145	0	25.8	34.9	5.85	89.5			
			5	25.8	34.9	5.90	88.6			
			10	25.7	35.0	5.94	88.6			
			15	25.7	35.0	5.98	88.7	1.0	0.35	8.2
			20	25.7	35.0	6.08	88.3			
3	11/20/05	1330	0	26.0	34.7	6.65	97.7			
			5	25.9	35.0	6.09	90.6			
			10	25.9	35.0	6.21	92.5			
			15	25.9	35.0	6.22	92.4	1.0	0.33	8.2
			20	25.9	35.0	6.27	94.2			
4	11/19/05	1030	0	26.0	34.9	6.04	88.7			
			5	26.1	34.9	5.93	88.9			
			10	26.1	34.9	5.99	88.6			
			15	26.1	34.9	6.07	90.3	1.3	0.36	8.2
			20	26.1	34.9	6.09	90.4			
			25	26.1	35.0	6.01	91.3			
5	11/19/05	1250	0	26.2	35.0	6.06	92.0			
			5	26.2	35.0	5.95	88.3			
			10	26.2	35.0	5.91	87.8			
			15	26.2	35.0	5.88	87.1	1.5	0.36	8.1
			20	26.1	35.0	5.90	87.0			
6	11/19/05	1445	0	26.4	34.9	6.20	94.1			
			5	26.3	35.0	6.16	91.6			
			10	26.3	35.0	6.10	92.0			
			15	26.3	35.0	6.08	88.7	1.5	0.37	8.1
			20	26.3	35.0	6.09	91.5			

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3. Post-Storm Event Water Quality

3.1 Background

The following excerpts from the National Weather Service Forecast Office report entitled "Unprecedented Extended Wet Period Across Hawaii,"[1] summarize conditions preceding the post-storm sampling:

> *Normally during March, Hawaii will see several strong trade wind events and shear line passages with considerable rainfall over the windward, or north- and east-facing slopes of the islands. Instead, March 2006 brought only 5 days of low level winds from a trade direction with the remainder being from the southeast through southwest due to the persistent pattern of low pressure to our west. It was not a single low that persisted for nearly 7 weeks, but rather a series. A particular low would last for a few days and weaken and then give way to a developing new low as a shortwave would drop into the persistent upper level trough and provide additional energy to the system and create another "Kona Storm." When this occurred, strong southwest winds aloft would extend as far south as 5 degrees north latitude, tap into the deep tropical moisture and transport it over the state. This moisture, combined with the instability in the atmosphere would produce another round of thunderstorms and heavy rains. …*
>
> *March 19. A strong shortwave embedded within the upper level trough swept across the state. This system hit Oahu the hardest with strong thunderstorms dumping 3 to 5 inches of rain, mostly in a 6-hour period between 8 AM and 2 PM.*
>
> *March 21-25. Several more shortwaves. This latest round of unpleasant weather featured strong dynamics and instability, very similar to those found in the Midwestern U.S. during tornado season…heavy rains did continue with flash flood warnings issued daily from March 21 through 24. On the night of March 22, an area of thunderstorms moved over Honolulu from the southwest resulting in flash flooding….Thunderstorm activity shifted eastward and impacted Molokai on the morning of March 23. These storms dropped over 2 inches of rain within a 3-hour period…. Another round of fast-moving thunderstorms swept over Honolulu and east Oahu during the evening of March 23….*

Preliminary National Weather Service climatological data for station "Molokai" (21° 8'N; 157° 6'W)[2] show 4.52 inches of rain in the five days preceding sampling, with half of that received on the day before sampling. Prior to these events, most of the unusual March rainfall over the state occurred on Kauai and Oahu. With the shift of heavy rain eastward to Moloka'i, we quickly mobilized to conduct the post-storm sampling event. Subsequent days produced even more rainfall over Moloka'i, and coastal water quality may have deteriorated further from what is reported here.

[1] http://www.prh.noaa.gov/hnl/pages/events/weeksrain/weeksrainsummary.php
[2] http//www.nws.noaa.gov/climate/getclimate_nonjs.php?wfo=hnl

3.2 Methods

Water quality measurements were made on March 24, 2006 at the same six stations around La'au Point that were sampled earlier. Once again, i*n situ* measurements were made at five-foot intervals through the water column with a YSI Model 85 water quality meter. Parameters measured included temperature, salinity, dissolved oxygen concentration, percent oxygen saturation, conductivity, and specific conductance. Conductivity and specific conductance were used to post-calibrate the conductivity sensor against a YSI secondary standard solution of 50,000 microsiemens/cm ±1% at 25°C. Salinity values were corrected as necessary, based on the conductivity calibration.

At each station, discrete water samples were collected on replicate casts with a horizontal Van Dorn bottle from depths of approximately 5 and 15 feet. The collection depth varied somewhat between stations because variable water currents caused some differences in the line angle at different stations. The somewhat surprising lack of vertical stratification in water quality parameters through the water column, however, rendered inconsequential any resulting minor differences in sampling depth. Water samples were stored on ice until delivery to Hawaii Food and Water Testing for analysis of turbidity, pH and total suspended solids concentrations. Nutrient samples (phosphate, total phosphorus, nitrate plus nitrite nitrogen, ammonia nitrogen and total nitrogen) were processed by Marine Analytical Specialists.

3.3 Results

Winds were light and from the southeast. Swells were generally small and the tide was rising to a very low high (~0.5 feet) at about 1 PM. Along the west coast of Moloka'i, north of La'au Point, fingers of "red water" extended away from gulch mouths and were interspersed with areas of visibly cleaner water. Nearer to shore the red water was nearly continuous. East of La'au Point, a fairly narrow (on the order of 100 yards wide) plume of red water was being held against the shore and pushed westward by the southeast winds. The plume was deflected offshore by the Hale o Lono Harbor breakwater, creating a fairly clean area in the wake of the breakwater west of the harbor. Once past the harbor, the plume returned to the shoreline. At Station 5, however, there were two bands of red water, one at the shoreline and one about 200 yards offshore, separated by a band of visibly cleaner water. This general pattern of red water distribution was confirmed from the air on the flight back to Honolulu.

Water quality results are shown in Table 11. Despite the influx of runoff through the various gulches along the study area, only a very slight indication of stratification of the water column was seen in the temperature and salinity data, and this was mostly at Station 1. Water temperature varied over a narrow range from 24.4 °C to 25.2 °C over all stations and depths, with surface temperatures rising slightly over the sampling period. As explained in the previous section, the State standard for temperature is "ambient," so by definition, there were no violations.

Salinity throughout the study area varied from 34.1 ppt to 35.0 ppt, with the lowest value again being recorded at the surface at Station 1. The maximum salinity dilution seen at the surface (Station 1) was about 1.5% of the value at depth. The applicable State standard is that "salinity shall not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors. Like the temperature standard, the salinity standard is defined in terms of natural ambient conditions, and there were no violations.

Dissolved oxygen (DO) concentrations were generally slightly higher at the surface, but sometimes showed an increase near the bottom, presumably due to algal production. This was especially true at Station 5, where slight super-saturation was observed at depth. DO concentrations ranged from about 91% to about 101% saturated. The applicable State standard for dissolved oxygen is "not less than seventy-five per cent saturation," and was not violated at any sampling location.

Total suspended solids concentrations were on the order of twenty times greater in the post-storm samples than in the baseline samples. Mean values of two samples per depth ranged from 19.4-30.2 mg/l. The highest values were recorded at Station 1, but there were no consistent trends with depth or station location.

Turbidity values varied from 0.43 to 1.27 NTU at Stations 2-6, but were more than an order of magnitude greater at Station 1 (29.9-30.2 NTU). The geometric mean (which decreases the influence of extreme values compared with an arithmetic mean) of all samples is 1.19 NTU. These values would exceed all nominal State criteria for "dry" open coastal waters, however, the criteria are presented in terms of the percentage of time the criterion is exceeded. For example, turbidity is not to exceed a value of 1.00 NTU more than two per cent of the time.

pH values ranged from 8.1 to 8.3, well within the applicable State water quality standard.

Concentrations of nutrients at the six stations for shallow (5 feet) and deep (15 feet) casts are shown in Table 12, along with the applicable water quality criteria. The water quality criteria are based on geometric mean values, and three values are given for each criterion: not to be exceeded by the geometric mean, not to be exceeded more than ten per cent of the time, and not to be exceeded more than two percent of the time. Geometric means were calculated by station and depth, and by parameter using all stations and depths. There is no standard for phosphate-phosphorus in open coastal waters; this parameter is included for reference only.

Values for total phosphorus were fairly constant over the study area, ranging from a low of 10.85 µg/l to a high of 12.09 µg/l. There were no apparent trends with depth or station location. These values are within the range expected for open coastal waters in Hawaii. Geometric means by station varied from 11.31 µg/l at Station 6 to 12.09 µg/l at Station 4. The geometric mean for all stations and depths combined was 11.75 µg/l. None of these geometric mean values exceeded the total phosphorus criterion of 16.00 µg/l.

Values for nitrate plus nitrite nitrogen were relatively more variable than those for phosphate and there was a consistent pattern of higher values in the shallow sample than the deep sample at every station. The geometric mean value by station was highest at Station 6 and lowest at Station 4, with no consistent trend through the study area. Geometric means exceeded the criterion of 3.50 µg/l at all stations except 4 and 5. The overall combined geometric mean of 3.58 slightly exceeded the criterion. Typical baseline values in open coastal waters around Hawaii are in the range 1.2-1.7 µg/l.

Ammonia values were relative high. There was no consistent trend with depth, but there was a geographic trend. The highest geometric mean value was seen at Station 4, and values decreased with distance from this station. The overall geometric mean value of 4.28 µg/l was more than double the criterion of 2.00 µg/l. By station, only Station 6 had a geometric

mean below the criterion. That resulted from a very low value in the shallow sample. Typical baseline values in open coastal waters around Hawaii are in the range 1.8-2.1 µg/l.

Total nitrogen concentrations at every station showed the same trend with depth as did the nitrate plus nitrite values, lower concentrations in the deep samples, but no geographic trend was apparent. Geometric means by station and the combined geometric mean all exceeded the criterion of 110.00 µg/l, with the single exception of that at Station 5, which was just 0.12 µg/l below the criterion. However, the absolute concentrations of total nitrogen were not atypical of those found in open coastal waters around Hawaii, which are generally in the range 120-125 µg/l.

In summary, the waters around La‘au Point after a period of heavy rainfall showed relatively high concentrations of nitrate plus nitrite nitrogen and ammonia nitrogen. Concentrations of total phosphorus and total nitrogen, however, were not atypically high, although the latter did exceed the applicable state water quality criterion.

The following conclusions may be drawn with respect to the potential water quality impacts of the La‘au Point development. The marine waters surrounding La‘au Point experience episodic “red water” events following periods of heavy rainfall. Turbidity, suspended solids and nutrient concentrations may be significantly elevated during these events. Sediment delivery to coastal waters is exacerbated by soil loosened by natural causes, including the effects of deer and livestock transiting and foraging in upland areas. The return to baseline conditions after a storm event is aided by turbulent mixing from waves and advection by currents along this exposed coast. The coastal marine communities are adapted to this periodic influx of runoff as well as to occasional high surf and the resulting scour from moving sand and rocks. Coral cover in particular is low and the low relief of the substratum provides limited fish habitat.

It is likely that sediment discharge from runoff to the ocean will be significantly less with the La‘au Point development compared with existing conditions. This is because the Master Plan for the La‘au Point Residential Community contains several elements that will protect nearshore waters from increased degradation of water quality. These include drainage control systems, CC&Rs to regulate the use of fertilizers and pesticides, re-vegetation as a means of permanent erosion control measures throughout the developed areas, and livestock fencing to keep deer and livestock from disturbing the soil near the community. Therefore, it is likely that the long-term water quality in adjacent coastal waters will be improved by these measures.

Potential short-term impacts of construction on marine waters can be mitigated by implementation of best management practices to control drainage and mitigate erosion from grading.

Table 11: Post-Storm Water Quality Data, Laʻau Point, Molokaʻi

Station No.	Date	Start Time	Depth (ft)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Saturation)	Total Suspended Solids (mg/l)	Turbidity (NTU)	pH
1	3/24/06	0925	0	24.6	34.1	6.44	94.9			
			5	24.5	34.3	6.34	91.3	29.9	16.4	8.2
			10	24.5	34.4	6.35	92.2			
			15	24.4	34.5	6.35	92.1	30.2	15.3	8.2
			20	24.5	34.6	6.27	90.7			
2	3/24/06	1015	0	24.5	34.7	6.85	99.4			
			5	24.5	34.9	6.72	97.5	22.5	1.27	8.3
			10	24.5	34.9	6.65	95.5			
			15	24.5	34.9	6.62	95.1	21.7	1.17	8.3
			20	24.5	34.8	6.63	95.5			
3	3/24/06	1048	0	24.7	35.0	6.68	97.2			
			5	24.7	35.0	6.50	94.1	22.2	1.09	8.3
			10	24.6	35.0	6.75	98.6			
			15	24.5	35.0	6.82	98.8	19.4	0.55	8.3
4	3/24/06	1135	0	25.0	34.8	6.96	100.3			
			5	24.8	34.8	6.87	99.8	19.5	0.43	8.3
			10	24.8	34.8	6.85	99.5			
			15	24.8	34.8	6.84	99.3	19.5	0.48	8.3
			20	24.8	34.8	6.86	99.3			
5	3/24/06	1210	0	25.2	34.5	6.88	99.5			
			5	25.1	34.6	6.79	98.4	20.7	0.73	8.3
			10	24.9	34.6	6.92	101.3			
			15	24.9	34.6	6.87	100.8	26.9	0.58	8.3
			20	24.9	34.8	6.92	100.9			
6	3/24/06	1245	0	25.1	34.5	6.75	99.2			
			5	25.1	34.5	6.65	97.2	21.4	0.58	8.3
			10	25.1	34.5	6.68	97.6			
			15	25.1	34.7	6.72	98.9	20.9	0.68	8.3
			20	24.7	34.9	6.76	99.2			

Table 12: Post-Storm Nutrient Concentrations, La'au Point, Moloka'i

Station No.	Phosphate (µg/L)	Total Phosphorus (µg/L)	Nitrate+Nitrite Nitrogen (µg/L)	Ammonia Nitrogen (µg/L)	Total Nitrogen (µg/L)
1S	2.48	11.78	5.04	3.78	124.46
1D	2.17	12.09	3.92	4.48	120.26
Geometric Mean		11.93	4.44	4.12	122.34
2S	2.48	11.78	4.90	5.18	132.44
2D	2.48	11.47	4.34	4.06	121.80
Geometric Mean		11.62	4.61	4.59	127.01
3S	2.48	12.09	4.76	5.88	143.64
3D	1.86	11.47	2.94	3.64	123.48
Geometric Mean		11.78	3.74	4.63	133.18
4S	2.17	12.09	2.52	5.60	126.56
4D	2.17	12.09	1.40	7.00	121.38
Geometric Mean		12.09	1.88	6.26	123.94
5S	2.79	11.47	4.48	5.74	115.92
5D	2.48	12.09	2.10	6.44	104.16
Geometric Mean		11.62	3.07	6.08	109.88
6S	3.10	11.78	5.04	0.84	123.06
6D	2.48	10.85	4.48	4.06	108.08
Geometric Mean		11.31	4.75	1.85	115.33
Combined Geo Mean		11.75	3.58	4.28	121.71
Criteria		16.00	3.50	2.00	110.00

Shaded values exceed State water quality criteria.

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Appendix H

Archaeological Plans

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

February 13, 2007

Mr. Alan Suwa
PBR Hawaii
100 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawai'i 96813

LOG NO: 2007.0484
DOC NO: 0702NM10
Archaeology

Dear Mr. Suwa:

SUBJECT: **Chapter 6E-42 Historic Preservation Review (County/Molokai Properties Limited)**
Revised Data Recovery Plan Papohaku to Hakina Ahupua'a o Kaliako'i Island o Moloka'i (Majors, CLH, 2006)
West Moloka'i, Island of Moloka'i
TMK: (2) 5-1-002: 30; 5-1-006: 157; 5-1-008: 04, 03, 06, 07, 13, 14, 15, 21 and 25

Thank you for submitting the revised data recovery plan which is 875 acres for a residential community comprising of mixed residential uses, cultural preserves, parks and shoreline access.

Data recovery is to take place at the following sites: 697, 698, 743, 745, 746, 749, 755, 756, 758, 760, 761, 762, 1118, 1121, 1124, 1125, 1130, 1131, 1132, 1134, 1136, 1141, and 1145. Data recovery work is to include: relocation of these sites by GPS, mapping, testing and surface collections. Sites 761, 1125 and 1136 once relocated might be outside of the subdivision boundaries. We concur that if these three sites are outside the subdivision boundaries they will be preserved and included in an amended preservation plan which would include appropriate buffers around the sites.

This plan also mentions the road corridor survey and resurvey work. We recommend that this be completed as soon as possible.

Research questions on the data recovery will address land use in the settlement margins, agricultural practices, lithic production and mauka-makai routes. We concur with this framework for the research. Ideally the data recovery work shall take place prior to construction. To ensure that these sites are protected during construction and archaeological data recovery can take place, we recommend that all sites set for data recovery shall be marked by highly visible flagging tape.

This plan is approved. If you have any questions, please call Nancy McMahon, our Molokai Archaeologist at 808 -742-7033.

Aloha,

Melanie Chinen, Administrator
State Historic Preservation Division

NM:jen

c: Anthony Ching, State Land Use Commission P.O. Box 2359, Honolulu, HI 96804
OEQC, 235 S. Beretania St. Suite 702, Honolulu, HI 96813
Peter Nicholas, Molokai Properties Limited 745 Fort Street Mall, Suite 600, Hon, HI 96813
Mo Majors, Cultural Landscapes Hawaii

Papohaku to Hakina, Ahupua'a o Kaluako'i, Island o Moloka'i

(Portions of TMK 5-1-02-030, 5-1-08-4 through 15, -19, and -23)

Revised Archaeological Data Recovery Plan

Prepared for Molokai Ranch
by
Maurice Major, MA

Cultural Landscapes
9712 Overhill Road
Richmond, Virginia, 23229

www.culturallandscapes.net

May, 2006

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LĀʻAU ARCHAEOLOGICAL PLAN SUMMARY

The archaeological plans for Lāʻau include four sections for cultural resource needs that will arise in relation to 196 sites within the proposed development and preserves.[1] The plans are:

Preservation – Procedures for protecting and preserving 160 cultural sites. Actions range from the immediate to the perpetual, and include site condition evaluation, stabilization, short and long-term protection, protocol education, periodic field checks, and data collection. The focus is on conservation of cultural landscapes, rather than isolated sites.

Data Recovery – Procedures and research issues for mapping and excavation of 21-24 sites within the road/infrastructure corridor and proposed subdivision lots. Since the most significant sites are being preserved, data recovery sites mostly consist of very simple agricultural modifications, lithic scatters, and more recent historical sites. All sites will undergo data recovery or, more likely, preservation, and samples within sites will be more robust than minimal SHPD requirements.

Monitoring – Procedures and responsibilities for archaeological maka ʻala of development activity. In addition to ensuring that preservation areas are not damaged, monitoring detects previously unknown cultural deposits, and halts work in an area, to evaluate finds, and if necessary consult with SHPD and interested parties to establish a preservation buffer or recover data.

Burial Treatment – Procedures for dealing with known, suspected, and inadvertently discovered burial sites (with no revisions to the accepted 2001 plan). All burials will be preserved in place, and all sites of unknown function for which burial is a possibility will be preserved. Newly found burials trigger consultation with the Molokaʻi Island Burial Council.

Because the plans are interrelated, and important part of the general approach is to define the **process and sequence**. The past two years of community meetings can be considered the first phase, and with ongoing consultation helps define what happens next. The Ranch has committed to planning for the entire project area, to maintain or expand upon previous preservation commitments, and to have this revision include plans for all of the affected parcels including proposed subdivision lots, whose future owners must also abide by the plans. The process continues:

- Re-survey the road corridor to verify and augment site records, and search for new sites. Unexpectedly significant finds may cause re-routing. Also, the Papohaku Ranchlands section of the corridor will be described and reported at inventory level for SHPD review.
- Next, short-term preservation measures will be implemented, such as establishing protective buffers and emergency stabilization.
- Next, data recovery will be implemented. At the same time, implementation of long-term preservation measures will begin.
- During the course of construction, monitoring will occur.
- Final reports for each plan will be submitted for community feedback and submitted to SHPD for review as required by rules and statutes.

[1] 197 sites appear in Table I-1 because Sites 53 and 655 refer to the same site. 12 of the 196 lack integrity and significance and are not included in these plans.

The original version of this plan (*Kahaiawa to Hakina, Ahupua'a of Kaluako'i, Island of Moloka'i*, Major 2001) dealt with the former "Alpha USA" parcel (TMK 5-1-2-030). Since then, changes in the project area and the size and location of proposed subdivision lots have necessitated some revisions. More fundamentally, the Ranch's decision to engage the community in master planning has resulted in a scaled-back development with a more conservation-oriented approach, and the proposed land trust, resource management staff, and cultural protection zones have required that the preservation and data recovery plans be augmented and revised. For the most part, the archaeological plans closely resemble the 2001 version, which was accepted by SHPD. Changes in the revised version include:

- Re-assignment of several Data Recovery sites to Preservation.
- Shift from defining buffers around individual or clustered sites to instead establishing a confined development corridor.
- Increased emphasis on active cultural resource management, anticipating as a neighbor a community land trust employing a cultural resource staff person.

Recommendation to collect some data from preservation sites to provide a better baseline for monitoring and help expand our understanding of the chronology and nature of settlement in the area, and specifically to guide environmental restoration.

INTRODUCTION

Background

The cultural resource management plans contained in this volume represent the culmination of a process that has evolved over several years as the landowner's plans have altered, as the scope of planning has grown to encompass most of western Moloka'i, and as the community has become more deeply involved in the process. Despite this recent history of change, many elements of the plans remain as they were in 2001: preservation continues to be the most common treatment for archaeological sites, a process of verification and augmentation of existing inventory survey data precedes development activity, and procedures for preservation, data recovery, monitoring, and burial treatment remain much as they were in the original plans. And while the landowner and the community have engaged in far-reaching discussions about land use and resource management across a large portion of the island, this document focuses only on the southwest corner of the island in a portion of the *ahupua'a* of Kaluako'i.

A brief history of cultural resource management in this area clarifies some of the changes that have happened with regard to this set of plans (archaeological findings of previous studies appear in the following **History and Archaeology** section). Although information about sites had been reported sporadically during the 20th Century, and Catherine Summers (1971) had compiled this information along with her own field observations and research, explicit focus on sites as "cultural resources" to be preserved and otherwise managed did not occur until the 1980s, when Marshall Weisler (1984) undertook the systematic survey, recording, and evaluation of sites in portions of Kaluako'i. This work led to the establishment of the Southwest Moloka'i Archaeological District (Site 50-60-01-803, also referred to as the "SMAD"), a series of well-defined areas that were listed on the State and National Registers of Historic Places, and therefore afforded some protection against future development and alteration.

Several years later (in 1991), after the Japanese real estate company Alpha USA had purchased a 6,350-acre section of southwest Kaluako'i intending extensive development there, Bishop Museum performed archaeological survey of the parcel, producing an inventory extending in scope beyond the major sites recorded by Weisler, as well as significance evaluations and treatment recommendations for each site (Dixon and Major 1993). The majority of the nearly 600 recorded sites deserved further investigation or data recovery in the case of development plans that would have caused damage, a small number (due to more recent origin or very poor site integrity) were considered not significant, and 46 sites were recommended for permanent preservation. The inventory, evaluations, and recommendations were reviewed and accepted by the State Historic Preservation Division (SHPD) at that time.

A decade after the Bishop Museum survey, Alpha USA had sold the property and Cultural Landscapes was retained by the new owner to create a set of management plans for the property, including a Preservation Plan, a Data Recovery Plan, a Monitoring Plan, and a Burial Treatment Plan (Major 2001). These plans provided detailed procedures and site treatments for sites covered by the 1993 inventory report, and were intended to minimize and mitigate any impacts that a smaller subdivision would have on sites. Although the 1993 report recommendations served as the starting point, the new plans emphasized avoiding rather than mitigating impacts, and so the number of sites slated for preservation grew from 46

to 138, including all of the sites outside the proposed subdivision as well as those between the new lots and the ocean, a large preserve encompassing a settlement system from the shore to an inland quarry, and sites within the proposed subdivision amounting to an estimated 10 – 15% of the area within subdivision parcels.

Shortly after SHPD had reviewed and accepted the 2001 plan, the landowner decided to change the subdivision plan by altering the proposed access road alignment, in response to which Cultural Landscapes produced an addendum to the plans (Major 2002). Rather than having the road meet up with the existing road from Maunaloa town to Hale o Lono Harbor on the eastern edge of the parcel, there would be a single entry to the subdivision from the north, from an old subdivision known as Papohaku Ranchlands. (Of that subdivision, the affected lots would be TMK 5-1-08-4, -5, and -14). At that time, an archaeological reconnaissance had been carried out in the Papohaku subdivision for the Army, since the area had been a target range during and after WW II. Although this project produced some good maps and site descriptions (Burtchard and Athens 2000), its authors believed it would not meet inventory standards, and the client had not released the report or submitted it for SHPD review at the time of the Lā'au addendum. On the basis of a draft report recording 27 sites, five of which were in or near the proposed Lā'au subdivision access road, the 2002 addendum proposed inventory survey within 30 m of either side of the propose road centerline. These sites included one with habitation and agricultural features (Site 50-60-01-520), one habitation (Site 1784), one agricultural site (Site 1758), an isolated lithic artifact (Site 1760), and a possible burial (Site 1761); all except for 1760 had been deemed significant for their information content and recommended for inventory survey by Burtchard and Athens (2000). The 2002 addendum to the Lā'au plans suggested that all of these sites could be preserved in place, and recommended that fieldwork be done that would bring the records up to inventory standards, but also begin implementation of site preservation measures such as establishing protective buffers, avoidance, and stabilization (Major 2002). This plan has been integrated into the current revision.

The most recent period of cultural resource management has witnessed a new willingness on the part of the landowner to engage in master planning for all of their holdings and a greatly increased role for the community. In the past two years, a series of meetings with both the general public and of smaller committees composed of Molokai Ranch staff, representatives of various Hawaiian organizations, and interested members of the public have worked on plans to conserve and manage not just cultural resources, but biological and other natural resources as well. The Cultural Committee called on Cultural Landscapes to provide information regarding sites on Ranch lands, archaeological and regulatory concerns regarding cultural resources, and planning for a much-expanded preservation program. Besides further reducing the scope and potential impacts of development, this process sought to increase preservation as a cultural resource management goal by establishing a community land trust tasked with preserving natural and cultural resources within lands deeded to it, by creating conservation easements and cultural overlay districts on privately held land, and by writing codes, covenants, and restrictions for the proposed subdivision that would help preserve sites therein and establish procedures for a management partnership between the new population of subdivision dwellers and Hawaiians who have been on Moloka'i for generations.

The proposed changes in land use, a reduced footprint for the subdivision, and the new approach toward managing cultural resources necessitated this revision of the 2001 plans and the 2002 addendum. Many elements of the existing plans remain the same, and this set of plans simply adjusts the plans to fit the current situation. So while most of the procedures for archaeological measures remain the same, reconfigured boundaries make the status of some sites different; for example, the most recent subdivision plan, being smaller than before, changes the status of some sites from data recovery to preservation, and others from the more protection-oriented preservation of sites within subdivision lots to the avoidance-oriented preservation measures associated with sites outside of development areas. Responsibilities for implementation of some preservation measures have changed with the advent of greater community participation and the proposed establishment of a land trust employing a cultural resource staff person.

Given the more robust management program envisioned by the landowner and community, some measures have been added or augmented, such as: re-survey of development areas, use of GPS to increase site location accuracy, and an increased effort to identify and mark ancient trails. In response to community concerns, the landowner has committed to additional archaeological fieldwork in advance of the road corridor construction, leading to a reorganization of the work-flow envisioned in the 2001 plans. Namely, re-survey of the road corridor will be completed prior to fieldwork done strictly in relation to preservation and data recovery plans. Because the 1993 report (Dixon and Major, for TMK 5-1-02-030) completed the inventory, evaluation, and treatment recommendations for the subdivision parcel, and were approved by SHPD, road corridor fieldwork may be best considered as a "supplemental data collection," a type of archaeological investigation that exceeds the regulatory requirement, but which serves the landowner's and community's desire that final engineering and construction be based on an enhanced understanding of the archaeological sites in the proposed development corridor. Although this does not fit within the usual SHPD review process, a report will be prepared in case of any significant sites located during the new fieldwork, or if new information leads to revised significance evaluations or treatment recommendations. If, however, a known site is encountered during the supplemental survey, but the description does not change substantially, and does not lead to a re-evaluation of significance or different treatment recommendation, then whatever new information is collected will be reported in the preservation or data recovery report that follows those phases, depending on the status of the site.

For the parcels north of the parcel being subdivided (TMK 5-1-08-4, -5, and -14), road corridor survey will in fact constitute an inventory survey, and the data collected from those areas will be prepared as a normal inventory report with site significance evaluations and treatment recommendations, all of which will be submitted to SHPD for review according to the Hawaii Administrative Rules, section 13-13-276.

Perhaps the most profound change embodied in this revision, though, is change in outlook from the traditional practice of defining a site and surrounding it with a protective buffer to defining a development area and enclosing it within what the Cultural Committee came to call a "bubble." By reversing the approach from "Keep out of the fenced sites" to "Do not stray beyond the development corridor," the current plans should result in two major benefits: reduction of inadvertent archaeological finds, and increased preservation of cultural landscapes rather than site "islands" in a sea of development.

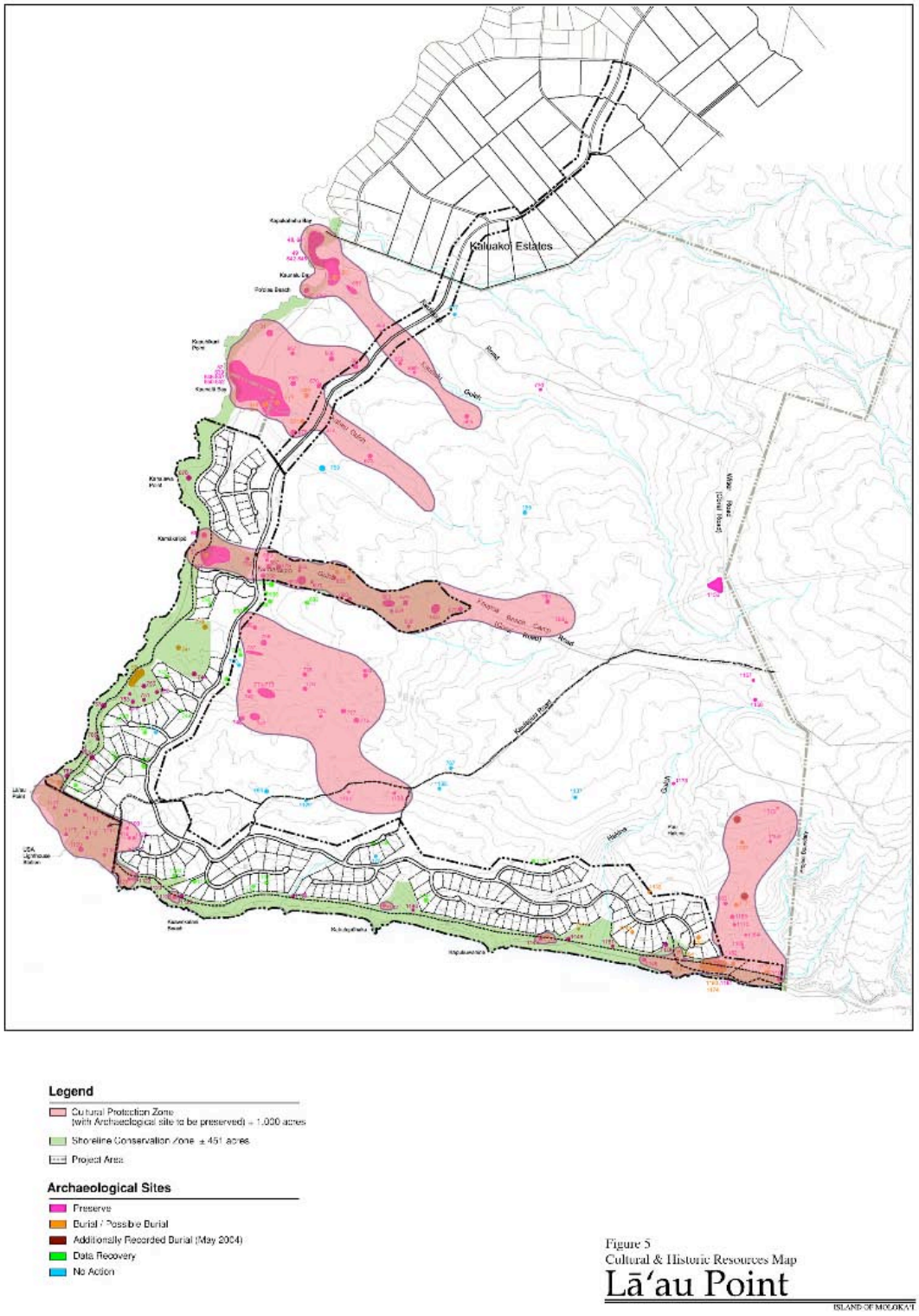
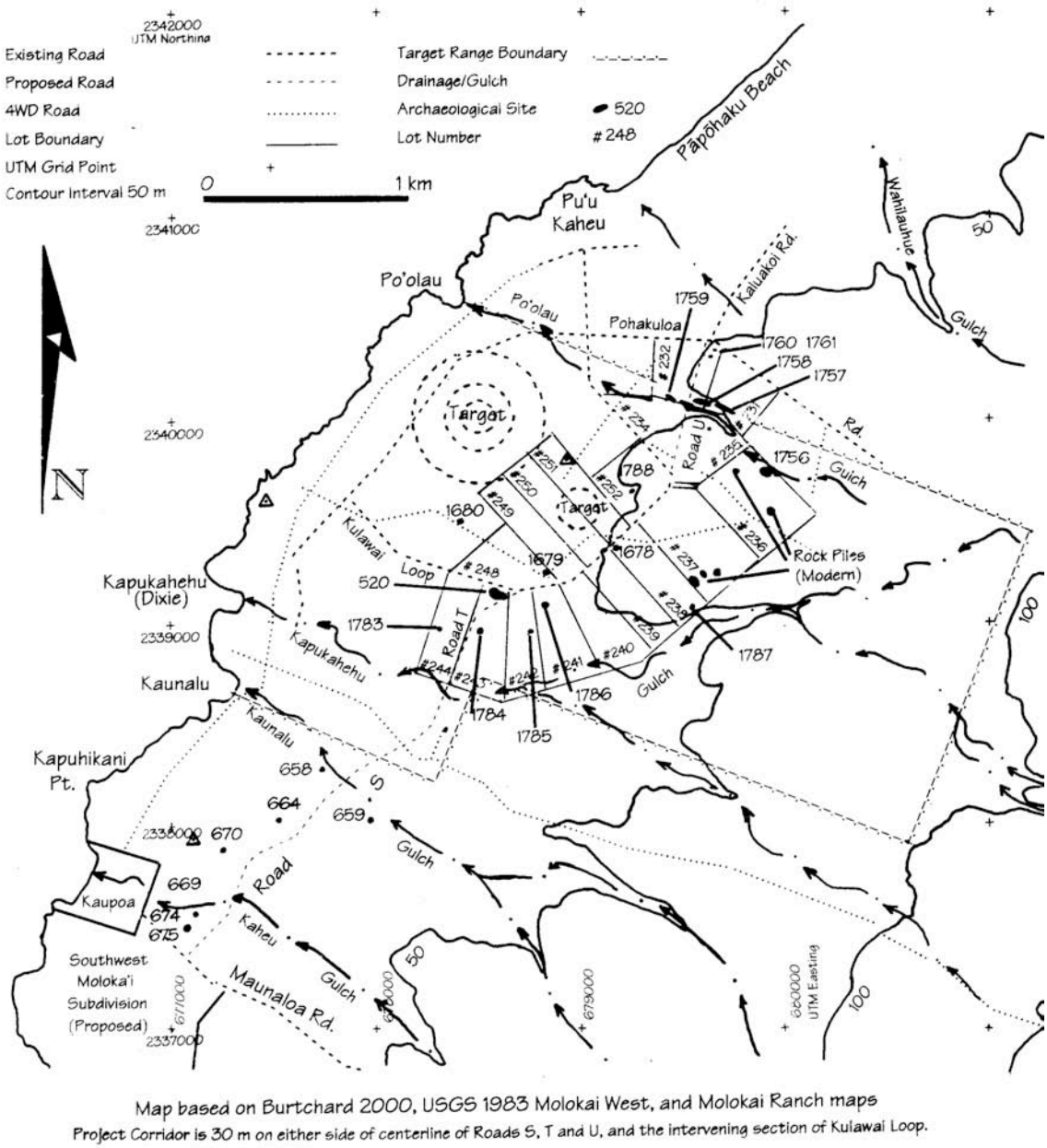


Figure I.1: Lā'au Subdivision Project area, Sites, and Cultural Protection Zones



Map based on Burtchard 2000, USGS 1983 Molokai West, and Molokai Ranch maps

Project Corridor is 30 m on either side of centerline of Roads S, T and U, and the intervening section of Kulawai Loop.

Figure I.2: Papohaku Ranchlands portion of Project Area

The physical scope of the cultural resource management plans in this volume remains limited to those portions of Kaluakoʻi *ahupuaʻa* that could be directly affected by the proposed subdivision (hereafter referred to as the "Lāʻau Subdivision"), rather than all of the lands affected by the recent community planning process. Specifically, the revised cultural resource plans focus on the 1,492-acre project area described in the Ranch's petition to the State Land Use Commission, which requests a 613-acre area to be changed from Agricultural to Rural designation, 10 acres from Conservation to Rural (for a park), and 252 acres from Agricultural to Conservation. In addition, this plan covers the "Lāʻau Mauka"

Rural Landscape Reserve, which corresponds to the remainder of the 6,350-acre parcel surveyed in 1991. All of the proposed Lā‘au Subdivision lots and most of the infrastructure derive from that original parcel (TMK 5-1-02-030), although development activity will affect only a limited portion—400 acres of house lots and 153 acres of roads, infrastructure and parks, or less than 10% of the original parcel area. Finally, the total acreage for the road and utility corridor leading into the Lā‘au Subdivision includes several lots in the older Papohaku Ranchlands subdivision. This volume proposes treatments for each of those subdivision lots where potential effects could occur (a total of approximately 15 acres), but does not encompass the entirety of Papohaku Ranchlands.

Because they concern separate actions in the State Historic Preservation Division administrative rules (the general process being described in Hawaii Administrative Rules 13-13-275), this volume presents Preservation (detailed in HAR 13-13-277), Data Recovery (HAR 13-13-278), Monitoring (HAR 13-13-279), and Burial Treatment (HAR 13-13-300) plans as separate sections. A single Introduction and set of appendices serve all of these sections to reduce repetition and save paper.

A final note regarding figures. The original and addendum plans included numerous reproductions of site sketches and maps from the Dixon and Major 1993 and Burtchard and Athens 2000 reports. As these are now available in at least two documents, paper conservation wins out in this revised plan.

Environmental Setting

Southwest Kaluako‘i lies on the flanks of Mauna Loa, the extinct shield volcano that formed the west side of Moloka‘i prior to the eastern (Ko‘olau) volcano. Mauna Loa, like most other Hawaiian volcanoes, formed through a series of bedded basaltic lava flows MacDonald et. al. 1983:412). The project area includes portions of the western and southern slopes of Mauna Loa, as well as traversing the southwest rift zone, a line of greater activity where vents and flows created a ridge between the summit and Ka Lae o Lā‘au (Lā‘au Point, the southwest tip of Moloka‘i).

Although Mauna Loa is older, the drier conditions have produced less topographic variation than on the Ko‘olau side of Moloka‘i, where heavier rainfall has cut spectacular valleys. The gulches of Mauna Loa are relatively shallow, interspersed with broad, relatively undissected landscapes. Many of the smaller gullies between and feeding into the larger gulches are very young, the result of drought and overgrazing that denuded surface vegetation in the 19th and 20th Centuries, leaving it vulnerable to violent erosion during occasional downpours. Other consequences of this period of erosion have been exposure of hardpan subsoils on high ground and accumulation of wind and water-borne silt in leeward low areas and gulch bottoms.

Rainfall is concentrated during the winter months, but has amounted to an average of only 15 inches per year in modern times; on the lower slopes of the southwest region, that figure is lower (Baker et. al. 1968). One aspect of the local climate not mentioned in rainfall data is the typical cloud cover, which consists of a line of clouds parallel to and directly above the island. In dry periods, it barely extends past the high Ko‘olau mountains, but often extends past the west coast. During wetter periods, this line of clouds brings rainfall that seems to be concentrated over the gulches of Kamāka‘ipō, Kaheu, and Kaunalā. The tradewinds that cause these clouds to pile up over the island dominate, but on the south shore there is frequently little or no wind. When tradewinds are absent, land and sea breezes are

more noticeable, and convection clouds (with occasional rain) may occur if humidity is sufficient. A traditional name for a wind of Kaluakoʻi is "Haleolono," which is also a place name for the land just east of the project area (Nakuina 1992:68).

Although there were reportedly a few springs in the past (Summers 1971, Kaimikaua personal communication 1999), there is no reported evidence of perennial streams that would support typical wetland taro agriculture. Another indication of the aridity of the project area is that there are no traces of traditional coastal fishponds, which generally were constructed where some fresh water input fostered plant growth. However, the wetland just behind the dunes at Site 1146 shows that at least brackish water is present at some coastal locations.

The general soil types of the project area are low humic latosols interspersed with lithosols (Foote et. al. 1972). Soil series represented in the project area are dominated by very stony eroded soil in the north and the interior, Kapuhikani along the southern shore to just south of Kamākaʻipō, and Mala silty clay in the Kamākaʻipō Gulch bottom (ibid.). Both Baker and Foote mention deep soils on the west end, but field experience shows that the project area generally has a very shallow soil cover, with rocky and hardpan areas exposed rather frequently, and substantial accumulation of sediments occurring only in the lower reaches of gulches. The 1991 excavations rarely went more than 50 cm in depth before reaching extremely hard clay.

The soil classifications interpret the project area as having very low productivity Baker et. al. 1968, Foote et. al. 1972). This may be true for modern forms of agriculture and animal husbandry, but it is likely that higher rainfall occurred prior to upland deforestation, providing enough moisture and could cover to grow the less thirsty Polynesian crops such as *ʻuala* (sweet potato, *Ipomoea batatas*), *ʻipu* (gourd, *Lagenaria siceraria*), and the thatching grass *pili* (*Heteropogon contortus*). George Cooke (1949), who managed Molokai Ranch in the first half of the 20th Century, saw Hawaiian *kō* (sugar cane, *Saccharum officinum*) growing in an old household garden at Kamākaʻipō. Terraces, planting circles, and areas cleared of stones show that Hawaiians once practiced agriculture within the gulches, and to a more limited extent, on the sloping lands. Monitoring at Kaupoa, then old ranch house on the outskirts of an ancient village at Kaheu gulch, revealed deposits of loamy soil sometimes exceeding 30 cm in depth, soil that appeared to have a relatively high organic content and held onto moisture for weeks after rainfall—attributes that would have been attractive to ancient farmers.

Currently, vegetation is dominated by *kiawe* (*Prosopis pallida*) forest, which sometimes forms dense thickets, but may also be open. *Lantana* (*Lantana camara*) forms an understory in the forested areas, and also occurs in the open areas. There are occasional grasslands, with various pasture and weedy species that have become naturalized. Chili peppers (*Capsicum frutescens*), bittermelon (*Momordica* species), and basil (*Ocimum* species) are also naturalized, representing historic household garden introductions, but possibly from elsewhere on Molokaʻi, since birds readily disperse each. The native flora are much diminished, although hardier shrubs that are adapted to dry and disturbed conditions are still present; these include: *ʻuhaloa* (*Waltheria indica*), *ʻilima* (*Sida fallax*), and *maʻo* (native cotton, *Gossypium sandvicense*).

Insects and other arthropods dominate fauna of southwest Kaluakoʻi, and it is beyond the expertise of the archaeologists to list or evaluate these. Bird life includes game species introduced by Kamehameha V, and later by the territory and

state, as well as exotic songbirds such as cardinals, mockingbirds, and mynahs. Herds of Axis deer, another of the king's introductions, wander Molokaʻi's west end, and along with the other introduced ungulates (cattle, sheep, and goats—only the former of which is still present) have affected the ecology significantly. More important to the human inhabitants of old was the marine fauna, from pelagic species at the offshore Penguin Banks, to reef fish, to shellfish and echinoderms found on the coast, and even the turtles that hauled up on shore.

The character of the southwest Molokaʻi shoreline merits attention, not least because this is where ancient and historical people settled. Sand beaches cover most of the coastline, although basaltic ridges do extend to the shore in a few locations, with those at Lāʻau Point and along the south shore being highest. Low dunes occur as well, although sand mining depleted those at the eastern end of the project area's south coast. Sandstone and limestone underlie the sand and are visible in many locations. Slabs of this material appear in ancient and historic construction, but the more consistently important aspect of such stone is that the shoreline and shallow waters where it occurs are riddled with holes and cracks that form excellent habitat for fish, lobsters, and other food. Because canoes formed the backbone of the ancient transportation system, the presence of numerous channels through the reef and sandy beach landings would have been an attractive trait of this shoreline in ancient times. The waters of Lāʻau Point, however, remain notorious to this day, as currents traveling down each coast collide in a choppy, swirling mix that makes paddling dangerous.

In the reconnaissance of the gunnery range, Burtchard noted highly eroded areas and charcoal indicative of wildfire (2000). It is no great stretch to infer that live fire practice could have ignited vegetation in this parched landscape, and an aerial photo from 1965 shows what appears to be a recent burn area in the range. The reconnaissance also noted several graded and bulldozed areas, piles of stone, and military dumps. In an analysis of Burtchard's report; Dixon and Major's 1993 report; 1955, 1964, 1965, and 1969 aerial photos; Molokai Ranch color aerial photos from the 1990s; the publication *Detailed Land Classification – Island of Molokai* (Baker et. al., 1968); and USGS quad sheets from 1924 and 1983, Cultural Landscapes has been able to estimate the minimum extent of disturbance in and around the new corridor.

Between Poʻolau and Wahīlauhue Gulches, only a small, unnamed gulch appears to have escaped disturbance prior to the mid-1960s. Between about 100 and 250 feet in elevation, numerous dirt roads criss-cross the landscape here. Poʻolau Gulch itself appears to have escaped much direct impact, except where roads crossed it—Burtchard's discovery of intact agricultural sites in the gulch is consistent with this. (His Site 1760, a single adze preform in "an erosional scar" that may in fact be in a dirt road visible on aerial photographs.) South of Poʻolau Gulch, almost everything inland of the old coastal road, north of where the south arm of Kulawai Loop meets Pohakuloa Road, and below about 250 feet in elevation has been heavily disturbed. Grading to clear the target areas, construct roads, and build observation towers and bunkers has obliterated nearly everything inside of Kulawai Loop, and as far east as the rock piles recorded as Sites 1683-1687. The single contra-indication to this situation may be Site 1788, a concentration of boulders including a slab that was interpreted as a fallen upright from a shrine (Burtchard 2000). Low, seasonably wet ground nearby (interpreted as a spring with which the shrine would have been associated) may have saved this area from grading, and is visible on air photos due to the vegetation.

South of Kulawai Loop, the situation changes markedly, and several sites were present beginning between the road and Kapukahehu Gulch. Sites have been recorded in and between Kapukahehu and Kaunalu Gulches, with a few *mauka-makai* roads being the only disturbance to the intervening ridge. The ridge south of Kaunalu Gulch, however, has been disturbed as far down as 100 feet in elevation, and the 1965 aerial photograph shows a series of lines following the contours from this elevation up to nearly 200 feet. It is uncertain what these are, although they appear to have a few intact trees, and may represent grubbing of pasture, an attempt at erosion control, or both. Kaheu Gulch and south appears to be far less disturbed, except for the road down the ridge to Kaupoa.

History and Archaeology

To achieve a more comprehensible and holistic understanding of southwest Kaluakoʻi's past, this document combines historical and archaeological background. This discussion summarizes what is currently known about the project area, and then offers a brief regional overview as a framework for the research plan. Site particulars appear with the detailed site mitigation plans below, to avoid redundancy and the need to flip pages constantly. A more developed discussion of overall patterns will be included in the final data recovery report.

The name of the *ahupuaʻa* containing all of these places, Kaluakoʻi, refers to the pits or quarries ("lua") from which adzes ("koʻi") were made. Kumu Hula John Kaimikaua notes that the largest quarries were inland at "Amikopala, Kahinawai, Koholalele, and Kamakahi," and that the best types of stone were named "Awalau…Awaliʻi, and Awauli" (Kaimikaua 1997:4). He also relates that when the Maui *aliʻi* (chief) Kiha-a-Piʻilani ruled over Molokaʻi, he stationed his men in all of the coastal villages of Kaluakoʻi "to secure the mining rights of the valuable koʻi as an added wealth for the high chief," and that access to and security over the quarries was the reason he built his famed trail ("KealapūpūoKihaaPiʻilani, See Summers 1971:12-13) around the west end (Kaimikaua 1997:4).

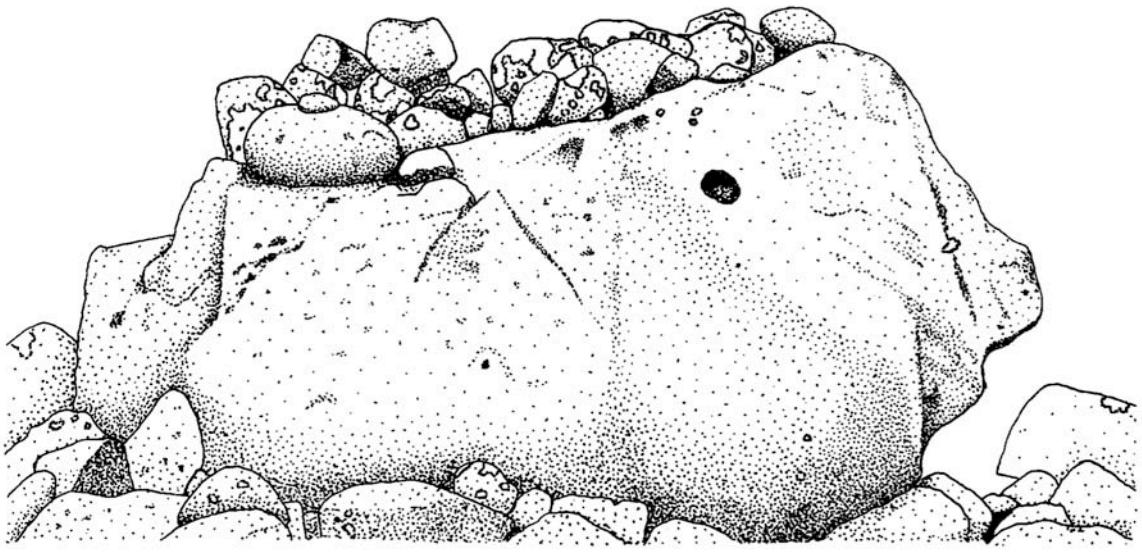


Figure I.3: Trail marker at North Kamākaʻipō

One of the Molokaʻi chiefs who provided labor for the trail, Kamākaʻipō, was immortalized in the name of the gulch and bay north of Lāʻau Point. Kamākaʻipō was also the name of an owl who lived at the place, and whose droppings appeared as a type of gray clay found there. Two Kamākaʻipō places known from traditional oral history that may have identifiable archaeological sites associated with them are a *heiau* dedicated to Hina that is supposed to be small and circular, and a hill named Ahoaho, a small hill where chiefs were buried (Kaimikaua 2001, personal communication).

By the time Europeans found the Hawaiian Islands, western Molokaʻi was not heavily populated, although both the Cook and Vancouver expeditions noted that a small population was present prior to AD 1800 (see Dixon and Major 1993:9). Molokaʻi also became a battleground in the struggles between Maui, Hawaiʻi, and Oʻahu, and during the latter 18th Century lost much of its population due to warfare; a Hawaiian told the surgeon of the Vancouver expedition that Kamehameha had decimated the island (Menzies 1920:115, 118). Another source indicates that a generation earlier, the Oʻahu chief Peleioholani raided and burned Molokaʻi in revenge for his daughter being killed on the island (Fornander, cited in Summers 1971:18). Ash exists widely on the west end, observed in buried layers from at least Poʻolau (Burtchard and Athens 1999) to Kaheu (also known as Kaupoa, Major 2000). An older explanation of the barrenness and low population may be found in the story of ʻAmiʻikopalā, which said that the wells dug by that supernatural crab dried up when he was killed (Kaimikaua, personal communication 1999). Another *moʻolelo* told that other water sources dried up when people carelessly, and later maliciously, poisoned springs with pieces of the Kālaipāhoa gods (Kaimikaua 1988).

Regardless of the causes, the view that Kaluakoʻi was a dry, thinly populated area found its way into archaeological literature, and is accepted today. Stokes (1909) stated that "inhabitants of the western end of Molokai deserted or were removed from their homes nearly half a century ago" (Stokes 1909:30), a period when Kamehameha V had begun ranching operations on the island. Stokes concentrated on religious features, and near the current project area recorded *koʻa* (fishing shrines) on the coast at Kamākaipō (Sites 53 and 55), Lāʻau (Site 58, destroyed by lighthouse construction before 1909), Keawakalai (probably Keawakalani, Site 59), Kahalepohaku (Site 61), and Puʻu Hakina (Site 62). At the latter place, he also recorded Kalalua Heiau (Site 67), which had an unusual reef rock slab construction, and was reportedly used for human sacrifice (ibid:31-32). Stokes further reported that local people identified Kahalepohaku as the place where Kiha-a-Piʻilani had been raised.

During the 1920s and 1930s, most Molokaʻi archaeology was done by visiting scholars such as Fowke (who wrote a brief paper for the Bureau of American Ethnology in 1922), and Phelps (who produced a monograph on Molokaʻi archaeology in 1941). The Phelps paper is more interesting for its consideration of environmental variables than its site recording. He divided the island into ecological regions, of which the western was the driest; Phelps highlighted this aspect by repeating a Hawaiian newspaper story about the 18th Century *aliʻi* Kaiakea, who ordered a well dug with adzes near Ka Lae o Lāʻau (Phelps 1941:57). He stated that the advantages of Kaluakoʻi were its namesake adze quarries and its fine fishing grounds (ibid:55-60). He used the *ahupuaʻa* of Kaluakoʻi to support his conclusion that land divisions with the greatest area had the least population, and that the absence of valleys to provide natural divisions was what made Kaluakoʻi the largest *ahupuaʻa* (ibid:75-76).

Few new sites were recorded prior to the 1950s, when the Bishop Museum and University of Hawai'i began working together on Hawaiian archaeology, and on educating a new generation of scientists. One of these students, William Bonk, reiterated the conventional wisdom in his master thesis, which included the lines, "this was a decidedly marginal land for the inhabitants of Molokai. Fishing and the quest for adze stone brought people into the area, and fighting probably sent refugees into it, but temporarily" (1954:139). His excavation of a house site at Kamāka'ipō (Site 54) revealed less than 10 inches of midden, leading him to conclude that the intensity of habitation had perhaps increased over time, but that the site represented a fisherman's house, and that the area had little more in the way of permanent habitation (ibid:51-52).

Catherine Summers compiled historical and archaeological documentation over the next two decades, and published the results in 1971. Few of the sites are within the current project area, but the book is notable as the first and last attempt to bring together knowledge about sites island-wide. *Molokai: A Site Survey* includes notes made by Stokes and other early site recorders, as well as Hawaiian myths and oral histories, unpublished accounts, and historical documents. Based on all of this information, Summers concurs with the portrayal of Kaluako'i as a land blessed with excellent adze stone and fishing grounds, but also where habitation was limited by aridity (1971:39-40). Also implicit in her maps and descriptions is a settlement pattern in which the most heavily used areas are clustered at the bays and high in the uplands. The current project area occasionally reaches the margins of the coastal settlements, but is largely in the "empty" middle elevations. The Statewide Inventory of historical properties began shortly after the publication of Summers, but consisted more of an effort to relocate previously recorded sites than to discover new ones, and added no new information.

The same year that *Molokai: A Site Survey* was published, a University of Hawai'i student named Hal Strong documented some of the Kamāka'ipō habitations. He described and photographed four house sites and a variety of associated features, including: *ahu* (stone mounds), shrines, *ko'a*, a stone pile, and scatters of midden and artifacts strewn on the surface (Strong 1971).

In the early 1980s, Marshall Weisler surveyed coastal southwest Moloka`i, relocating and discovering eleven sites (State Sites 50-60-01-53 through –56, -655, 1118, and -1134) in or near what has become current project area. He reiterated an aspect of Phelps' settlement pattern in which topography was key—sites were concentrated in gulches and the bays where they met the sea—and added that there was a correlation between the size of the bay and the quantity and diversity of features (Weisler 1984:27). Another pertinent outcome of Weisler's work, creation of the Southwest Moloka`i Archaeological District (hereafter SMAD, Site 50-60-01-803) included some sites (53, 54, and 56), in or near the project area. This district is now on the State of Hawai'i and National Registers of Historic Places, meaning that sites within it are afforded additional protection.

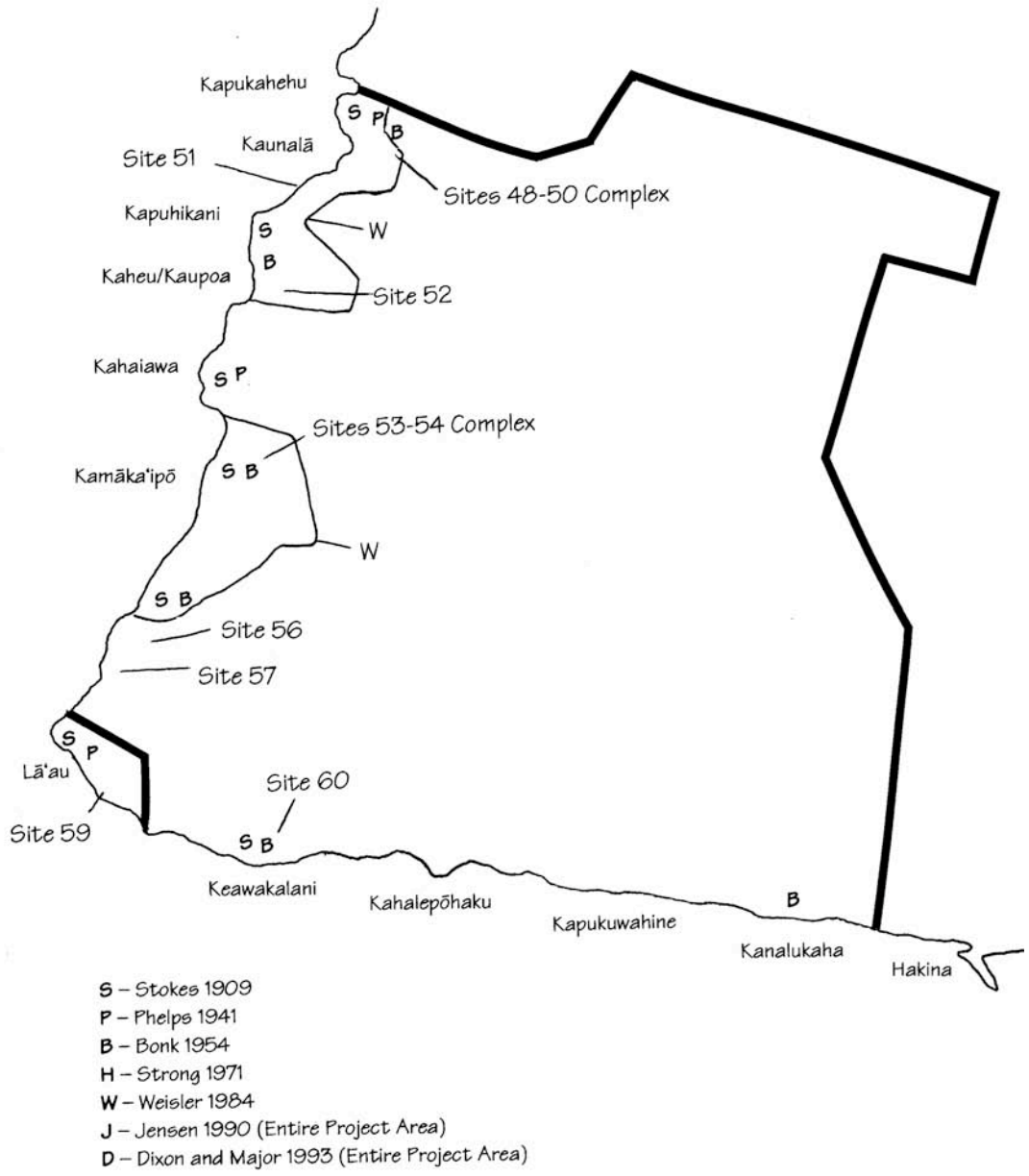


Figure I.4: Previous archaeological study areas. (Note: Burtchard and Athens project area is north of this, and is shown in the Papohaku Ranchland map earlier in this report.)

In 1991, a survey of 6,350 acres of southwest Moloka'i done by Bishop Museum encountered features throughout southwest Moloka'i, including the current project area (Dixon and Major 1993, referred to in this report as the "1991 inventory" and the "1993 report"). This survey provided the most complete coverage of southwestern Kaluako`i to date, and the settlement pattern model that emerged from the inventory reinforces the main pattern mentioned above, that sites cluster around bays and gulches (Dixon and Major 1993:337). However, having a survey area that extended well inland from the coast, it was possible to refine the model. For example, although the inland margins of sites had the expected agricultural areas and lithic work stations, they had a surprising number of "temporary and semi-permanent residential compounds" (ibid:337).

Discovery of large, multi-roomed enclosures near the 100 foot elevation also went against conventional wisdom that inland features were marginal and ephemeral. Two such enclosures occur in the Site 771-773 complex, each with six or more rooms, some of which display massive, well-built walls. Excavation revealed evidence of lithic manufacture (over 3,000 flakes from a single 100 by 50-cm excavation unit), while presence of a metal pick-ax head suggests that this could be a site that transcends the era of contact between Hawaiians and Europeans. These sites remain enigmatic, but seem to suggest a degree of permanence or intensity previously not recognized on the west coast, and certainly not at that elevation.

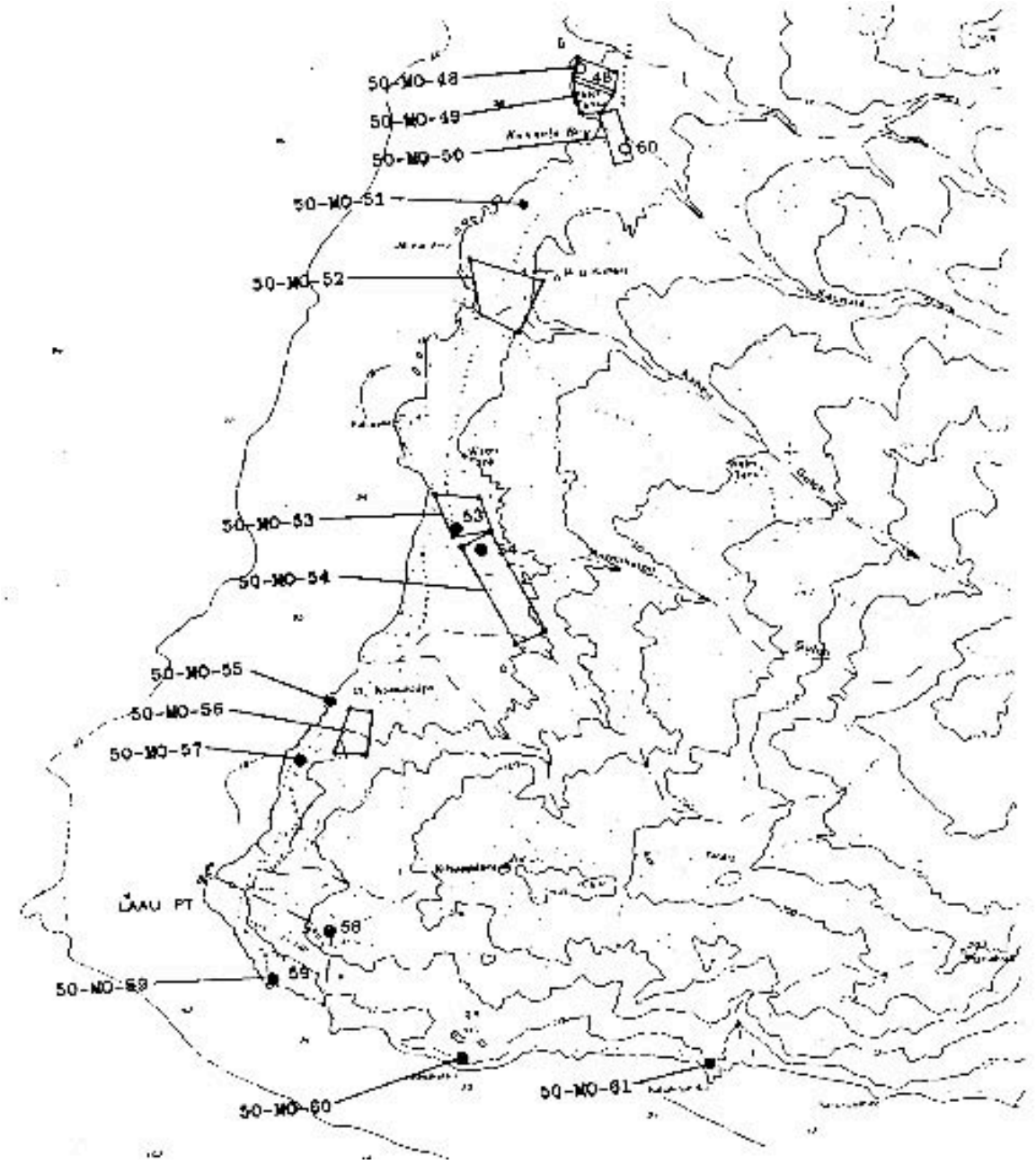


Figure I.5: Southwest Molokai Archaeological District sites and areas.

The 1991 project also documented variation between west coast settlements (where features clustered at the bays and stretched inland to gardening or quarrying areas) and south coast settlements (where habitations were spread laterally along the coast), indicating that the causes again related to topography (ibid:337-338). Analyses of subsistence strategies and lithic production, paired with the form and distribution of features, suggested that rather than a temporarily occupied, culturally peripheral area, southwest Kaluakoʻi was probably permanently occupied late in prehistory, and that its access to fishing grounds and adze quarries meant that it was integrated into island-wide society (ibid:240-344). A more recent study including part of the north end of the current project area concluded that coastal habitations must have been permanent (Burtchard and Athens 1999). Presence of extensive occupations in the uplands (Summers 1971, Major 2000) and of major specialized features such as *heiau* (temples) and *holua* (sledding courses) in the lowlands (Summers 1971) provide evidence that the Kaluakoʻi area had permanent, perhaps socially stratified, occupants.

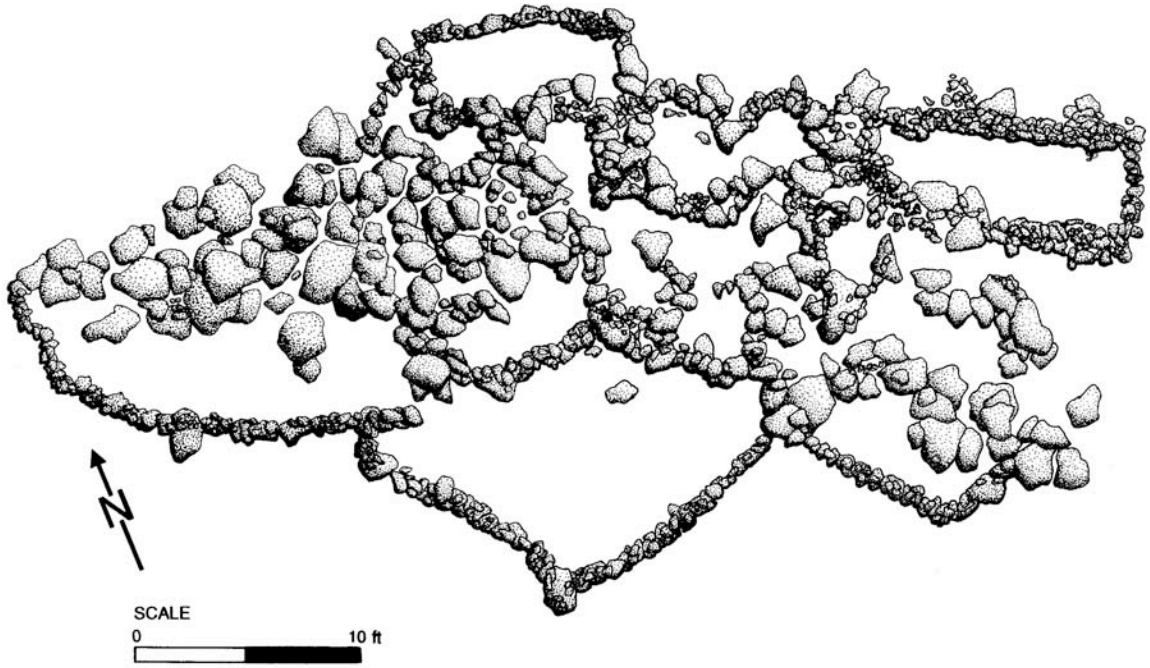


Figure I.6: Site 771, a multi-room enclosure on a ridge above Kamākaʻipō

Traditional wisdom among archaeologists has also concluded that this region would have been settled only after sweet potato was available, and after population densities had risen in the wetter areas, probably no earlier than about AD 1500 (Kirch 1985). Radiocarbon dates suggest somewhat earlier occupation may be possible, although the limited data make it hard to discern sporadic early use from a stable early habitation. An inland quarry yielded a radiocarbon date of AD 1260-1440, and the south Kamākaʻipō coastal site was dated between AD1410-1955. A subsequent, unpublished date from the 1991 excavations at Site 654, in a coastal *imu* that Weisler originally recommended dating, provided an even earlier date of AD 1019-1211, confirming the suspicion that coastal areas were used much earlier than they were permanently settled.

The condition of Site 654, eroding from an exposed dune face, may be a result of the 1946 tsunami. The Cookes (1948, 1961) both wrote of the effect that this wave had on the west coast, impacting Kawakiu heavily and working its way a half mile inland at Pāpōhaku beach; it could easily have come well inland at Kamāka'ipō, where the alluvial flat is severely eroded. Even without tsunami, however, many sites at Kaluako'i have been damaged by erosion, itself catalyzed by cattle and deer grazing since the mid-Nineteenth Century and several periods of severe drought.

Because the archaeology of Kaluako'i is relatively well known, mitigation plans may be based not only on particular knowledge of the sites, but on the patterns evident in southwest Kaluako'i. Because the current project area mostly runs *mauka* of the sites, the data that will be recovered will be skewed toward traces of peripheral activities and agriculture. In the Data Recovery Plan, the effect of this on the techniques of data recovery and the research issues will be evident.

Papohaku Ranchlands Section

Then Papohaku Ranchland section of the project area is discussed separately here for two reasons. First, the presence of an aerial gunnery target range had a profound effects on the environmental setting and on the integrity of archaeological sites. Second, the fact that a formal inventory survey has not been reviewed by SHPD means that the preservation process in this portion of the project area is less advanced than elsewhere.

In 1998, under contract with the Army Corps of Engineers, archaeologists from the International Archaeological Research Institute, Inc, (IARII) attempted an inventory survey of the former gunnery range (Burtchard 2000). Unfortunately, funding was inadequate, and IARII was unable to do more than a reconnaissance of the area, meaning that coverage was not intense enough to guarantee location of all sites, and that excavation to determine age and function of sites was not performed. However, recording of the sites that were located is good, GPS locations make them easy to relocate, and the report is in fact better than some inventory surveys done on Moloka'i in earlier years. Age, function, and significance were estimated for all sites located during the reconnaissance, and will form the basis for treatments proposed in this plan.

Before describing sites in or near the corridor, however, some historical background specific to this new project area deserves attention. The target range mentioned above appeared on maps as early as 1952 (USGS Ilio Point Quad) as a "Bombing Range," and was apparently leased by the US Government from Molokai Ranch between 1944 and 1965 (Burtchard 2000). Documentation of what exactly occurred has not been located, but a combination of physical remains, recollections of residents, and photographs allows some reconstruction. An aerial photograph taken in 1955 shows that the largest feature of the range, a huge (about 600 m in diameter) circular target comprised of three concentric earth and rock rings, had not yet been constructed, although a smaller (about 200 m) one of similar plan was clearly visible. By 1965, facilities included the targets, three cement observation bunkers, a range control tower, a munitions dump, and another possible communication or observation tower. Grading for target and infrastructure development, as well as the direct effects of the munitions, have cleared large areas beyond the constructed features themselves, and the archaeological reconnaissance found several piles of disturbed stone *mauka* of the active range. Local residents recall the area being used for ground troop training in the 1950s and 1960s, and the abundant munitions on the ground confirm that aerial bombardment occurred as well. It is possible that other portions of the

project corridor may have been used for training, since a retired marine recalls participating in amphibious and land-based exercises around Kaupoa. Besides the impacts from thousands of men and heavy machinery being moved around, he noted specifically that they constructed C-shaped shelters (Dixon and Major 1993)

Subsequent to the military training era, the land was not heavily used, although it may have reverted to cattle pasture until the 1970s and 80s, when subdivision for residential development was planned. It was during this period that Hal Hammatt recorded four sites in an archaeological reconnaissance of 3,200 acres subsuming the current project area, and William Barrera recorded five more sites along proposed roads (Hammatt 1980 and Barerra 1982a, both cited in Burtchard 2000). Development of the subdivision resulted in construction of several roads, which also served as corridors for water and electrical infrastructure, which was all installed below ground. However, few of the lots have actually been developed. Near the coast (adjacent to the Poʻolau beach access), grading has damaged archaeological features believed to be part of Site 45, a settlement with habitation, religious, and probably agricultural features. Sand dunes at the south end of Pāpōhaku Beach have also been surreptitiously mined during the 1970s through the 1990s. The extent of impacts resulting from development of the residential lots is undetermined.

The Hawaiian place names near the project area extension shed some light on the cultural landscape. Poʻolau, the name for a gulch and the bay where it terminates, is left un-translated in *Place Names of Hawaiʻi*, but the word means "leaf base; butt end of a leaf" (Pukui and Elbert 1986). Many of the long time residents of Maunaloa, however, know it by the name "shit creek," apparently because it once received waste from the town. However, it should be noted that Poʻolau Gulch terminates well below Maunaloa Town, and instead it is Wahīlauhue Gulch that descends from Maunaloa to the coast, where it ends about one-third of the way from the south end of Pāpōhaku Beach. It appears that extension of that name to the entire beach may be a fairly recent phenomenon, since Monsarrat (who made the first Molokaʻi map in1886) was careful to find knowledgeable Hawaiians, and applied the name to a structure at the beach; Pāpohaku means "stone enclosure." Another name near the project area that appeared on the 1886 map was Puʻu Koai, which Pukui, Elbert and Moʻokini considered to be Puʻu Koaʻe, or "tropicbird hill" (1974).

South of Poʻolau, Kapukahehu Bay (whose origin and meaning are uncertain) is more commonly known now as "Dixie," and does not appear in either form on the old maps. "Dixie Maru," was a boat that crashed there, and the coastline is known for shipwrecks. In a less drastic way, Dixie is also the end of the road for cars, and locals and tourists alike frequent the sandy bay. Continuing south less than half a kilometer, the next gulch and bay are now called Kaunalā ("placing sun" Pukui, Elbert and Moʻokini 1974), although maps until 1924 used Kaunalu, or "placing wave" (ibid). Further south is Kapuhikani, or "sounding eel" (ibid), a point of land that has appeared on all maps beginning in 1886. Next is Kaheu, a gulch and bay whose name first appeared on the 1924 USGS map, and is thought to mean "the fuzz" (ibid). Kaheu is better known as Kaupoa, a name that first appeared as a mapping station on the 1897 map (which was made after the overthrow of the monarchy, and is suspect due to its omission of many Hawaiian place names or replacement with English names). The name was popularized by the Cooke family, who in 1925 built a house by the bay and named it Kaupoa.

Archaeologically, the action is at the bays, and the current project corridor is in the hinterlands. The general settlement pattern of the west coast is for habitations to cluster around the bays, and for the traces of human presence to diminish rapidly with increased elevation and distance from the bay. On the coast, *koʻa* (fishing shrines) and dispersed temporary habitations may occur between bays, and it is likely that dunes contain human burials. Heading inland from the bays, gulches contain terraces and stone piles indicative of attempts to retain freshet moisture and soil, and to clear the stony soil for planting, respectively. Aside from the agricultural features and temporary shelters (both C-shapes and pavements) associated with them, stone mounds that appear to be burials are the most common features at the margins of coastal settlements. Of the features occurring above 50 feet in elevation, few are outside of gulches.

Further inland (generally over 150 feet in elevation), the presence of temporary habitations (usually C-shapes) and concentrations of lithic debris present traces of traditional quarrying and stone tool manufacture sites. Quarries usually occur on gulch margins or ridges where a stratum of fine-grained basalt was accessible, and could be removed with relative ease. Primary reduction into cores and roughly formed adzes was done at the quarry, after which finer flaking and polishing at the coastal habitations resulted in finished tools. Between the quarries and the coastal habitations, stone cairns mark the trails and occasional concentrations of basalt flakes suggest limited lithic work, although the latter usually represent single episodes rather than the sustained or repeated behavior that happened in quarries.

Because it is inland of the coastal settlements, but not far enough in to be a part of the quarry activity, the current project corridor has few archaeological features. Only in Poʻolau Gulch, where the corridor will cross an area of stone piles interpreted as agricultural clearing piles (Site 1758), does it directly encounter sites. However, a few sites are known to be relatively near the corridor, and will be described here.

Site 520. Located by Kulawai Loop near the beginning of Road T, this site consists of numerous features on the crest and in the lee of a ridge. Features atop the ridge include three C-shapes, three walls, a pit, and two platforms, forming a probable habitation site. Barrera (1982) excavated one C-shape, uncovering a large fire pit feature and cultural deposition extending to 60 cm in depth. Whereas Barrera only recorded five of the habitation features, Burtchard's crew spotted the additional features on the ridge, as well as a minimum of 23 small stone mounds extending down the southwest slope. He considered the mounds to be agricultural without specifying whether they were clearing or planting features, but wondered whether the windswept ridge crest would be an undesirable place for habitation, and suggested a possible religious function (Burtchard 2000). However, the walls and C-shapes are very typical of windbreak features, and the form of these and the platform-terrace is commonly associated with habitations in the region. Part of the religious interpretation appears to rest on the presence of a "rough basalt upright" near the pit, but religious uprights tend to be smooth (often waterworn) or have worked surfaces, which this apparently did not. Despite the good view from this location (an attribute of shrines in Kaluakoʻi), the C-shapes are not open toward the sea, as would be expected, and lack the typical stone platform/pavement interior or coral offerings. Although it is possible that the free standing platform could be a burial, the overall function of the site appears to have been habitation and

agriculture. Site 520 covers an area of 6,750 m^2 at an elevation of about 100 feet. [2] Site 520 has been evaluated as significant under Criterion D.

Site 658. This small, isolated stone mound appears to be one of the infrequent agricultural modifications to Kaheu Gulch, along with Site 659. It is significant under criterion D, and covers 4 m^2 at an elevation of 60 feet.

Site 659. About 200 m up Kaheu Gulch from Site 658, this consists of a single alignment of boulders on the south slope, forming a rough terrace. It is significant under criterion D, and covers 30 m^2 at an elevation of 90 feet.

Site 664. This site consists of five small cobble mounds, apparently associated with agricultural clearing in a small gulch north of Pu'u Kaheu. The site is significant under criterion D, and covers about 100 m^2 at an elevation of 60 feet.

Site 669. This site is on the north slope of Kaheu Gulch inland of the main settlement there. The components include a possible burial (a mound), and possibly areas of temporary habitation associated with agriculture (a C-shape, a terrace, an enclosure alignment, and a possible hearth). The site is unusually situated, being in the middle of a small gulch. A test excavation here in the enclosure yielded no cultural materials, and hit hardpan subsoil in only 10 cm (Dixon and Major 1993). The site was listed as significant under criterion D, but will be treated as possibly significant under criterion E due to the possible burial. The site covers about 2400 m^2 at an elevation of 85 feet.

Site 670. This site includes low, oblong mounds interpreted as agricultural features, a substantial C-shape with a cupboard interpreted as a shrine, and an unusual C-shape open toward the northeast tradewinds. Testing in the latter revealed a single, shallow layer with cultural materials including ash, hammerstones, basalt flakes, and a grindstone. Presence of a possible shrine among the other features led to positive significance evaluations including criteria D and E. The site covers and area of 1500 m^2 at an elevation of about 90 feet.

Site 674. This single stone mound was interpreted as a possible burial, and was assigned significance under criteria D and E. It covers 1m^2 at an elevation of 80 feet.

Site 675. This site appears to be an agricultural area with associated temporary habitation. It consists of an enclosure with a possible hearth, and several small stone rings interpreted as planting circles, and was listed as significant under criterion D. The site covers 1000 m^2 at an elevation of 70 feet.

Sites 1678-1680. These sites each consist of a single concrete bunker for observation of the nearby targets. None have been judged significant, and they probably do not meet the 50-year age requirement. Site 1680 is not in a potentially affected lot.

Sites 1683-1687. These were recorded by Burtchard (2000) as a series of rock piles made by the military. They probably represent stockpiles of stone used for target construction, or surface material pushed aside during construction of the target range. None have been judged significant, and they probably do not meet the 50-year age requirement. On the project area map, they are simply marked as "Rock Piles (Modern)."

[2] Burtchard (2000) reported an elevation of 30 feet, but his map and UTM locations place the site much higher. Apparently due to a GPS error, many sites in the IARII report have this problem. This report estimates elevations based on map and UTM locations, written descriptions, and USGS and Molokai Ranch topographic maps.

Site 1756. This site, well *mauka* of the corridor, lies on the opposite (south) side of Po'olau Gulch about 200 m up from Sites 1757-1759 and just inside Lot 236. Burtchard reported a terrace platform on an outcrop, but noted that more features could be expected in the high grass. This feature was described as having two "chambers" (2000). A fence post and 55-gallon drum were interpreted as ranching activity, and the overall site area was estimated to be 1500 m^2 at an elevation of about 200 feet.

Site 1757. Located in Po'olau Gulch, this site consists of 8 small piles of cobbles placed on low boulders on the first natural terrace above the gulch bottom. Because they are in a tight cluster and are rather low to the ground, they do not appear to be trail markers, such as those found in Kamāka'ipō Gulch. Instead, they have been interpreted as agricultural clearing mounds (piles of stone removed from the soil and put on boulders where nothing could be planted). These differ from so-called "sweet potato mounds," which were planting features in which soil or compost was covered with a mantle of cobbles that acted to conserved moisture. Presence of oblong cobbles on one mound caused Burchard to speculate that it could conceivably have been a shrine. This site covers nearly 6,000 m^2 at an elevation of 150 feet, and is *mauka* of the proposed corridor

Site 1758. This is a larger set of 36 stone mounds like those found in Site 1757. These, too, are stacked on boulders and are interpreted as clearing piles. This site occurs in the flood plain of Po'olau Gulch, covering approximately 3,150 m^2 at an elevation of about 140 feet, just down the gulch from Site 1757. Burtchard speculated that these may actually be part of a single site, and noted that a few oblong stones were also present here. The proposed corridor traverses this site.

Site 1759. A third cluster of small clearing mounds (11 in number), this site occurs in a smaller area, also on the flood plain of Po'olau Gulch. This site covers about 800 m^2 at an elevation of approximately 130 feet, and is located down the gulch from 1758, and *makai* of the proposed corridor.

Site 1760. This consists of a single basalt adze preform, broken into two pieces. Because it was visible in an eroded area amid grass, Burchard speculated that it might be part of a larger deposit. Analysis of aerial photographs shows several dirt roads in the area, and it is possible that the erosional scar is one of these roads. This artifact is about 80 m north of Site 1761 at an elevation of about 150 feet, and is just *mauka* of the proposed corridor.

Site 1761. The size (2.9 x 2.5 x .55 m and 1.3 x .75 x .35 m), shape (elongate), and stacked edges of these two stone mounds, as well as their placement on a small knoll, suggests that they are human burials, rather than agricultural features. However, this is rather far inland for burials (which are more often found at the inalnd margin of settlement complexes), and proximity to roads means that these could conceivably be historic features. They are located *mauka* of the northern end of the project corridor. The site covers 100 m^2 at an elevation of 150 feet.

Site 1783. This site consisted of some cobbles piled on a boulder. Burtchard speculated that they may simply have been cleared to provide a sitting area, and there was no evidence of formal construction. The site reportedly covers 400 m^2 at an elevation of 100 feet.

Site 1784. A rectangular platform and a small hearth comprise this site, which Burtchard (2000) interpreted as a habitation. The platform, measures more than 7 m in length, and is raised about 30 cm above the surrounding surface. The hearth, a small ring of stone is described as being 25 m southeast of the platform, but is

shown 25 m northeast on the site map. The site covers an area of 1050 m^2 at an elevation of approximately 110 feet.

Site 1785. This site on a flat area up-slope of Kapukahehu bay consists of a possible hearth, an alignment, and a stone slab interpreted as a shrine based on the presence of traditionally worked surfaces and its oblong shape. Site covers 300m^2 at an elevation of about 125 feet.

Site 1786. This site, north of 1785, occupies a small ridge and consists of a series of modifications to an outcrop, atop which appears to be an artificially set boulder upright. The modifications include low walls, alignments, and terraces, as well as what appears to be a trail leading up toward the upright. The immediate area around the boulder is defined by a rectangular platform incorporating natural boulders and set cobbles, and is the high point before the ridge descends toward the sea. Site 1786 covers about 875 m^2 at an elevation of about 150 feet.

Site 1787. This site consists of two large boulders, each with a small pile of cobbles on top. The absence of historical debris led to an estimation that the site is pre-Contact in origin (Burtchard 2000), and the feature type is similar to many found in southwest Moloka'i that have been interpreted as trail markers, based on their visibility and distribution in the landscape (Dixon and Major 1993). The site is reported as covering approximately 150 m^2 at an elevation of close to 190 feet.

Site 1788. This site is located in a low area near a seasonally wet depression interpreted by Burtchard as a possible spring (2000). Because of this proximity and the presence of an oblong boulder slab, the site was interpreted as a shrine. Although the concentration of stone here suggests that this is indeed a feature, the existing records are unclear, since the accompanying sketch depicts a smaller, more amorphous feature than the rectangular one described as retaining its integrity. Proximity to the heavily disturbed target range area warrants consideration that this may be a later feature, and the records fail to note attributes (phallic shape, smooth or worked surface) known to be associated with sacred stones, and the photograph seems to show a fractured, angular stone not commonly associated with that function. Site 1788 is near the 150 foot contour, and is said to have an area of 100 m^2, although the map shows less than 20 m^2, even if the spring is included.

Supplemental Data Collection

Two types of archaeological investigation that are not required by the regulatory historic preservation process will be done in association with the Lā'au subdivision. While elements of each have been part of the plans from the outset, the recent period of community consultation have made it clear that they are a priority to many community members and most Hawaiians on Moloka'i, and their importance is highlighted here. First, because construction of a new road and utility corridor represents the greatest single potential for impact, and is the initial step in construction for the new subdivision, the landowner has committed to re-survey the corridor, most of which as already been through the official review process. The character and methods for this are described beginning in the following section.

The second form of data collection relates to preservation sites within and close to proposed subdivision lots, where the process will amount to a thorough re-survey of sites that are to be protected within or in close proximity to new house lots. Because this type of work is to be done as part of the **Preservation Plan**

implementation, it will be described in more detail there, but it is important to note that it will be done well in advance of any house construction, and therefore any new or augmented finds may be considered in the design and construction process, so that new houses need not damage old sites. An overview for this process is included below.

Road Corridor Re-Survey

As described in the **Introduction**, the first fieldwork associated with these plans will be to re-examine the road corridor and verify descriptions of known sites, gather additional data if possible, and search for unrecorded archaeological deposits or features now obervable due to changes in surface visibility. A preliminary plan for the road corridor has been prepared by engineers, the centerline of which will be staked on the ground by surveyors prior to commencement of archaeological fieldwork. The proposed road begins at the end of Kaluakoi Road, connects to an portion of Kulawai Loop (an existing road in the Papohaku Ranchlands subdivision), and then runs roughly southwest to a point just south of the Kaupoa House lot, and then more or less follows the shoreline down the west coast and along the south coast to the vicinity of Site 1155, south of Pu'u Hakina (see map). Along the way, 12 short spur roads depart from the main corridor, providing access to subdivision lots. No connections to the Hale-o-Lono harbor road or other existing roads are planned, and the old coastal road—a roughly graded, unpaved jeep trail—will be abandoned as part of the development plan due to its alignment through several archaeological sites and erosion-prone environments.

As noted above, the portion of the road corridor north of TMK 5-01-02-030 has not been officially inventoried, and a report for that portion of the road corridor survey will in fact be submitted to SHPD for review as an archaeological inventory with significance evaluations and treatment recommendations. Despite this procedural difference, survey techniques will remains the same throughout the road corridor.

The area for data collection consists of a 30 m wide swath on either side of the centerlines for the main and spur roads, and a 50 m radius surrounding each end point, where turn-arounds have been planned. The eventual impact of road construction and utility trenching will be less than the resulting 60 m wide corridor, but that width has been chosen both to provide the best archaeological understanding of the road and its context, and to provide intensive coverage that may be used to avoid additional survey or unexpected impacts should presence of sensitive sites within the corridor cause a need to adjust the alignment.

The survey team will consist of Moloka'i residents with archaeological experience and training led by the Principal Investigator, with additional archaeologists hired from off-island if necessary. The corridor will be divided into segments, and the crew will perform sweeps in each segment with a 5 m interval. Where grass is thick enough to obscure surface visibility, gas-powered string trimmers will be used to expose the surface within 10 m of the centerline, so that low-relief features such as pavements and lithic scatters will not escape notice. Vegetation will also be cleared around the periphery of any visible surface features found within the corridor (regardless of distance from the centerline) to allow their accurate documentation and to search for additional features or deposits.

Any finds within the corridor will be documented with scaled surface planviews, cross-sections and profiles as necessary, photographs, and descriptive notes. Where sediments occur that could contain buried cultural deposits, transects of probes will be employed to determine site boundaries and characterize site stratigraphy. Each

probe is to be excavated with a shovel, by stratigraphic layer as far as practicable, with the entire volume screened through $^{1}/_{4}$-inch mesh. For each probe a representative profile will be drawn, referenced to the current ground surface. Any features encountered will be drawn and photographed in plan and profile and excavated as a separate stratigraphic context. All cultural materials will be collected, described, and recorded in a project inventory. Probe intervals will range from 1 to 5 m, depending on the area of sediment where buried features could occur, as well as the nature and density of the surface features and visible deposits. Probes will begin at the outer edge of surface features and radiate outward in at least two directions along grids established for each site (the orientation of which will be decided in the field by the PI according to topography and local conditions). Where probe intervals are greater than 2 m, follow-up probes will be used at tighter intervals to better determine the horizontal extent of the site.

For each site, a minimum of one datum point will be flagged and marked on site planviews to facilitate location on large maps. Initially, a GPS device will be used at each of these to provide a location; consumer-grade Garmin units used on property by Ranch staff have achieved accuracy to within 2-m of the UTM coordinates provided by survey grade GPS, and will be used during the re-survey to provide interim site locations. Subsequent to the initial fieldwork and prior to construction, these points will be plotted lot surveys to provide accurate, precise control points for site and buffer locations. Each datum point will be integrated into the engineering consultant's CADD system, along with either an appropriately-sized point buffer or a polygon derived from the site planview.

Sites that have been previously recorded will be reported in the Data Recovery or Preservation report, according to its status, including any newly-located features or artifacts found within 10 m of the know features. Features not associated with known sites will be reported in a Supplemental Inventory Survey report, submitted to SHPD along with significance evaluations and treatment recommendations. This report will also cover sites located north of TMK 5-1-02-030 in the Papohaku Ranchlands subdivision.

In a few cases where the site is minimal, Data Recovery measures proposed in the accompanying Data Recovery Plan may be done in conjunction with this phase of fieldwork. For example, Site 697 consists of lithic artifacts on a deflated hardpan surface, for which the proposed data recovery method is surface collection; rather than draw a planview (for the supplemental data collection) and return later to collect the artifacts (for data recovery), a single period of fieldwork will be done to satisfy both phases.

Subdivision Lot and Coastal Zone Re-Survey

Sites within proposed subdivision lots have reasonably accurate locations due to their proximity to coastal reference points, and many have been previously documented in detail by archaeologists. In order to ensure that all sites have been adequately recorded and those slated for preservation receive timely and effective preservation, land within and in close proximity to the subdivision lots will be re-surveyed as well. As with the road corridor, the aim is to verify extant site records, augment them as necessary, and search for any previously unrecorded sites.

Methods for investigating and recording sites will be the same as well, although the project area differs. Rather than a corridor defined by the road centerline, this survey area consists of the proposed private lots and the lands makai of them. Inclusion of the coastal land (most of it already zoned Conservation, and the

remainder to be so if the Ranch's petition to change some near-shore land from Agriculture is approved) in this phase stems from two facts. First, some sites straddle the boundary between Conservation land and lots. Second, as lots are occupied and coastal parks are opened, foot traffic through coastal sites will increase, subjecting them to a greater potential for impact than in recent decades.

Because so many sites have been recorded near the shoreline, this phase will begin with the known and work outward, annotating and augmenting site documentation as necessary, firmly establishing site boundaries. Areas between sites will be surveyed at 5-m intervals to search for any unrecorded features or deposits.

Vegetation clearing in this phase will focus on sites, exposing surface features and visible deposits to allow for mapping. However, clearing in Conservation lands will be limited to cutting grasses and vines, and close attention will be paid to any native plants, preserving them. A sampling of high probability landforms (ridge-tops, natural terraces within gulches, and level ground above slopes) will be cleared to check for unrecorded features in the private lots, but not within the coastal strip. In all cases, clearing will proceed with an awareness of soil, slope, and groundcover, to avoid exacerbating erosion.

In addition to the use of shovel probes to define site boundaries, some excavation will be done in this phase to help further the general conservation goals of the master plan and to better understand chronological and functional issues regarding the sites. Wherever hearths or *imu* are at risk from erosion, they will be excavated to reveal the stratigraphic relationship to other site components, and to collect charcoal for taxonomic identification, providing a basis for future re-vegetation efforts. Likewise, eroding deposits will be cleaned up to provide a representative vertical face for profile illustration, and a charcoal or other materials may be collected at this time.

Proposed Site Mitigation Measures

Sites will be dealt with differently depending on their significance, their position in the cultural landscape, and their location relative to private parcels, the proposed land trust, and conservation overlays. Options for site treatment include preservation, data recovery, and no action. Monitoring may be done in addition to other actions, and will also occur throughout the road corridor. Sites for which no action is planned are those that were deemed not significant in the 1993 inventory report, typically because they were recent hunting blinds or had been so badly damaged as to eliminate the possibility of determining their original form or salvaging meaningful data. **Table I-1** lists the categories of mitigation actions generally; the subsequent Preservation and Data Recovery plans will add more detailed information regarding specific practices.

The forms of mitigation dealt with in these plans derive from the process outlined in HAR 13-13-275, which describes the historic preservation review process in Hawai'i. Preservation, obviously, means avoiding damage to the site, although there are different degrees of this measure that will be described in the appropriate section. **Data Recovery** pertains to sites that are significant for their information only, and covers actions such as mapping, excavation, and surface collection that adequately gather that information. The objective is to collect information prior to construction, so that any damage during development is offset by gains in knowledge. Once data recovery has occurred and the report approved by SHPD, the site is officially considered "no longer significant," although the approach in this project is to monitor any unexcavated portion in hopes of gathering further

data that may be unearthed. **Monitoring** means having an archaeologist present during ground-disturbing activities that could potentially have an adverse impact on a significant site, and to gather data from inadvertently encountered sites. The objectives are twofold: to prevent incursion into preservation areas and damage to sites being preserved, and to collect data from any sites or deposits encountered outside of preservation areas. In some cases, monitoring may result in discovery of previously unknown features or deposits, leading to an expedited inventory and evaluation, and potentially to data recovery or even preservation. This will occur wherever activity with potential to impact sites occurs, and therefore is not listed at the site-specific level. **Preservation** differs from the other treatments in that sites are protected, and there is no impact to mitigate. Options within this treatment revolve around the degree and type of protective measures to be implemented, and whether the preservation is to be passive (avoidance) or active (stabilization, interpretation, and other measures). **Burial treatment** concerns not only the actions taken for sites that have documented or possible burial sites, but also measures that will be followed should an inadvertent discovery of human remains occur. Like monitoring, the procedures for burial treatment apply throughout the project area.

Because of uncertainty regarding some site locations and the fact that the final alignment of the proposed road corridor has not yet been designated, some treatments may change later pending community and SHPD approval. (All such changes will be from Data Recovery to Preservation, and no objections are anticipated.) Any site thought to be near the road or within a proposed subdivision lot has a detailed mitigation plan. At least 14 sites recommended for data recovery in the 2001 plan are now slated for preservation due to the road realignment and the revised approach to subdivision, and as many as 8 more appear likely to do the same. SHPD will be consulted regarding such changes. As mentioned above, the preliminary road corridor will be resurveyed prior to finalizing the plan, and every effort will be made to realign it around significant sites.

A few sites listed in 1993 lack specific mitigation measures described in this plan. Some of these are sites recorded prior to 1991 that could not be located or were destroyed by that time (State Sites 55, 653, 1108, and Bishop Museum Sites B5-58 and B5-61). However, most consist of recorded sites that lacked cultural or archaeological significance. Other gaps in the site numbers—653, 1133, 59-638, 700-735 and 783-1099—have been assigned to sites elsewhere on Moloka'i, and do not actually denote gaps in the 1993 site records.

Table I-1. Site Conversions and Mitigation Treatments

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Inventory	Preserve	Data Recovery	No Action
48	B6-61		X		
49	B6-62		X		
50	B6-63		X		
50	B6-64		X		
51	B6-65		X		
52	B6-66		X		
53	B6-68 and -97		X		
54	B6-69 to -73		X		
56	B6-76 and -77		X		
57	B6-78		X		
520	N/A	X	X		
639	B6-67		X		
640	B6-74		X		
641	B6-83		X		
642	B6-84		X		
643	B6-85		X		
644	B6-86		X		
645	B6-87		X		
646	B6-88		X		
647	B6-89		X		
648	B6-90		X		
649	B6-91		X		
650	B6-92		X		
651	B6-93		X		
652	B6-94		X		
654	B6-96		X		
655 (aka 53)	B6-97		X		
656	B6-98		X		
657	B6-107		X		
658	B6-108		X		
659	B6-109		X		
660	B6-110		X		
661	B6-111				X
662	B6-112		X		
663	B6-113		X		
664	B6-114		X		
665	B6-115		X		
666	B6-116		X		
667	B6-117		X		
668	B6-118		X		
669	B6-119		X		
670	B6-120		X		
671	B6-121		X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Inventory	Preserve	Data Recovery	No Action
672	B6-122		X		
673	B6-123		X		
674	B6-124		X		
675	B6-125		X		
676	B6-126		X		
677	B6-127				X
678	B6-128		X		
679	B6-129		X		
680	B6-130		X		
681	B6-131		X		
682	B6-132		X		
683	B6-133		X		
684	B6-134		X		
685	B6-135		X		
686	B6-136		X		
687	B6-137		X		
688	B6-138		X		
689	B6-139		X		
690	B6-140		X		
691	B6-141		X		
692	B6-142		X		
693	B6-143		X		
694	B6-144		X		
695	B6-145		X		
696	B6-146		X		
697	B6-147			X	
698	B6-148			X	
699	B6-149		X		
736	B6-150		X		
737	B6-151		X		
738	B6-152			X	
739	B6-153		X		
740	B6-154				X
741	B6-155		X		
742	B6-156		X		
743	B6-157			X	
744	B6-158		X		
745	B6-159			X	
746	B6-160			X	
747	B6-161		X		
748	B6-162		X		
749	B6-163			X	
750	B6-164		X		
751	B6-165		X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Inventory	Preserve	Data Recovery	No Action
752	B6-166		X		
753	B6-167		X		
754	B6-168		X		
755	B6-169			X	
756	B6-170			X	
757	B6-171				X
758	B6-172			X	
759	B6-173				X
760	B6-174			X	
761	B6-175		?	?	
762	B6-176			X	
763	B6-177		X		
764	B6-178		X		
765	B6-179		X		
766	B6-180				X
767	B6-181				X
768	B6-182		X		
769	B6-183		X		
770	B6-184		X		
771	B6-185		X		
772	B6-186		X		
773	B6-187		X		
774	B6-188		X		
775	B6-189		X		
776	B6-190		X		
777	B6-191		X		
778	B6-192		X		
779	B6-193		X		
780	B6-194		X		
781	B6-195		X		
782	B6-196		X		
1100	B5-59		X		
1101	B5-60		X		
1102	B5-62		X		
1103	B5-63		X		
1104	B5-64		X		
1105	B5-65		X		
1106	B5-66		X		
1107	B5-67		X		
1109	B5-69		X		
1110	B5-70		X		
1111	B5-71		X		
1112	B5-72		X		
1113	B5-73		X		
1114	B5-74		X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Inventory	Preserve	Data Recovery	No Action
1115	B5-75		X		
1116	B5-76		X		
1117	B5-77		X		
1118	B5-78		X		
1119	B5-79		X		
1120	B5-80		X		
1121	B5-81			X	
1122	B5-82		X		
1123	B5-83		X		
1124	B5-84			X	
1125	B5-85		?	?	
1126	B5-86		X		
1127	B5-87		X		
1128	B5-88		X		
1129	B5-89				X
1130	B5-90			X	
1131	B5-91			X	
1132	B5-92			X	
1134	B5-93			X	
1135	B5-94				X
1136	B5-95		?	?	
1137	B5-96				X
1138	B5-97				X
1139	B5-98		X		
1140	B5-99				X
1141	B5-100			X	
1142	B5-101		X		
1143	B5-102		X		
1144	B5-103		X		
1145	B5-104			X	
1146	B5-105		X		
1147	B5-106		X		
1148	B5-107		X		
1149	B5-108		X		
1150	B5-109		X		
1151	B5-110		X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Inventory	Preserve	Data Recovery	No Action
1152	B5-111		X		
1153	B5-112		X		
1154	B5-113		X		
1155	B5-114		X		
1156	B5-115		X		
1157	B5-116		X		
1158	B5-117		X		
1159	B5-118				X
1160	B5-119		X		
1161	B5-120		X		
1162	B5-121		X		
1163	B5-122		X		
1164	B5-123		X		
1165	B5-124				X
1166	B5-125		X		
1167	B5-126		X		
1168	B5-127		X		
1169	B5-128		X		
1170	B5-129		X		
1171	B5-130		X		
1172	B5-131		X		
1173	B5-132		X		
1174	B5-133		X		
1175	B5-134		X		
1176	B5-135		X		
1758	N/A	X	X		
1760	N/A	X	X		
1761	N/A	X	X		
1784	N/A	X	X		

NOTE: Treatments with an outlined X signal changes in status from Data Recovery to Preservation status. Sites slated for Inventory will all be recommended for Preservation. Question marks (?) indicate sites currently recommended for Data Recovery that may change to Preservation, pending precise site location.

DETAILED DATA RECOVERY PLAN, GENERAL

Site-specific data recovery actions will be presented in a subsequent section, but there are several aspects of data recovery that will be practiced at all sites. ***First***, all sites near the development corridor (which consists of the road and infrastructure as well as construction in house lots)—including those that will be preserved rather than mitigated—will be checked to verify extant data. ***Second***, any gaps in the existing data will be filled. In several cases, for example, without replacing the existing sketch maps with tape and compass or plane table maps, most site records are inadequate for management purposes. ***Third***, because it is possible that the inventory survey missed some small but significant feature or artifact hidden beneath vegetation, vegetation clearing and intensive searches will extend out from data recovery site areas prior to construction. These actions augment the road and infrastructure corridor re-survey described in the **Introduction** of the revised plans.

Data Collection at Previously Recorded Sites

Verification

The first step in this phase of investigations will be to verify the existing data for known sites within the road corridor. This process will consist of examining the sites, comparing dimensions and descriptions to those contained in the 1993 report, and either affirming the inventory or adding corrected data. The inventory was reviewed and accepted by SHPD, but the fact that any site facing data recovery also faces construction impacts underscores the importance of having accurate site records.

Augmentation

The first action in augmentation will be to ensure that all features have been documented. It is possible that vegetation obscured smaller features or scatters or isolated artifacts, or that erosion since the survey has exposed additional deposits. Therefore, the road and infrastructure corridor will be resurveyed as described in the **Introduction** to search for such instances. Special attention will be focussed on known sites in or adjacent to the corridor, with intensive survey and clearing of the vicinity to guarantee 100% documentation of features and deposits within the area of potential impact. Eventually, as lots are sold and houses are planned, this process will be repeated in proposed construction areas within individual subdivision lots.

The second action will be to accurately place each site in space. Reference points for each site will be marked on the ground and site maps, located using a GPS receiver, and wherever possible recorded again by surveyors when the road corridor is laid out. These points will be identified by their UTM coordinates.

Another aspect of data augmentation is that while sites were documented, not all were mapped, and many were mapped only approximately. The nature of sites within the corridor is that they generally are not complex or large, and therefore tape and compass maps will be adequate to accurately record site plans. If the size and complexity of any un-mapped sites merits, plane table and alidade maps will be produced. Generally, 1:100 metric scale maps will be adequate, although 1:200 or higher may be appropriate for agricultural mound complexes, and 1:50 may be used for particularly interesting architecture.

Finally, if there is any information to add to that held in the 1993 report, it will be recorded at this time. For example, more detailed descriptions of architecture, lists of species present in midden, and other such details may be added.

New Data Collection

Once verification and augmentation have been completed, excavations can begin. The most basic goal of excavation will be to document the site stratigraphy, including natural and cultural components. Beyond this basic description and relative chronology, several research questions will provide the framework for interpretation of excavated assemblages; these revolve around cultural use of the lands located outside the nuclei of coastal settlements, and integration or contrasts between coastal and inland resource use. It is also anticipated that charcoal will be recovered that can be identified to provide environmental data, and dated to improve the local chronology. Research questions pertaining only to particular sites may also be investigated, and will be described later in the section on site-specific data recovery plans.

Documentation of Stratigraphic Sequence

The first goal of excavation is to establish the stratigraphic history of each site. Therefore excavations will be placed such that the depositional sequence(s) are exposed inside and outside of features. Underlying substrate and post-abandonment deposition will be distinguished from cultural deposits. Stratigraphy of particular features will be placed in the context of their sites, and sites will be placed within the context of the project area. Based on past work, it is anticipated that stratigraphy will be similar and simple throughout most of the project area, with potential for small areas of more complex layering within some heavily used features.

Documentation of Feature Chronology

Sites with surface features will be subject to excavation to determine the stratigraphic association of feature foundations, so that at least a relative chronology can be established. Likewise, subsurface features will be placed within the stratigraphic sequence. Although the expectation is that most excavations will encounter a lone cultural layer, any more complex stratigraphy will be placed in a Harris matrix system (Harris 1989), which will include all identifiable stages of surface feature construction, addition, and dismantling. This work will help construct a relative chronology, and radiocarbon dating will be used on at least a sample of features to provide absolute dates.

Documentation of Site and Feature Assemblages

Beginning with each minimum collection provenience (grid units for surface collections, and strata within excavation units for subsurface collections), the next basic task will be to create an inventory and basic description of cultural materials. Midden will be classified by taxa and weighed. Artifacts will be classified by material and type, measured, and weighed; samples of different types will be photographed and in some cases illustrated. Lithic debitage will be counted and weighed, the range of dimensions recorded for each lot, classified according to the degrees of decortication and modification, and finally described in terms of material, form, and any other salient attributes. Following these descriptive tasks, the assemblages of particular grid or stratigraphic units will be considered in

context of features and sites in an attempt to identify any systematic variation or patterning.

Research Questions

Although SHPD standards state that an inventory survey needs to go no further than documenting the resources present, the 1993 report did pose several research-oriented questions regarding southwest Kaluakoʻi, following topics suggested for the area by Weisler (1984). The nature of the project area forces revision of the research questions for this stage of investigation. Work will occur mostly within a corridor running approximately parallel to the coast, *mauka* of site concentrations. In addition, the project area includes several spurs leading to public beach accesses and to subdivision parcels; these are planned to avoid site complexes, and therefore will also relate more to peripheral areas than to core sites. Finally, data recovery is proposed for a limited number of sites within the subdivision lots, sites that mostly represent temporary habitation or workshops areas and are significant for their information only. Habitation in the data recovery sites is mostly limited to marginal features, with agriculture and lithic work sites being better represented, so the unbiased examination of settlement patterns attempted in 1993 will not be possible. Likewise, distance from the coast vastly reduces the amount of marine midden present, and therefore consideration of subsistence strategies will focus on agriculture. The earlier focus on lithic resources must be shifted to later stages of tool production, since few, if any sources of stone will occur within the project corridor. Finally, the consideration of sociopolitical complexity, difficult enough with the inventory data, would be presumptuous given the thin slice of the overall site spectrum that will be encountered.

The archaeological marginality of the data recovery sites makes them of limited use for considering the broad questions posed previously, but also creates its own opportunities. The margins of settlements clustering around the small bays of west and the coastal flats of the south may also be considered as frontiers, something akin to the high water mark of the culture that colonized these shores, where the modified and built landscape met the wild country. This kind of area has the potential to inform on land use in interesting ways, providing data that may reflect the Hawaiian zoning of the landscape into different types of use and degrees of human permanence (Malo 1951, Kamakau 1992, Handy and Handy 1972). On a different level, the sites may inform on central place theory, or core-periphery systems. As well as being the agricultural outlier of a coastal settlement, however, it is important to consider that the middle elevations also held the access routes between the more heavily used coastal and upland zones. The 1993 report showed that this was the case in Kāmakaʻipō, where a specific type of cairn marked *mauka-makai* trails. It was also evident that activities upon which coastal settlements depended, especially agriculture and stone tool manufacture, occurred primarily on the margins of habitation complexes. The irony of this is that the main road corridor, following a more or less unvarying elevation, becomes an important way of understanding the older *mauka-makai* trail corridors, since it will cross-cut the old trail networks and highlight patterns of where they occur and where they do not.

Land Use on the Settlement Margins

To the degree that the project area includes the peripheries of the major coastal settlements, it is useful in investigating the ways in which ancient residents of

Moloka'i used their frontier. Known sites suggest that agriculture was the dominant use, but this project will also attempt to evaluate the importance of lithic and temporary habitation sites by excavating samples at most such sites in the area of potential effect. Did these other functions occur independently, or may they be better understood as agriculturally related activities? Data recovery may occur primarily at the margins of coastal settlements, but by no means in inaccessible and remote land, and therefore it will be interesting to see the degree to which artifacts, midden, and feature styles prevalent at the bay settlements are also found here. In other words, how much does the cultural assemblage of the outlying sites conform to that of the coastal centers? Also, the permanence of the inland margin sites is worth investigation. Do they represent repeated, long-term use of this area, or were they short-lived frontier sites?

Sites that may be excavated regarding settlement margins will include: 520, 692, 694, 698, 743, 745, 746, 749, 753, 755, 756, 758, 1118, 1121, 1122, 1124, 1125, 1131, 1132, 1136, 1153, 1172, and 1784. Many of these sites will be outside the refined area of potential effect, and will therefore not be excavated. Unless a large number cannot be avoided, it is likely that all sites will at least have sample excavations.

Traditional Dryland Agricultural Features and Soils

Moving on from the issue of margins and frontiers, a narrower but crucial focus may be brought upon the practice of agriculture. This subject seems to have captivated archaeologists only where irrigation or vast field systems are involved, but as the basis for survival of Hawaiians it is of the utmost importance. Two types of features—planting circles and mounds—reflect the primitive state of archaeological understanding, since both tend to be interpreted with reference to archaeological folklore or occasionally to a few indigenous accounts. Excavation of these types of features will be directed toward understanding their agronomic benefits. Do they appear to aid in soil or moisture conservation? Does their construction involve use of organic or sediment fill? In the case of mounds, specific identification of planting versus clearing mounds will be sought, based on the types of stone present and the depth of topsoil present beneath the stones. Another class of agricultural features was the modified stone outcrop. These will be mapped and a sample excavated with the goal of understanding why such features may have been agriculturally useful.

After features, the second major source of data will be the soils. Traditional dryland agricultural practices by no means required features, and the presence of agriculturally viable soils will be tracked throughout the corridor, particularly with regard to their association with gulches or ridges. Soil samples from a variety of contexts will be sent for analysis to evaluate and compare their mineral nutrients, fertility, and acidity. Where it is available, charcoal will be collected for identification and dating. This data will inform on flora cleared from cultivation areas, and perhaps on the flora associated with cultivation. This approach is being used rather than pollen analysis because the scale being considered is more immediate (being wind-borne, pollen is more informative of regional than of local flora), and because comparative data are available for upland Kaluako'i sites. Erosion will be noted and possible links to agriculture will be considered, and features or modifications will be analyzed as to their potential to promote or retard erosion.

Sites that may address this topic include: 694, 736, 742, 745, 1130, and 1148. Many of these sites will be outside the refined area of potential effect, and will therefore not be excavated. Unless a large number cannot be avoided, it is likely that all sites will at least have sample excavations.

Lithic Production

Previous data have suggested that sources of tool-grade basalt occurred at higher elevations than most of the project area will include, and an obvious goal of this project is to verify this conclusion. Should any sources be found, the extent of their use will be evaluated, the suspicion being that any sources within the area of potential effect were probably relatively poor grade and were used briefly, perhaps only once, to supply blades rather than adzes or other more formal tools. If sources are not found, lithic work areas will be analyzed to determine the type(s) of materials present, type(s) of tools being made, and the stage(s) of production represented. In light of recent work near the Kukui Peak area (Major 2000), where evidence suggests that workshops were occupied by tool manufacturing specialists, lithics will be evaluated for evidence of the expertise involved, as reflected by regularity of technique, uniformity of production stage, quality of work, presence of specialized tools, and diversity of raw material.

Sites likely to address this research topic include: 692, 695-697, 738, 748, 1122, 1132, 1134, 1139, 1145, and 1151. Many of these sites will be outside the refined area of potential effect, and will therefore not be excavated. Unless a large number cannot be avoided, it is likely that all sites will at least have sample excavations.

Mauka-Makai Routes

The possibility that some of the data recovery sites could be nodes along travel or trade routes between the upland and coastal centers of occupation was raised earlier, and this presents an alternative to the wholesale conclusion that these sites are simply outliers to coastal settlements. In order to determine whether sites may be along *mauka-makai* trails, other sites beyond the project area must be considered first. This reveals *mauka-makai* oriented strings of sites in gulches (North and South Kamāka'ipō, as well as Kaheu and Kaunalā outside the area of potential effect), and atop ridges at Hakina and the southwest rift ridge extending northeast from Lā'au. (Interestingly, all of these converge in and area called "Pookohola" in Emory's 1922 notebook, itself a ridge on the southwest rift zone that provides a geologically convenient travel route toward Mauna Loa. This area has several lithic work areas and shelters—Site 1156-1158—and is also the route of the old lighthouse road, suggesting that it has been an important node in *mauka-makai* travel for centuries. Gentler, less rocky terrain and historical pineapple cultivation above this point make Pookohola the uppermost intact remain of the route.)

It is proposed that certain types of features—primarily cairns to mark routes and shelters for travelers to rest—are reflective of travel between the coast and the mountain, and therefore their locations will be carefully plotted. Assemblages of cultural materials found during surface collection and excavation may also indicate *mauka-makai* travel, since lithics from upland quarries or marine midden would have to be introduced. It is anticipated that charcoal identification may also help here.

Sites that are likely to address this research topic include: 692, 694, 738, 742, 743, 745, 748, 749, 756, 758, 760, 1130, 1139, 1141, and 1172. Many of these sites

will be outside the refined area of potential effect, and will therefore not be excavated. Unless a large number cannot be avoided, it is likely that all sites will at least have sample excavations.

Methods

Generally accepted archaeological practices and the draft SHPD rules for data recovery (HAR 13-13-278) will dictate the actions taken during this project. The initial step in fieldwork will be the relocation and verification of existing sites and search for additional surface sites within the project corridor. The entire area subject to impact, including the road corridor, turn-arounds, and staging areas, will be resurveyed to accomplish total documentation of surface sites and concentrations prior to excavation.

Locating Sites

Site locations will be fixed using a declination-adjusted compass in conjunction with aerial photographs with a topographic map overlay (using vegetation, landforms, eroded areas, and surveyed points serving for reference). In the case of artifacts observed without any formal features, the assemblage will be described and collections made. Artifact concentrations will be located on the topographic map in the same way as features. A GPS receiver may also be used to suuplement ground surveys.

Excavation

Excavation of sites will employ three techniques that accommodate different purposes and accomplish varying degrees of control over vertical and horizontal control. What follows is a general discussion of excavation techniques and how they will be employed to optimize data recovery. Anticipated departures from these generic types will be mentioned in the site-specific data recovery plans later in this report; should field conditions dictate a modification of procedures, this will be reflected in the final report.

1 - Trenching (ST-#): Trenches are dug with picks, shovel, and when the deposit warrants, by trowel. Excavation is by stratigraphic unit, meaning any perceivable subdivision of the excavated volume, such as lithostratigraphic layers, depositional units, erosional faces, soil horizons, and features. Where trenching is used to expose a long profile in an area where burials or dense cultural deposits are unlikely, a backhoe may be used. Although backdirt is examined for cultural materials, only a limited sample of the matrix is screened in this type of excavation, since it is to be used primarily in agricultural features where the goal is to expose the stratigraphy and the feature's position within it. Profiles are drawn of all features and of at least representative portions of each cultural layer. Where features or particularly dense or complex deposits are encountered, controlled excavation techniques will be employed, and possible artifacts will be point provenienced relative to the trench datum.

2 - Probing (P-#): Done with shovels and/or trowels, these 30-40 cm circular units provide quick data regarding stratigraphy and cultural materials in known cultural deposits and features. Because of the likelihood of finding artifacts and midden, all sediment is screened through 1/4 inch mesh. Excavation is by stratigraphic unit, and

profiles are drawn of all features and of at least representative portions of each cultural layer. These will most often be employed in transect or grid formations to establish the boundaries of a cultural deposit and gain some understanding of its constituents.

3 - Controlled Testing (TU-#): Excavation by trowel and brush will be used in situations where more precise control is warranted, such as recovery of data from pit features. A combination of stratigraphic units and arbitrary levels within each are used for vertical control, and all matrix is screened through 1/4 inch mesh, or possibly 1/8 inch where conditions merit. Profiles and plan views will be drawn of each layer, all features, and of at least representative portions of each cultural layer. Features, tools and other significant attributes of stratigraphy or material culture are point-provenienced with reference to the unit datum. For units exceeding 1 m in length, collections for each 1 m portion are recorded and collected separately.

Sampling Strategy

In general, the type of excavation done depends on the type of deposits and data anticipated, as well as the degree of control necessary to interpret the site. Therefore probes will typically be an initial stage of excavation, in which the general stratigraphy is exposed and the vertical and horizontal extent of a site is defined. Probes may be followed by trenching in agricultural terraces, mounds, or planting circles so that a longer continuous exposure of stratigraphy can be recorded. If any of these types of features appears more complex, or has a noticeably denser cultural deposit, then a controlled test unit may be excavated to recover data with greater precision. Test units will also be used in C-shapes, enclosures, and pavements. Placement of excavation units will be determined by the type of feature being investigated, and sometimes by prior knowledge of the cultural deposits in a site.

C-shapes, for example, will be tested with controlled units laid out with a long axis extending from the opening through the back wall, recovering the majority of interior deposits and exposing a sectional view of the feature wall and its stratigraphic association. This placement generally results in discovery of any associated fire features within, but units may be extended.

Planting circles and **mounds** will typically be excavated with a trench or test unit placed over half of the feature so that a 50% sample of the fill will be screened and a cross-sectional profile will result; if warranted, the other half may then be excavated.

Terraces will likewise be excavated with trenches or test units, placed perpendicular to the terrace facing to reveal a sectional profile. The perpendicular orientation will show the type of terrace construction, amount of fill, and relationship between the built and natural strata. If there are relatively abundant cultural deposits indicating something more than agricultural use, probes will be used to determine the extents of the deposits, followed by controlled excavation; the procedure will follow that described below for sampling deposits.

Enclosures and **pavements** will be excavated using test units of various sizes and arrangements. A 50% sample of the interior of enclosures or the surface of pavements will be excavated, including central portions where fire features are commonly found. For features with interior or pavement areas exceeding 10 m^2,

less than 50% may be excavated. In such cases, 5 m^2 of controlled units will be followed by removal of the contemporary horizon overburden to reveal any subsurface features, all of which will subsequently be excavated to recover at least 50% of their contents. Additional test units or stratigraphic trenches will be used to section one or more representative portions of any walls to provide a view of the foundations and its stratigraphic association.

Deposits of midden and **lithics** are documented or suspected in many of the project area sites, and a major task of data recovery is to delineate the boundaries of these and recover samples adequate for site interpretation. In many cases, complete excavation would be an immense task, and would go well beyond a point of diminishing returns for information. Once the extent and nature of a deposit has been determined, and the distribution of its component materials described and interpreted adequately, collection of redundant information is not necessary for data recovery purposes. The approach will be to collect a sample through the use of probes and controlled units.

The first step of this process will be to define the area that may be impacted, and create a grid covering it. Using a sample interval of 2 m (1 m where refinement is needed), the edges of a deposit will be defined, and a sample of the entire deposit collected. If the deposit is no more than 10 m^2, then it will be excavated with 1 m^2 units in a checkerboard arrangement to provide a minimum 50% sample. If the area is over 10 m^2 and less than 100 m^2, any post-abandonment overburden will be stripped away, and a 5-10% sample of the overall deposit excavated, with the potential for additional units if more are needed to cover the apparent range of variation. Subsurface features revealed will be excavated to provide a minimum 50% sample of the fill in each, regardless of whether they fall within a excavated grid square. When this has been done, machinery will be used to remove the cultural deposit to its average bottom depth, so that any deeper features penetrating the substrate may be seen and excavated as well. If machines are not available, a fraction of the area will be stripped with the same goal. If the deposit exceeds 100 m^2, the extra portion will be stripped by machine, to allow recovery of a minimum 50% sample from each feature fill.

Because the data recovery features will be impacted by construction, 50% controlled excavation is to be done first, so that a profile can be recorded. Following this, the remainder of the fill may be collected. In such instances, only the cultural fill will be recovered and not all materials may be collected.

Archaeological Presence During Construction

By definition, data recovery sites have already undergone mitigation, and therefore no longer retain integrity or significance. However, monitoring may be done in and near such sites, in part to be aware of any unexpected components to known deposits. Because data recovery excavations for this project will involve large, representative samples, it is not considered likely that anomalous or non-redundant information will be encountered near data recovery sites. However, since construction may be the last chance to collect information about sites before they lose integrity, monitoring will be done in many cases. For the most part, monitoring will consist of watching machine excavation and grading in order to search for undiscovered buried features. Any such features will be recorded and mitigated through controlled excavation. In addition, excavated sediments will be inspected visually, and in some cases sifted through quarter-inch mesh. Artifacts will be collected, whereas midden will be described. Discovery of relatively abundant

artifacts, midden, or charcoal will trigger a temporary work stoppage to determine if an intact remnant of the source deposit is still present; if so, it will be recorded and mitigated as appropriate. Because the sites where data recovery has been verified by SHPD are considered no longer significant, judgement of how much archaeological recovery to be done will be a matter for the field archaeologist to decide, although guidance of the Kūpuna Advisors will be sought in advance to determine their preference.

Lab Analyses and Collection Treatment

Materials collected during data recovery will be analyzed in Hawai'i. Artifacts and midden will be sorted by material and function, then measured and weighed, and described. This information will be recorded along with illustrations and/or photographs of representative specimens to form a complete catalog of cultural materials that will be included in the final report.

Charcoal identification will be performed in Honolulu by International Archaeological Institute, Inc., and radiocarbon dating by Beta Analytic in Florida. All collections, except for charcoal consumed during the dating procedure, will be returned to the landowner for storage on Moloka'i. Field notes, excavation forms, photographs, negatives, and unpublished documents will be retained by the consultant. Copies of the final report will be provided to the client, SHPD, and the Moloka'i Public Library upon acceptance by SHPD.

DETAILED DATA RECOVERY PLAN, BY SITE

Table D-1. Data Recovery Actions, by Site
(For Research Topics: M = Marginal land use, A = Agriculture, L = Lithics, R = Routes Mauka-Makai)

Site Number	Research Topic	Mapping	Grid Probes	Probes	Strat. Trench	Test Unit	C-shape Test Unit	Surface Collection
697	L	X						X
698	M	X	X		X			
743	M	X	X		X			
745	AM	X	X		X	X		
746	M	X	X		X			
749	M	X	X			X		
755	M	X	X		X			X
756	M	X	X					
758	M							
760	M			X				
761	*M*			*X*				
762	M	X	X					
1118	M	X		X		X		
1121	M	X	X					X
1124	AM	X	X			X		
1125	*M*	*X*	*X*			*X*		
1130	A	X	X		X		X	
1131	M	X	X		X			
1132	ML	X	X			X		
1134	ML	X	X			X		
1136	*M*	*X*	*X*					
1141	T	X	X			X		
1145	L	X	X			X		

NOTE: Sites in *italics* (761, 1125, and 1136) are likely to be outside of the subdivision, and if so will be preserved rather than subjected to data recovery. Their inclusion here covers the possibility that they may be within subdivision lots.

Site 697

This site consists of a 10 by 20 m area of lithic debris on hardpan. Data recovery will consist of surface collection.

Site 698

This site contains a wooden water tank and a trough, both built on stone platforms, which are probably older than 50 years based on a 1947 map that marks a "well" in this location. However, the main object of data recovery is to explore a stone wall remnant and determine if any intact cultural deposit remains at this location, since midden and lithics were observed on the surface.

Data recovery will begin with mapping of the surface features, which should suffice as data recovery for the historic features. This will be followed by excavation of a trench through the wall remnant to determine its age and stratigraphic association, as well as evaluate the likelihood of an intact cultural deposit. Should such a deposit appear likely, grid probe excavation will be done following the procedures outlined in **Sampling**.

Site 743

This site consists of a single stone alignment, where a 1929 bottle was fund during the 1991 inventory.

Data recovery will begin with mapping, followed by excavation of a single trench through the feature to explore its stratigraphic association and determine the likelihood of a buried cultural deposit. If no buried materials are found, there will be no further data recovery. Otherwise, a grid and shovel probes will be used to determine the horizontal and vertical extent of any buried deposit and recover data following the procedure outlined in **Sampling**.

Site 745

This site consists of an outcrop with two small enclosures attached, and what was interpreted as a fire hearth a few meters away. Together, these minimal modifications were interpreted as a possible planting area and temporary habitation.

Data recovery will begin with mapping the three features and the outcrop. In addition, controlled excavation will be done at the three features, so that precise data regarding their cultural assemblages and their stratigraphic association can be gathered. A 1.0 by 1.0 m unit will be placed halfway across Feature 1 (the suspected hearth), providing a cross-section profile; after this is recorded, any remaining feature fill will be excavated within a second unit of the same size. Each of the planting circles will be similarly sectioned along axes perpendicular to the rock outcrop; if there are cultural materials suggestive of something more than planting soil, the remainder of the feature's fills will also be excavated. Following this, shovel probes along a grid will be used to determine the horizontal and vertical extent of the site, and recover data according to the procedures outlined in **Sampling**.

Site 746

This site consists of an outcrop with a stacked stone wall extending outward to form an enclosure, as well as two small stone mounds. Although it was interpreted as a ranching feature in the 1993 report, it is possible that it may have served a different function, and further investigation is warranted.

Data recovery will begin with mapping to more accurately record the surface features. This will be followed by trenches sectioning the mounds and going through part of the enclosure wall. If trenching confirms that the features are rather recent and there is no significant cultural deposit associated with them, data recovery will cease. If, however, trenches reveal a buried deposit, then probes will be excavated on a grid system, according to the procedures outlined in **Sampling**.

Site 749

This site consists of a boulder outcrop with a natural overhang shelter and several areas of stacked stone creating small enclosed areas. A single test excavation done here in 1991 demonstrated the presence of a thin cultural layer containing both traditional (basalt debitage and shell midden) and historically introduced (ungulate bones and teeth) materials. Although it is possible that a deeper or more discretely stratified cultural deposit exists at this site, it is not likely.

Data recovery will begin with mapping, followed by controlled excavations in each of the enclosed areas. The controlled units within modified areas are to augment results from the earlier (1991) excavations. These units will explore both the interior deposits and the stratigraphic associations of the walls. It is anticipated that excavation of 2 1.0 by 1.0 m units within each enclosed area will result in recovery of 50% or more of the available deposits, as well as reveal the stratigraphic associations of the architectural elements. It is also likely, however, that with slightly more effort nearly 100% of the deposits can be recovered, and an attempt will be made to do a larger excavation covering most or all of the overhang deposits.

Following controlled excavation, shovel probes will cover the area outside of defined features on a 2 m grid, determining the extent of buried deposits and recovering additional data according to the procedures detailed in **Sampling**.

Site 755

This site is a pair of adjacent enclosure walls utilizing a natural outcrop.

Data recovery will begin with mapping, followed by trenching through the shared wall and at least one of the enclosures' outer walls. Matrix will be screened, and if a rich or complex cultural deposit is found, excavation will proceed as a controlled test unit. Unless a buried deposit is absent, the next step will be excavation of probes along a grid, as described in the procedures for deposits in **Sampling**. Finally, the stone mortar used in the feature 1 wall will be collected.

Site 756

This site consists of a boulder outcrop with modifications that create a large enclosure, within which are several natural overhang shelters.

Data recovery will begin with mapping, after which the interior will be marked in a grid and probed according to the procedures outlined for deposits in **Sampling**.

Site 758

This site consists of a natural boulder concentration with a piled stone wall extending outward from it and creating an enclosure. Although midden was not observed, this feature was interpreted as a temporary habitation in the 1993 report.

Data recovery will begin with the production of a map of this site, since none was included in the inventory survey report. One or more trenches will be excavated through the pile stone wall to reveal its stratigraphic association. Subsequently, a grid of shovel probes will be excavated in order to determine the extent and nature of any cultural deposits following the procedures outlined for deposits in **Sampling**.

Site 760

This site consists of two enclosure walls attached to a large outcrop, and was interpreted in 1993 as a military feature, based on the style of construction and absence of traditional cultural materials.

Military training occurred on Moloka'i during WWII and in the mid-1950s, but was not well documented, and therefore it is not likely that the age (and thus eligibility under NRHP criteria) can be determined historically. Since a major criterion is that sites be more than 50 years old, the potential significance of WWII sites would have changed since the 1991 survey. This, plus the uncertainty of wall style as an indicator of age, means that at least some testing should occur here. Given the expectation that the features are in fact temporary historic structures, it is likely that testing will indicate a lack of significance, and will end in an evaluation of no significance, or discovery of poor deposits that can be mitigated immediately. The planned treatment for this site will be to excavate it in a way that will satisfy data recovery requirements.

Shovel probes will be placed on two transects parallel to the southwest walls. Should cultural deposits be encountered, the follow-up will consist of controlled excavation of all features, and of up to 5 m^2 of a general deposit. A trench will section one of the walls.

Site 761

This is another enclosure formed of a stacked wall attached to a boulder outcrop. Like Site 760, it appears to be historic based on the construction style.

Data recovery will consist of mapping and of shovel probes along a northeast-southwest transect, covering the interior and leeward exterior of the feature. In line with this transect, a small trench will be excavated through the wall to provide a cross-sectional view of its construction and stratigraphic association. If the probes indicate a buried cultural deposit, excavation of probes on a grid as described in **Sampling** will follow.

Uncertainty about the exact location of this site relative to the proposed subdivision boundary remains at the time of writing, and it may be that Site 761 is within the Shoreline Conservation Zone, in which the site treatment will change to preservation.

Site 762

This is another enclosure formed of a stacked wall attached to a boulder outcrop. Like Site 761 and 762, it appears to be historic based on the construction style.

Data recovery will consist of mapping and of shovel probes along a north-south transect, covering the interior and exterior of the feature. In line with this transect, a small trench will be excavated through a wall to provide a cross-sectional view of its construction and stratigraphic association. If the probes indicate a buried cultural deposit, excavation of probes on a grid as described in **Sampling** will follow.

Site 1118

This site consists of an outcrop with several natural overhang shelters, three of which have signs of temporary occupation.

Data recovery will begin with a more detailed map, followed by excavation of each shelter interior. The initial task would be to better document the site's surface attributes, producing a detailed map and defining the boundaries more precisely. Data recovery would focus on Feature 2, doing 100% excavation (approximately 1.5 m^2) of that shelter. Each remaining shelter would be sectioned to excavate a 50% sample of the overall volume (less than 1 m^2 each), and reveal the stratigraphic sequence. The remaining cultural deposit would then be recovered to provide 100% recovery of its contents. Excavation of probes on a grid as described in **Sampling** will follow to determine the extent of midden and artifacts beyond the shelters.

Site 1121

This site has no constructed features, and instead consists of a small concentration of cowry shells amid natural boulders.

Data recovery will begin by establishing a grid centered on the shells, and measuring 6 to 8 m on a side. This will be used to map the distribution of midden, after which surface collection will be done. Probes will be placed at grid intersections to determine the presence or absence and extent of any subsurface deposit, and follow-up excavations may occur according to the procedures described in **Sampling**.

Site 1124

This site is another boulder outcrop with several small overhangs, one of which has midden. A short section of stacked stones at the south end is the only modification, and appears to be a hunting blind.

Data recovery will begin with a map. Next, a controlled excavation unit will be placed halfway across the overhang shelter, recovering 50% of the deposit and exposing a profile view. After this, the remaining cultural deposit will be recovered. Data recovery will be completed with a grid of shovel probes excavated to test and recover data from the deposit as described in **Sampling**.

Site 1125

This site is another boulder outcrop, this time with just one small overhang. Several marine shells and a 2 by 2-m area of level soil are present.

Data recovery will begin with a map. Next, a controlled excavation unit will be placed halfway across the overhang shelter, recovering 50% of the deposit and exposing a profile view. After this, the remaining cultural deposit will be recovered. Data recovery will be completed with a grid of shovel probes excavated to test and recover data from the deposit as described in **Sampling**.

Uncertainty about the exact location of this site relative to the proposed subdivision boundary remains at the time of writing, and it may be that Site 1125 is within the Shoreline Conservation Zone, in which the site treatment will change to preservation.

Site 1130

This site consists of four small enclosures (75-cm diameter) and one 1.5-m partial enclosure built around a concentration of larger boulders and interpreted as a

planting area. Features 1-4 are a cluster of similarly sized enclosures at the north end of the concentration, and Feature 5 is alone, but twice the size of the others.

Because of their small size, juxtaposition, and similarity, the Feature 1-4 set will be considered as one focus of data recovery excavation. A 1.0 by 1.5 m unit will be centered on Feature 2, exposing the walls dividing Feature 2 from 1, 3, and 4. The unit will also expose the exterior walls of Features 1-3, and some of the soil outside of the features for comparison. By excavating all but one wall of this set of enclosures, this unit will address issues of relative chronology: Do the features appear to be contemporaneous, or were some added later? Do the interior divisions separating these features appear to have been made originally, or could this have once been a larger enclosure (like Feature 5) that was later subdivided? In addition to these questions, sediments, stratigraphy, and cultural materials will be used to critically evaluate the existing interpretation of these features as planting areas.

Feature 5 will be excavated with a minimum 1.0 by 1.0 m unit, exposing 67% or more of the internal area. Although the enclosure wall will be at least partially excavated, the issues of relative chronology will not be pertinent to this enclosure, and the research focus will instead be on using data to evaluate the interpretation.

Following the controlled excavation units, a grid of shovel probes will be excavated to establish whether a cultural deposit is present, and if so, recover data from the deposit as described in **Sampling**.

There were no indications during the inventory survey that Site B5-90 went beyond the boulder concentration. Shovel probes may be used to test for deposits outside of features 1-5 should the known features yield assemblages indicating activity beyond agriculture, or if a field check turns up evidence of additional features or deposits.

Site 1131

This site consists of a small overhang shelter (.5-m wide and 0.75-m deep), outside of which is a 2-m section of stacked stone wall.

Data recovery will begin with a map, followed by controlled excavation of half of the shelter interior. After the resulting profile is recorded, any remaining cultural deposit within the shelter will be excavated. Depending on the content and extent of the deposit, either a trench or another controlled unit will extend to the southwest through the stacked wall, so that its foundation can be exposed in cross section. Finally, a grid of shovel probes will be excavated to test for and recover data from the deposit as described in **Sampling**.

Site 1132

Although this is another small overhang shelter associated with a natural outcrop, the quantity of midden and lithics is greater than at others, and the inventory reported that a fire pit was present. Cobbles atop the boulder appear to be a marker for this site.

Data recovery will begin with a map, followed by controlled excavation of half of the fire pit; after recording the resulting profile, any remaining cultural fill will be excavated. It is anticipated that a 1.0 by 1.0 m unit will provide complete coverage. Depending on the contents and density of any cultural deposit outside of the pit, controlled excavation will extend outward from the first unit, probably adding another two or three square meters of excavation. The outer boundaries of

the deposit will be established using a grid of shovel probes (and possibly additional controlled excavation) as described in **Sampling**.

Site 1134

This is another rock overhang shelter used for temporary habitation, and an additional modification in the form of a 1-m alignment of stones just outside the overhang. Basalt flakes and midden are present.

Data recovery will begin with a detailed map. Subsurface data recovery will begin with a 1.0 by 1.5 m excavation bounded by the back of the shelter on the east and extending through the alignment on the north reveal the stratigraphic associations of the alignment and the cultural deposit. This will also recover nearly 100% of the overhang interior as well as some of the exterior; if warranted by the contents and extent of the subsurface deposit, additional 1.0 by 1.0 m units will be excavated to the south and west. The next step would be to dig shovel probes on a grid to determine the total extent of the subsurface deposit and recover data as described in **Sampling**.

Site 1136

This site has a shallow overhang shelter in the lee of natural boulders, with a 3 by 3-m area of scattered shell midden. About 20-m to the southeast is a small stone cairn with a metal pole in the center.

Data recovery will consist of a single trench through from the back of the shelter to the edge of the midden, revealing a cross section profile and testing for the presence of a buried cultural deposit. If no deposit is present, data recovery will end, but if one if found, a grid of probes as described in **Sampling** will be used to determine its extent and recover data. The stone cairn will also be dismantled to confirm that it is a historic era feature.

Uncertainty about the exact location of this site relative to the proposed subdivision boundary remains at the time of writing, and it may be that Site 1136 is within the Shoreline Conservation Zone, in which the site treatment will change to preservation.

Site 1141

Because this site consists of just two boulders with cobble stacking on top and a seemingly natural, unutilized shelter beneath, data recovery will focus on surface attributes. A more detailed map will be produced, and the area will be resurveyed to determine if other similar features are present, indicating a traditional trail. Shovel probes will be excavated on a grid to determine if there is a buried cultural deposit, and if so, recovery will proceed according to the procedures for deposits described in **Sampling**.

Site 1145

This site is another boulder outcrop with a small overhang shelter beneath. Atop one boulder is a small lithic scatter.

Data recovery will begin with a map, followed by excavation of shovel probes along a grid according to the procedures for deposits described in **Sampling**. The grid will also serve for surface collection of the lithics on top of the boulder. A single controlled excavation unit will be placed halfway across the shelter to

determine whether there is a cultural deposit within and expose a profile. If cultural materials are present, the excavation will be extended to recover additional data; the total area of these excavations is expected to be between 1.0 and 2.0 m^{-2}.

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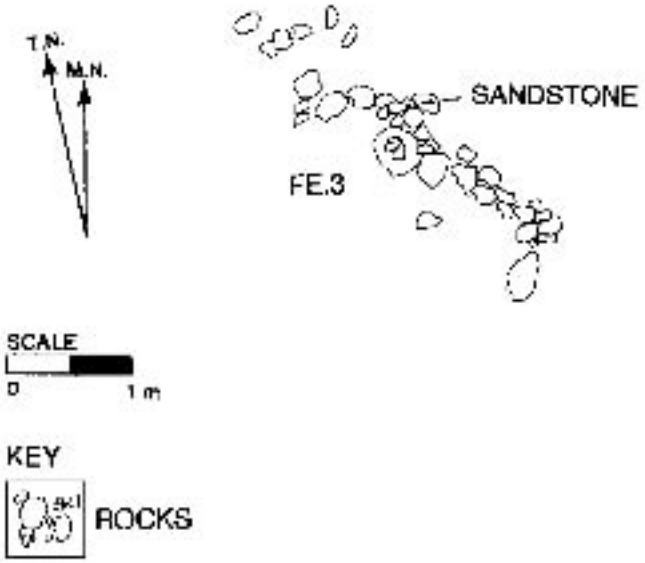
APPENDIX A

Site Data

The following table and maps provide information from the inventory report (Dixon and Major 1993). Summaries of the site descriptions from that report appear in the Site Specific Data Recovery Plans in the body of this document.

Table RA-1: Site Inventory Data and Significance Summary

State Site Number	BPBM Site Number 50-MO-	Feature Types	Site Function	Site Area (meters)	Alt.	Signif.
697	B6-147	Lithic scatter	Lithic work	20 x 10	50	D
698	B6-148	Tank, Trough, Wall	Ranching, Possible habitation	20 x 10	30	D
743	B6-157	Alignment	Undetermined	10 x 5	30	D
745	B6-159	Alignment 2 enclosure alignments	Agriculture	30 x 20	60	D
746	B6-160	Enclosure 2 Mounds	Temporary Habitation, Historic	40 x 15	70	NS
749	B6-163	Rock shelter	Habitation	20 x 10	100	D
755	B6-169	2 Enclosures	Temporary Habitation	10 x 4	50	D
756	B6-170	2 Enclosures	Temporary Habitation	14 x 10	110	D
758	B6-172	Enclosure	Temporary Habitation	10 x 10	110	D
760	B6-174	2 Enclosures	Military/Hunting	30 x 15	100	NS
761	*B6-175*	Enclosure	Temporary Habitation, Historic	10 x 10	50	D
762	B6-176	Enclosure	Temporary Habitation, Historic	3 x 3	25	D
1118	B5-78	3 Rock shelters	Habitation	45 x 30	40	D
1121	B5-81	Midden	Historic Temporary Use	2 x 2	30	D
1124	B5-84	Rock shelter Wall	Temporary Habitation, Hunting	10 x 5	60	D
1125	*B5-85*	Rock shelter	Temporary Habitation	4 x 3	60	D
1130	B5-90	5 enclosure alignments	Agriculture	10 x 5	190	D
1131	B5-91	Modified Rock shelter	Temporary Habitation	2 x 2	170	D
1132	B5-92	Rock shelter	Temporary Habitation	5 x 5	60	D
1134	B5-93	Modified Rock shelter	Temporary Habitation	4 x 2	85	D
1136	*B5-95*	Rock shelter	Temporary Habitation	25 x 4	30	D
1141	B5-100	Rock shelter Cairn	Temporary Habitation	3 x 3	210	D
1145	B5-104	Rock shelter	Temporary Habitation, lithic work	2 x 2	150	D



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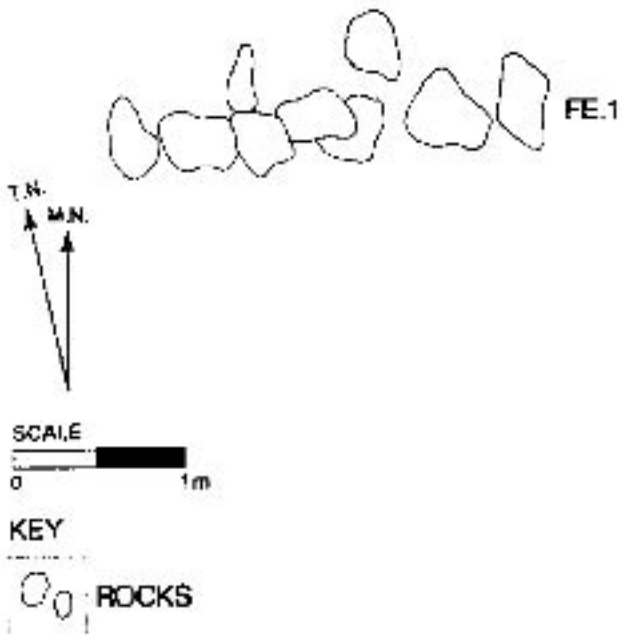

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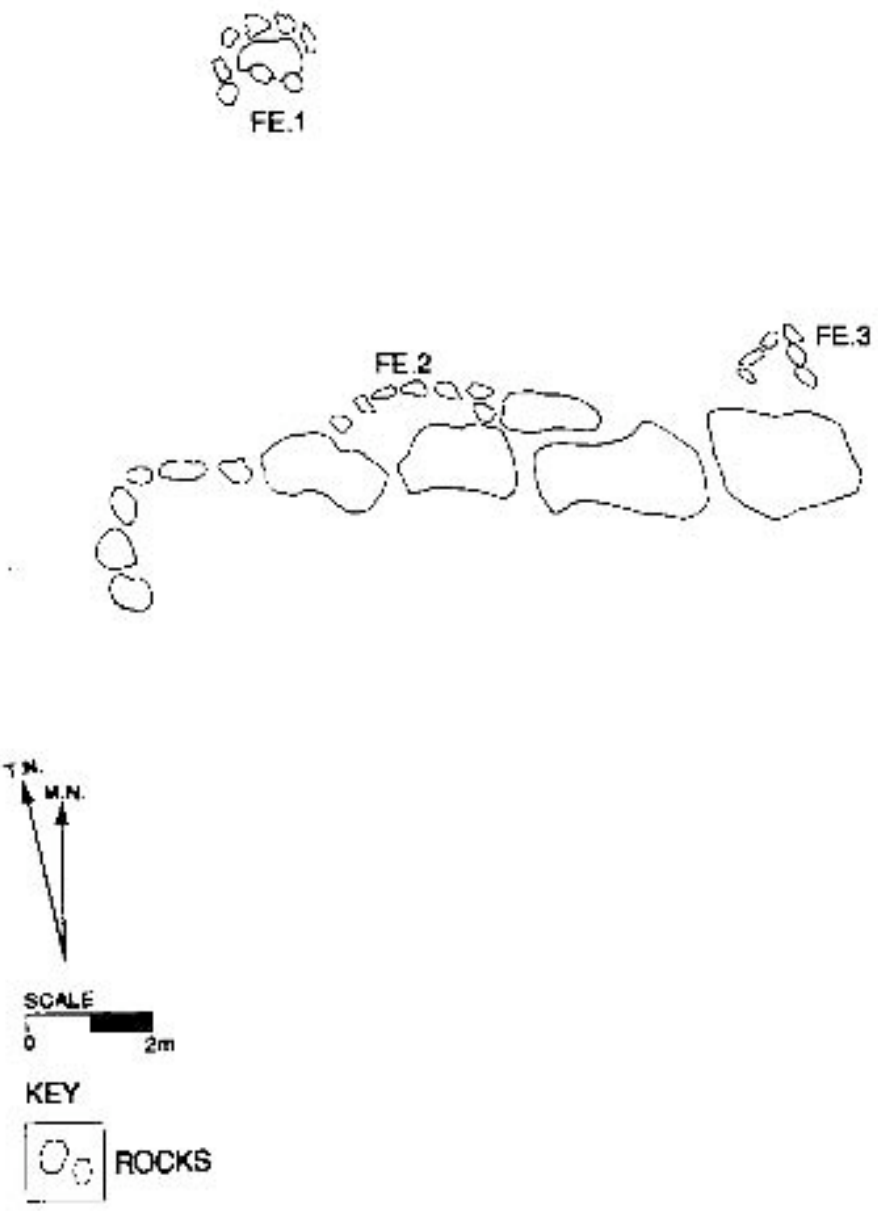

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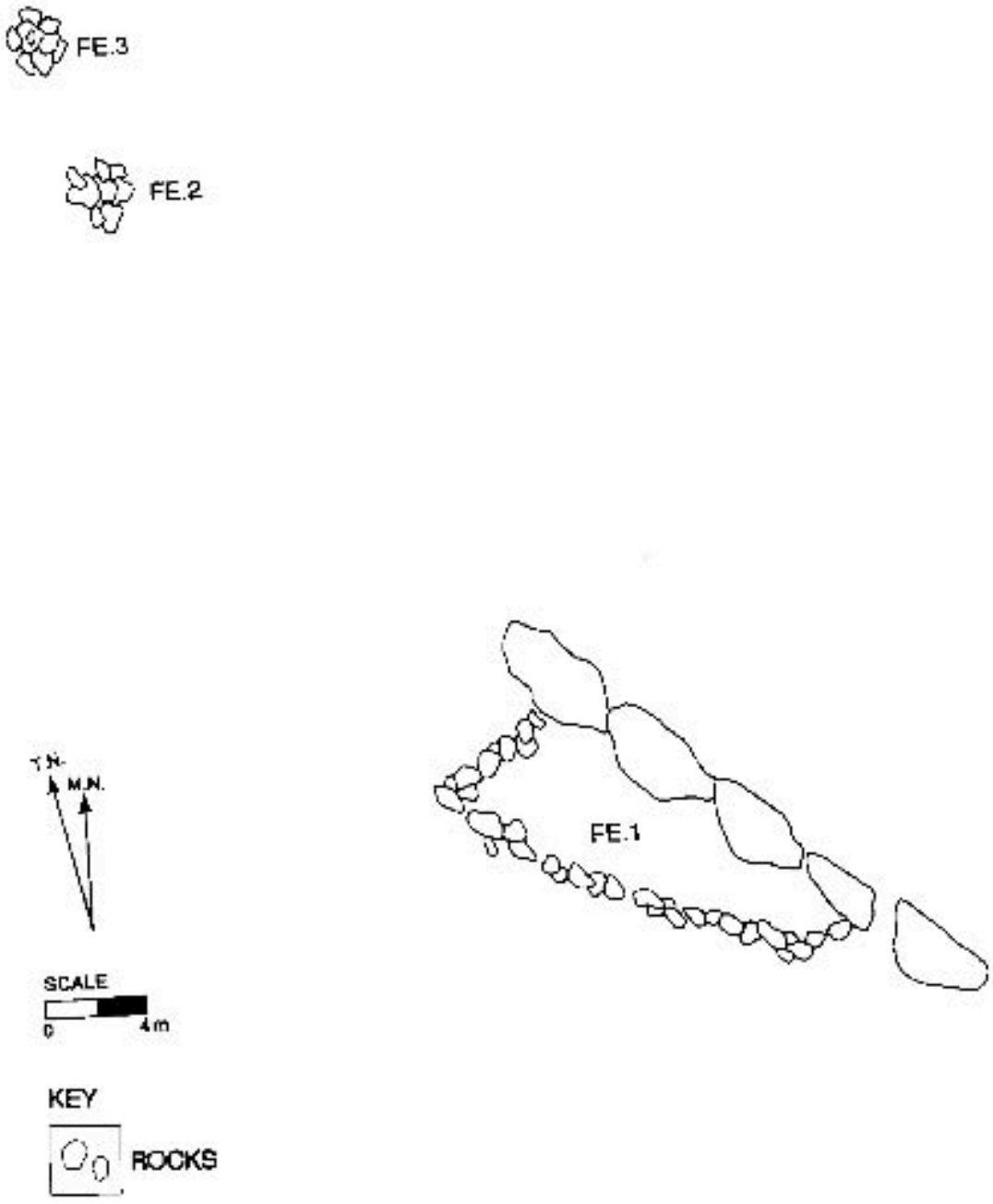

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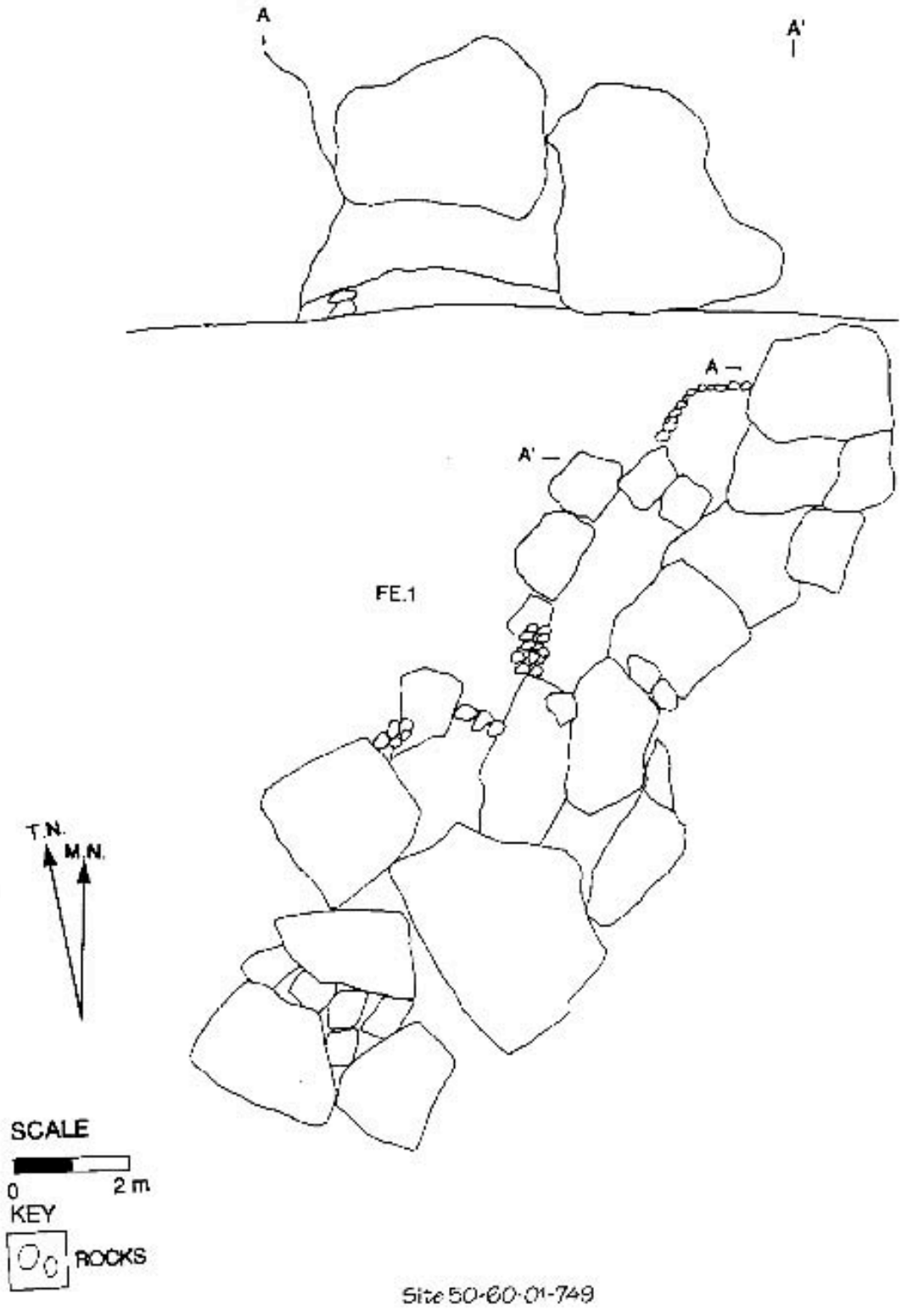

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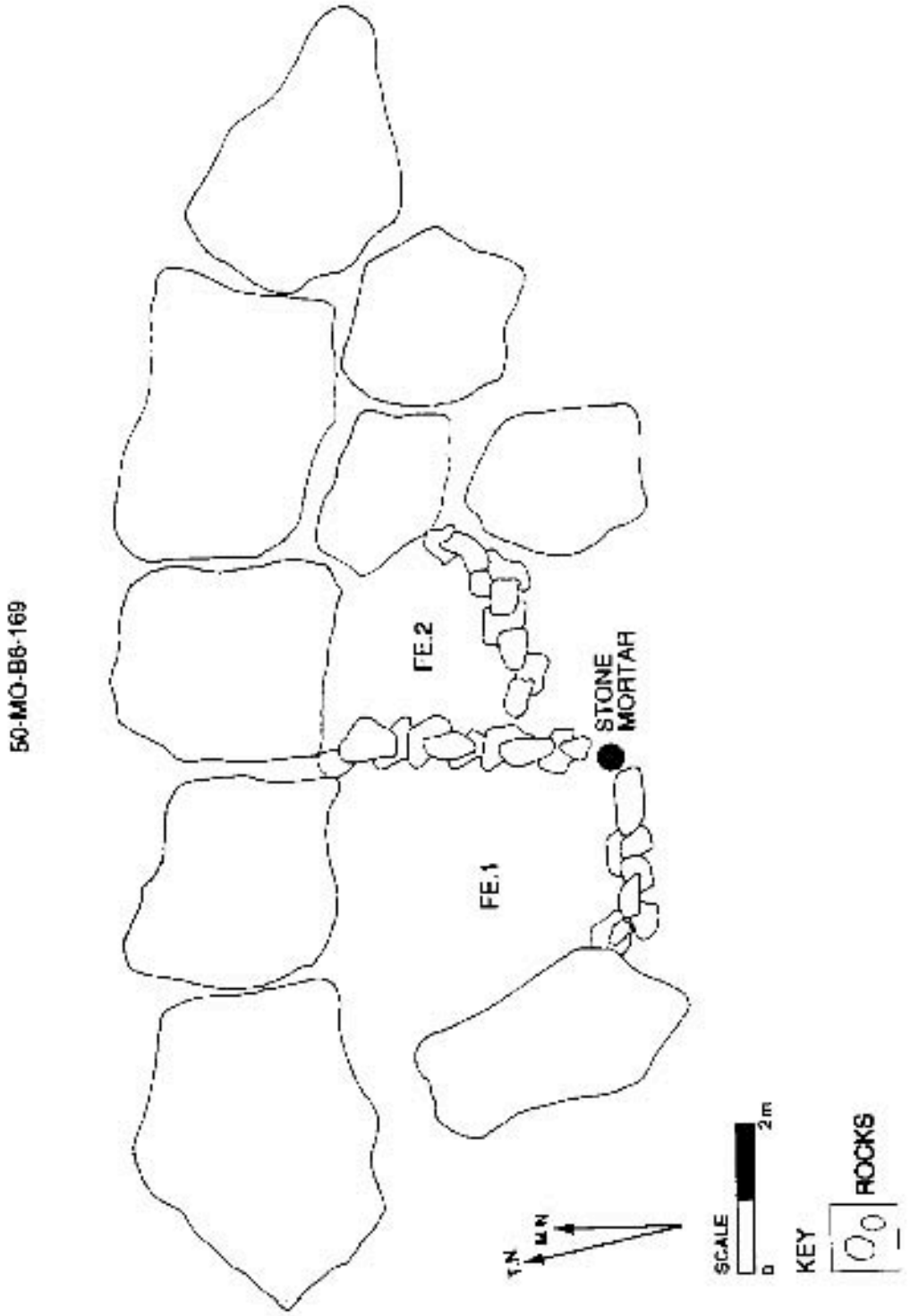

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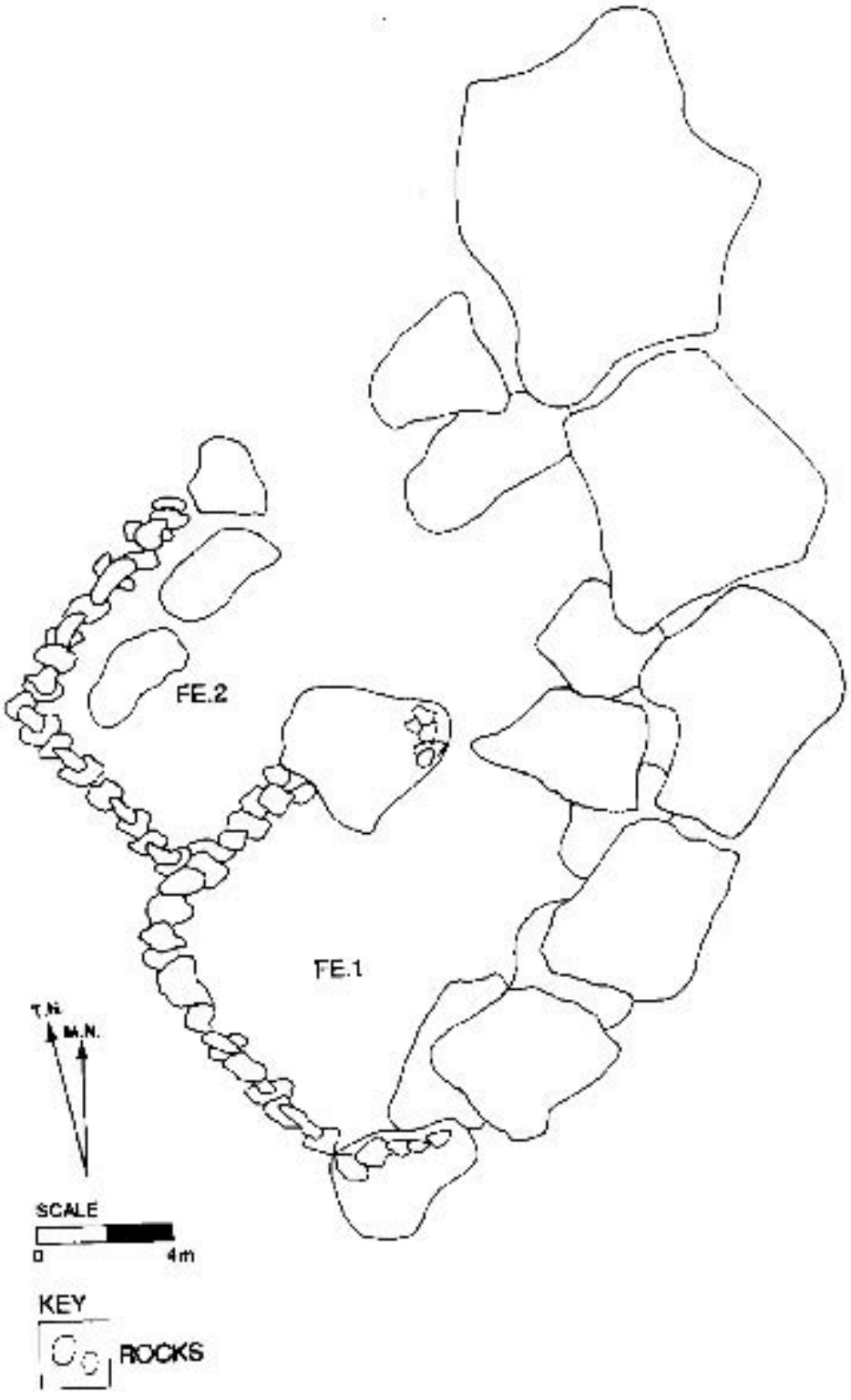

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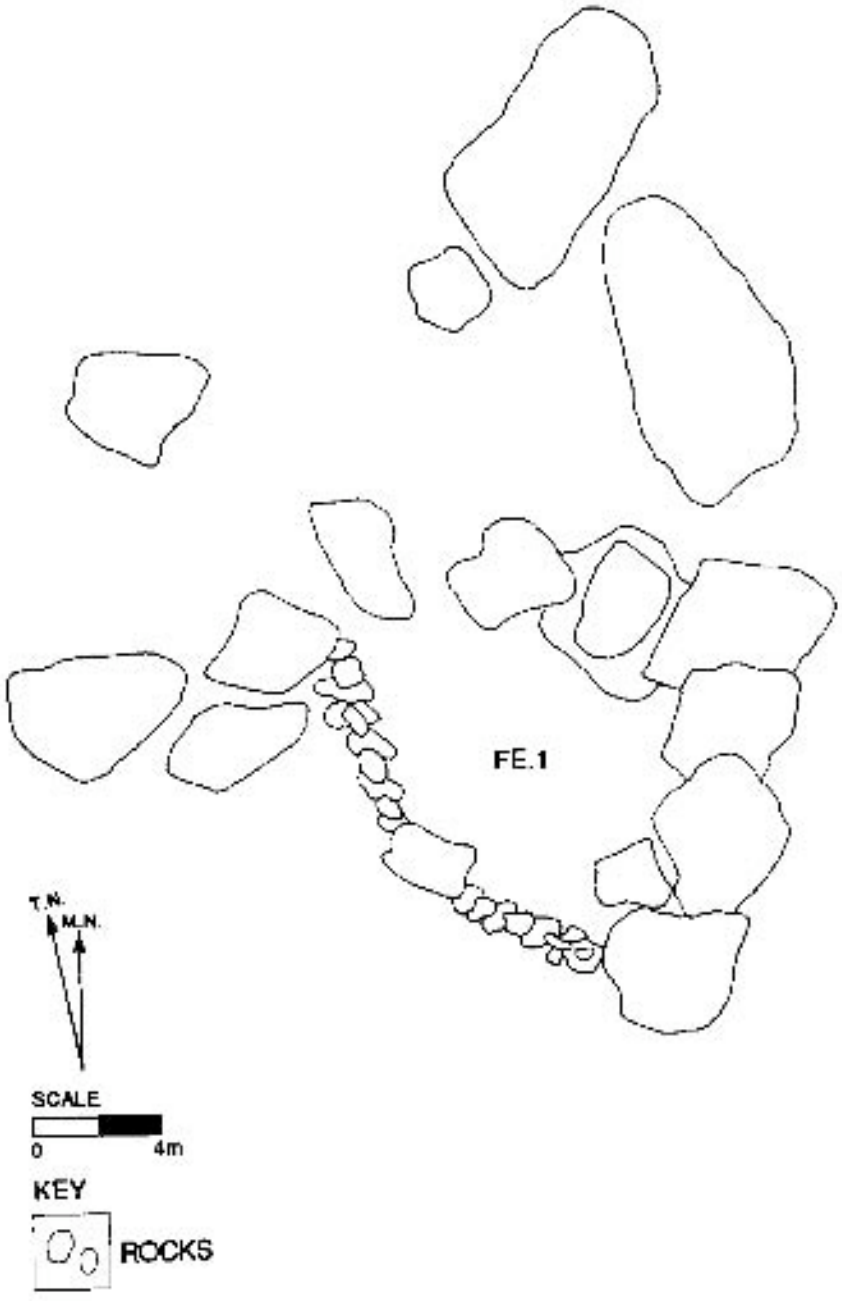

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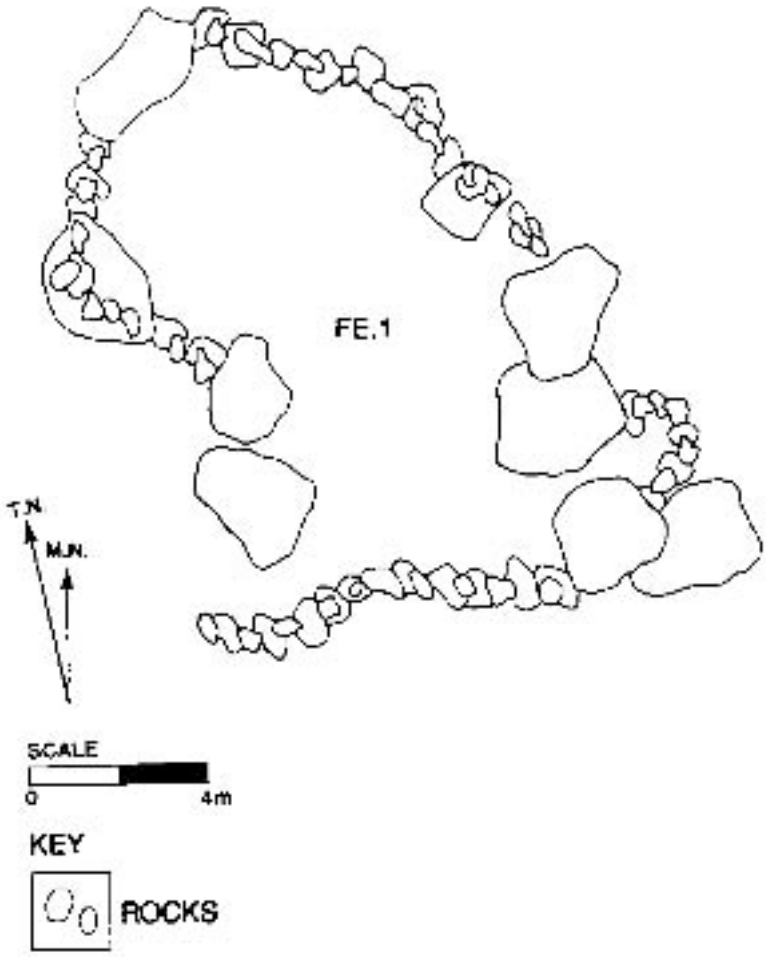

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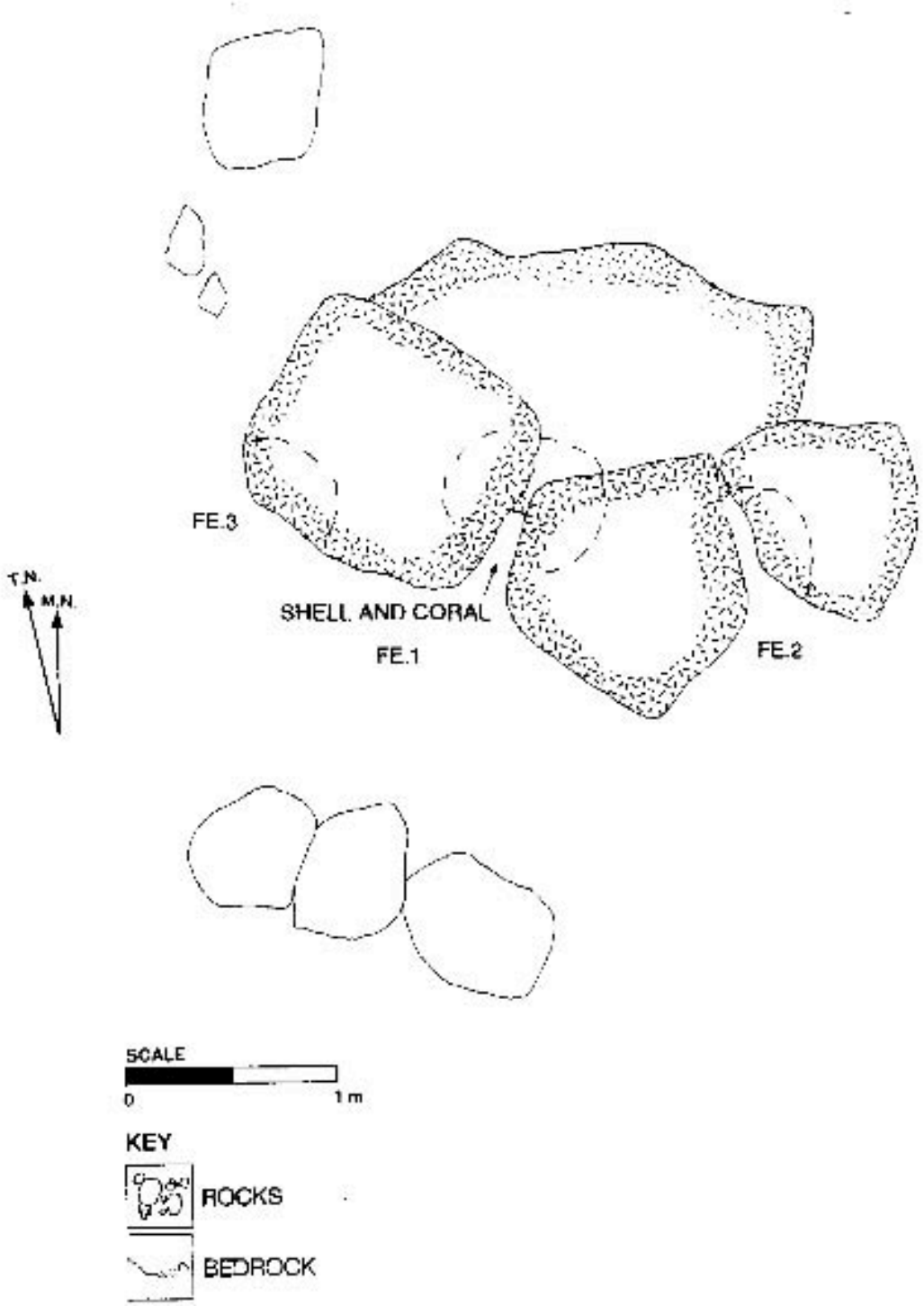

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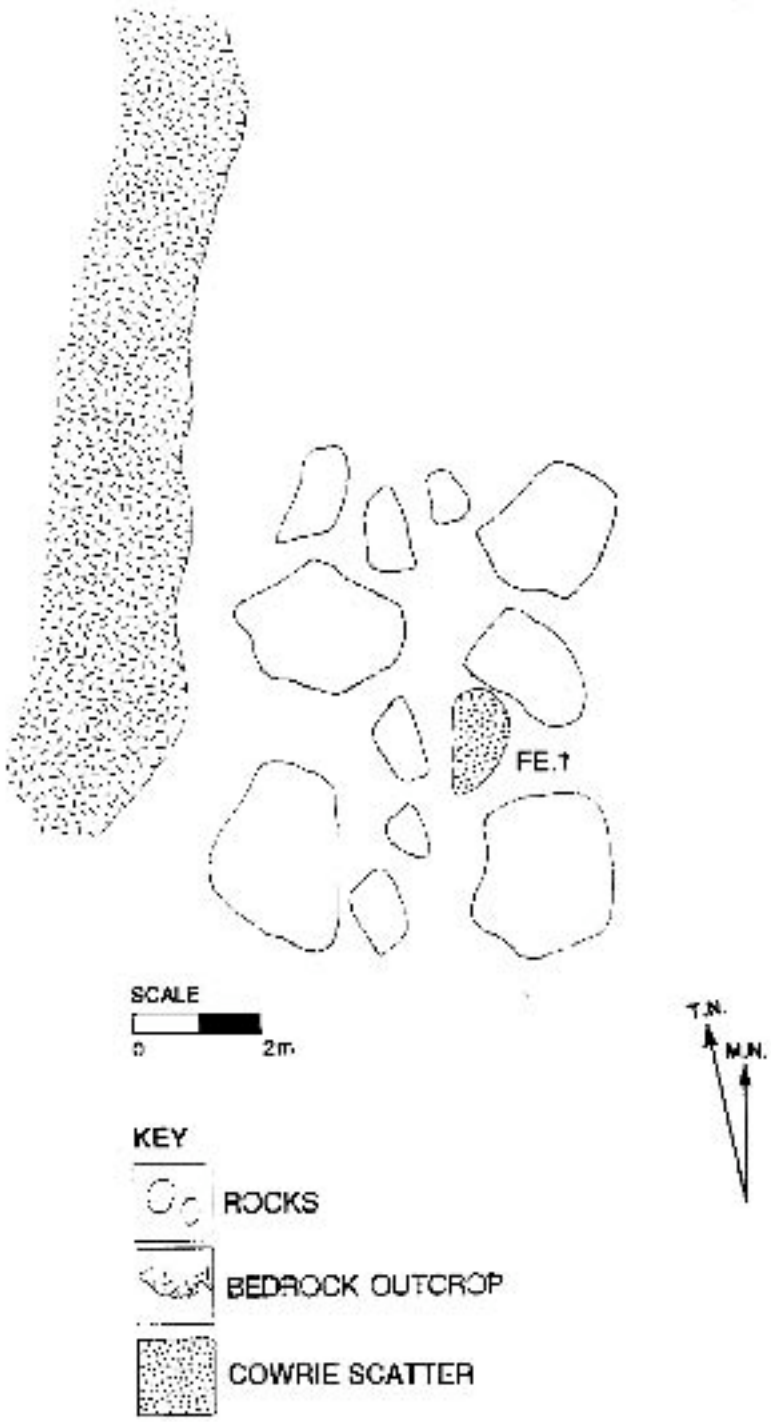

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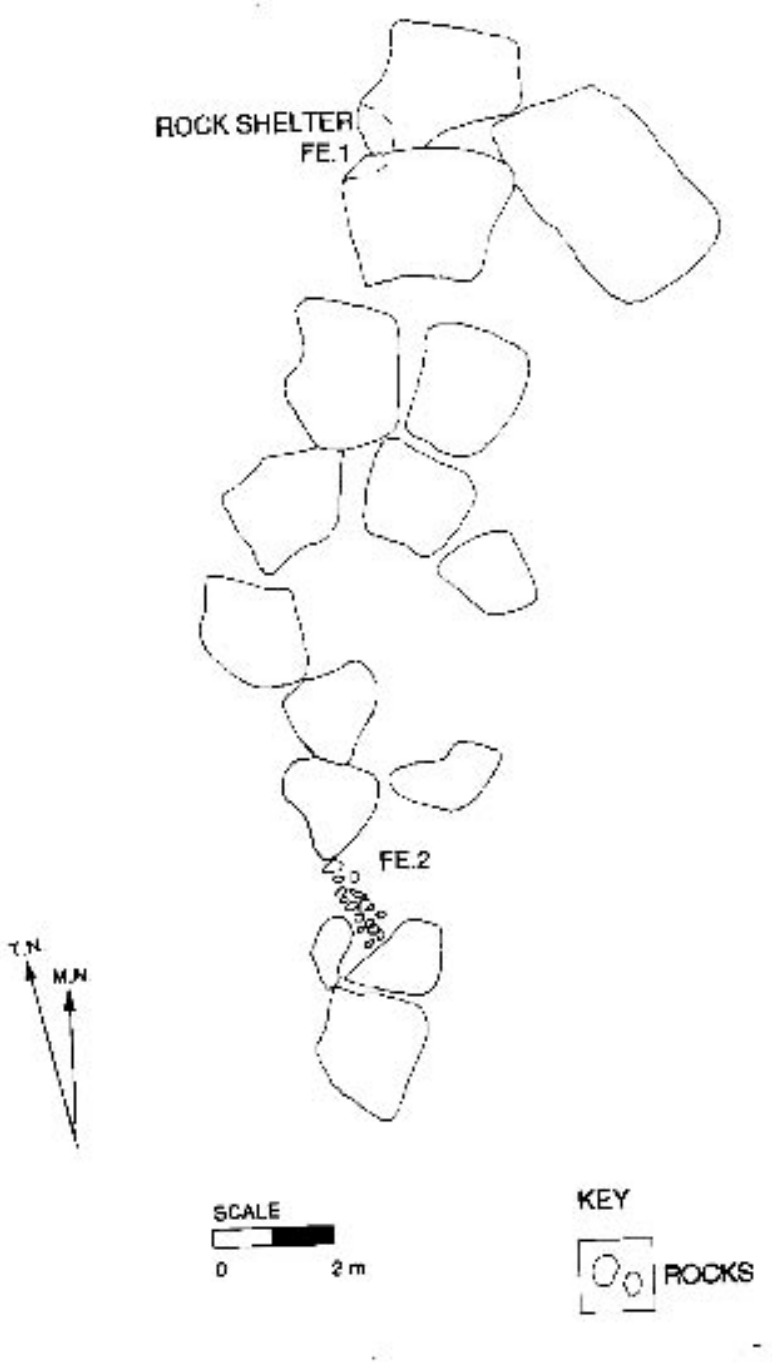

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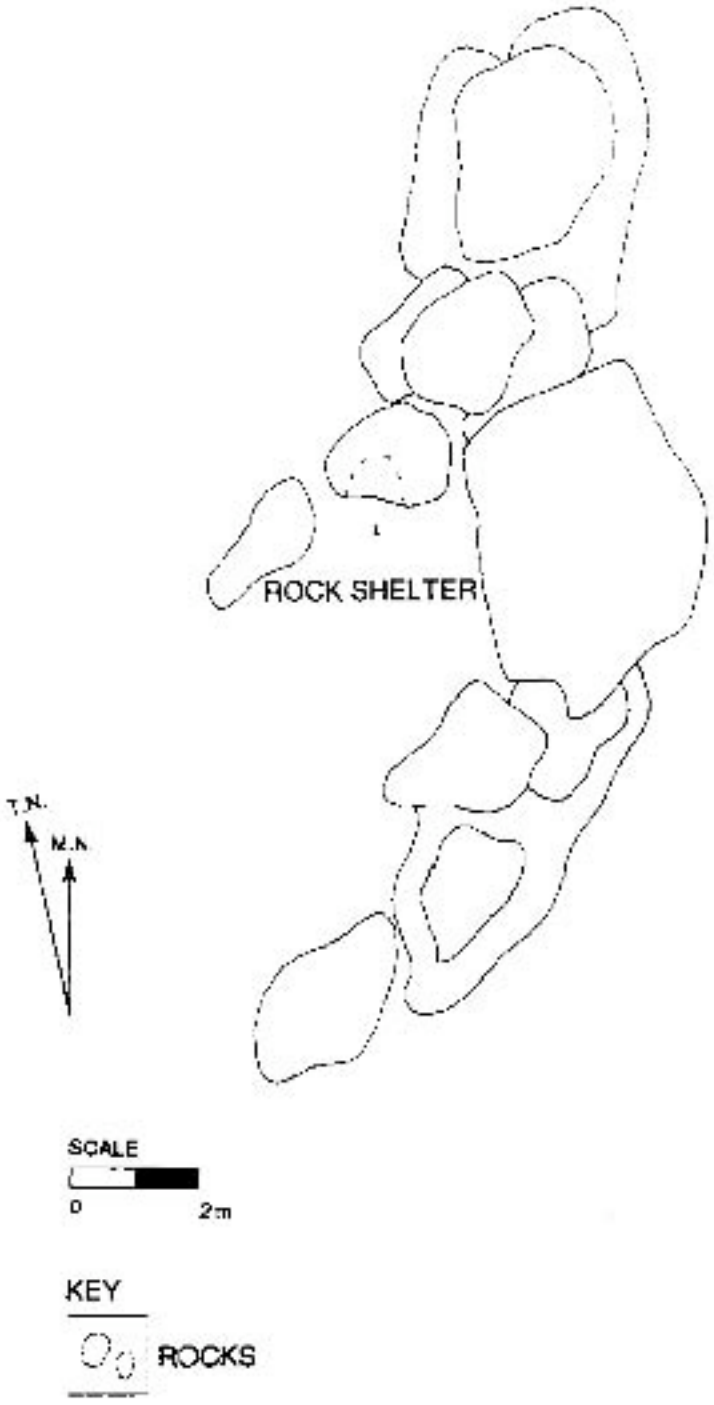

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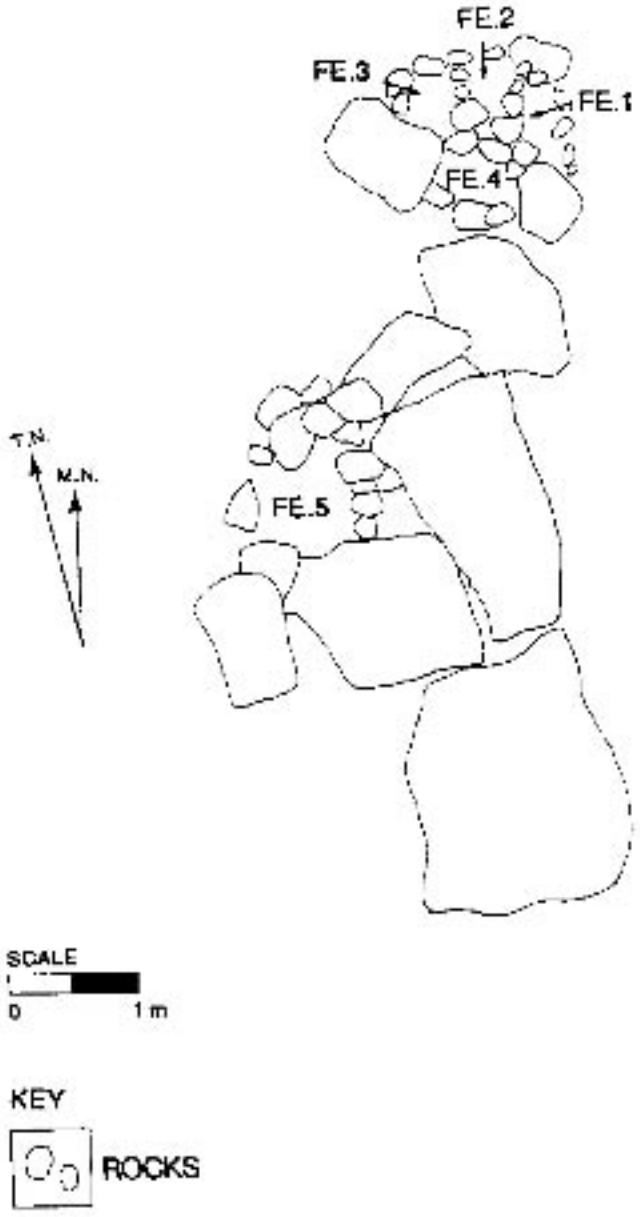

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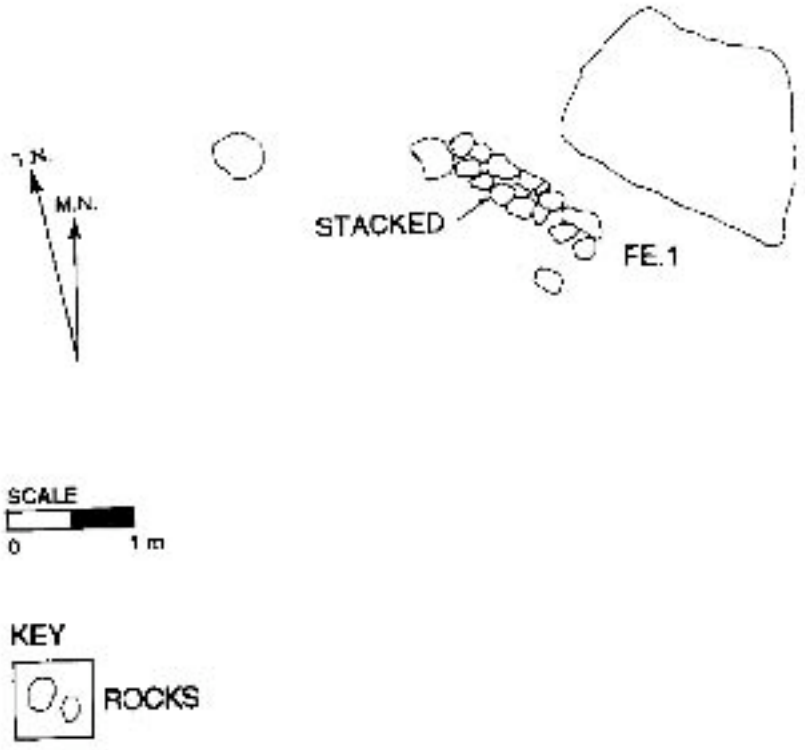

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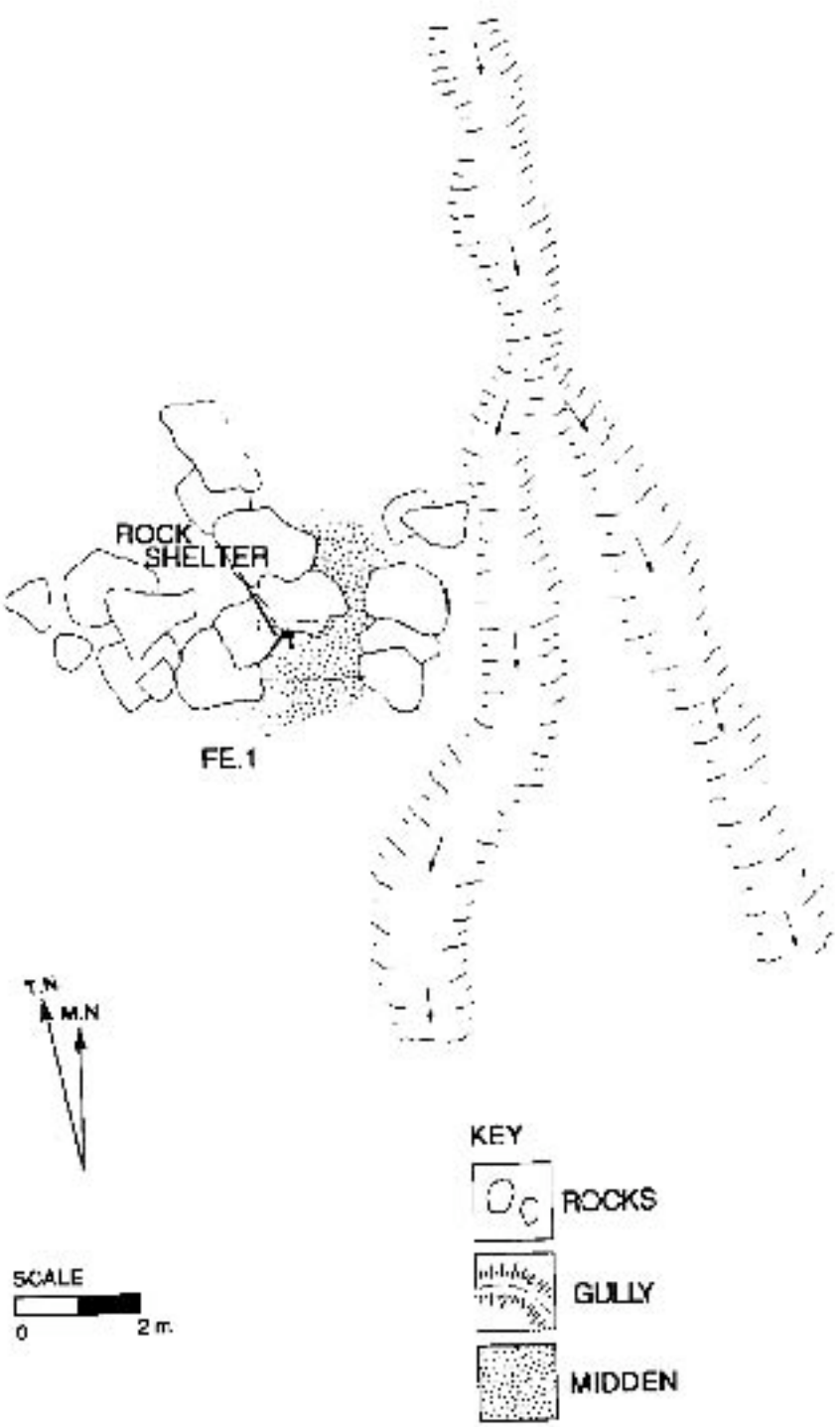

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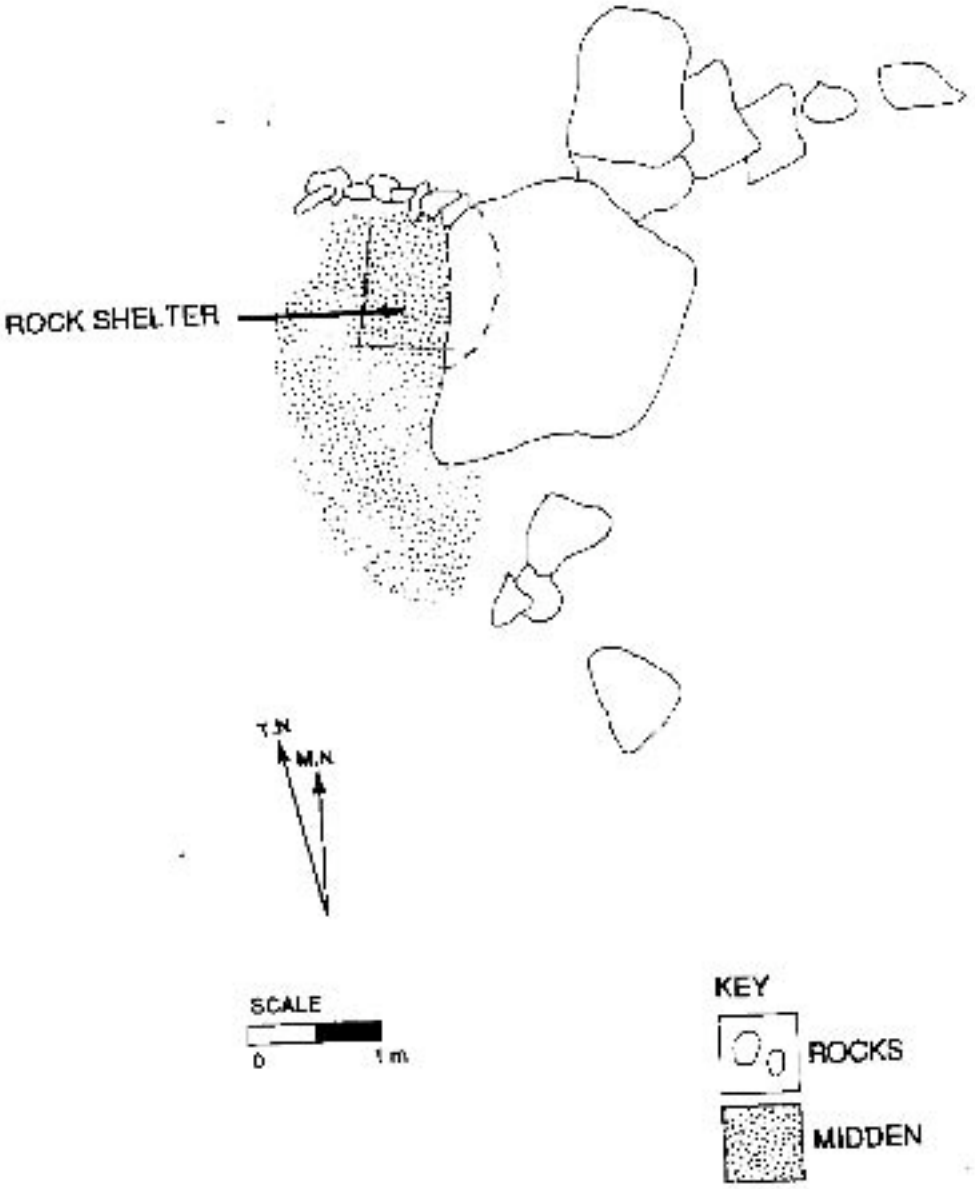

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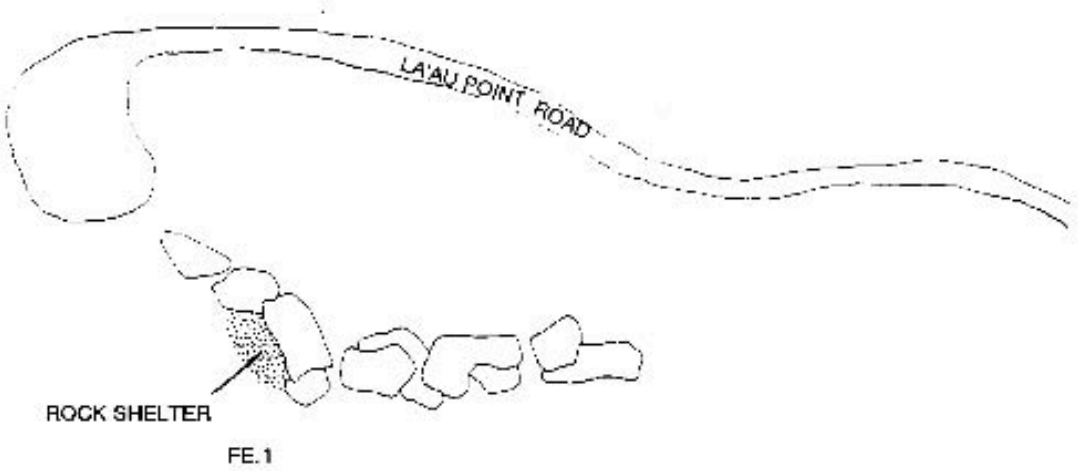

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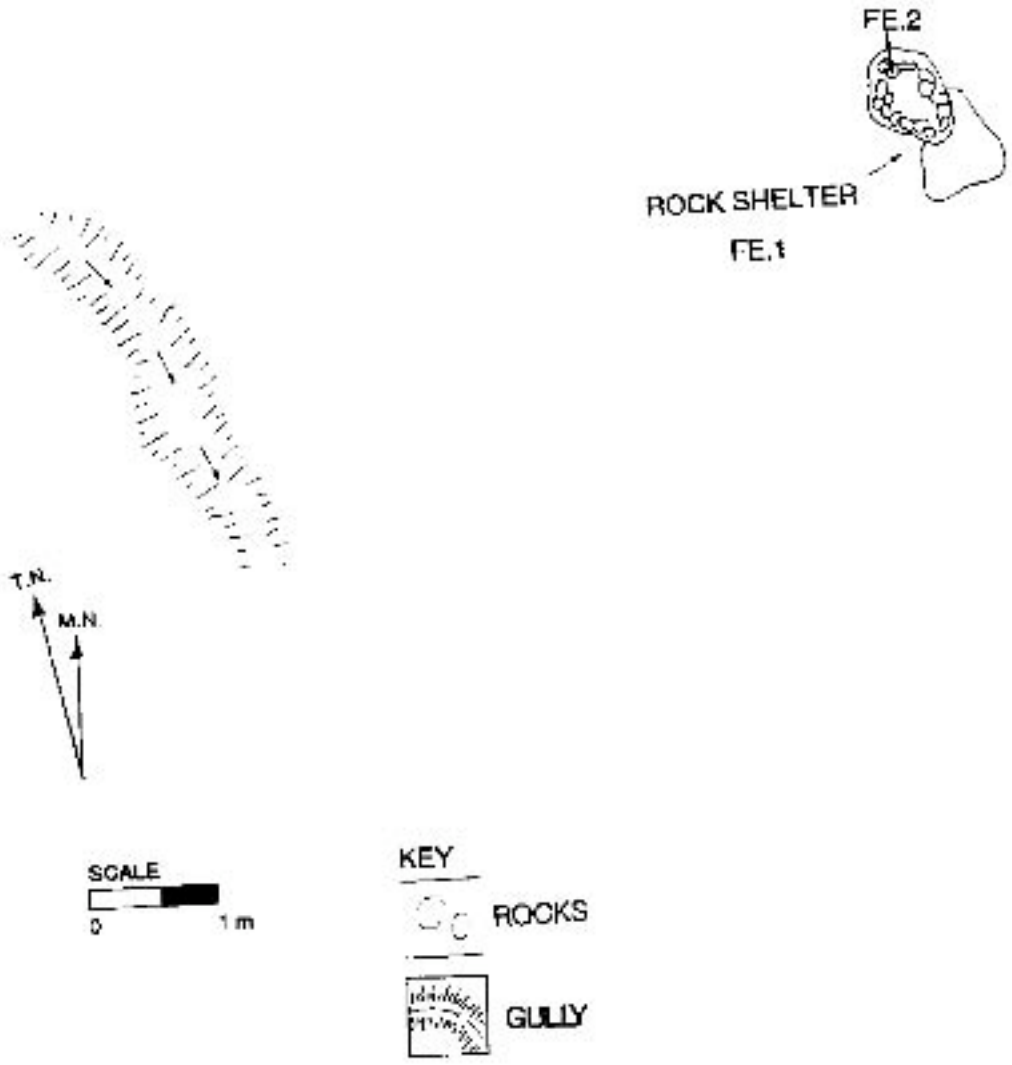

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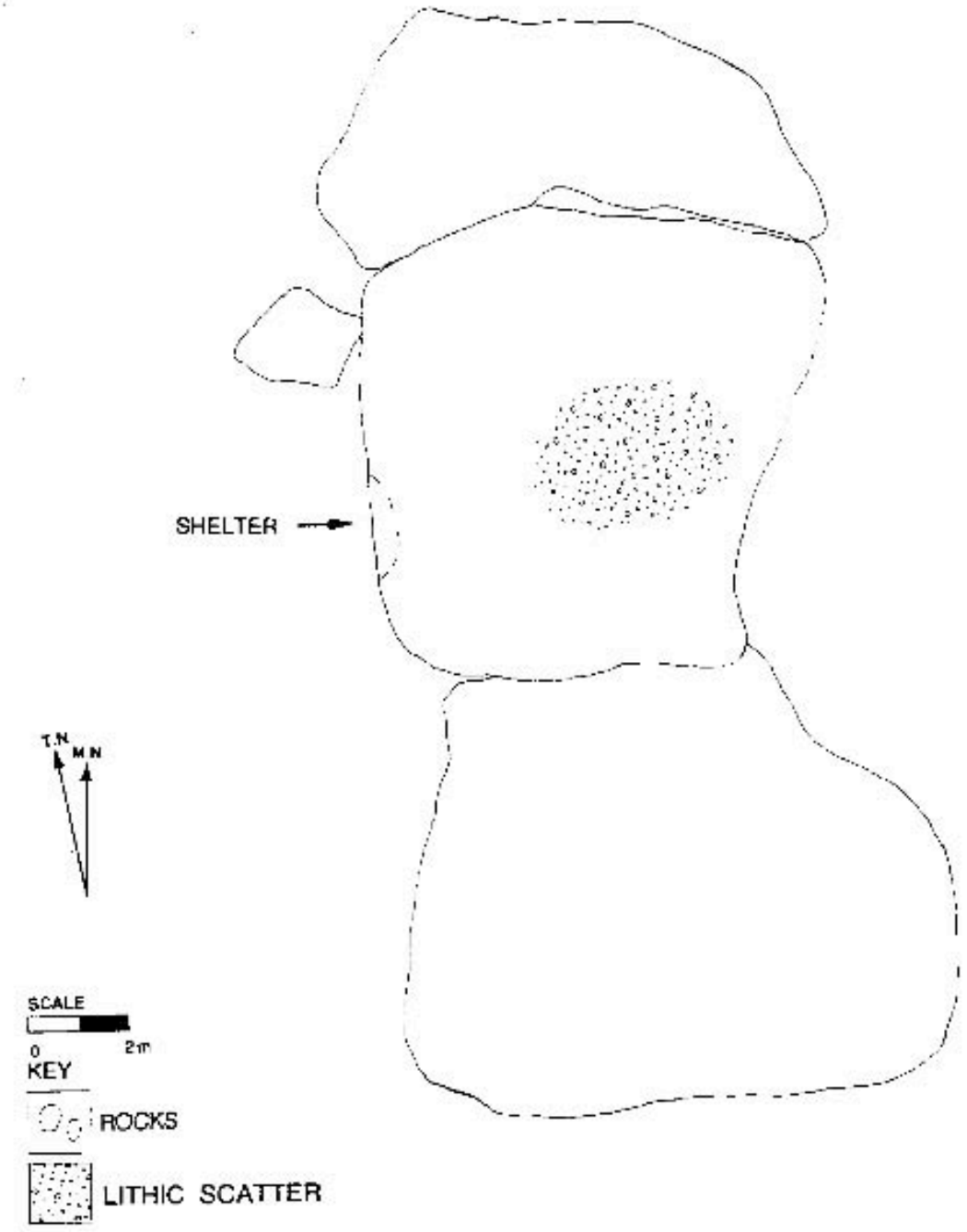

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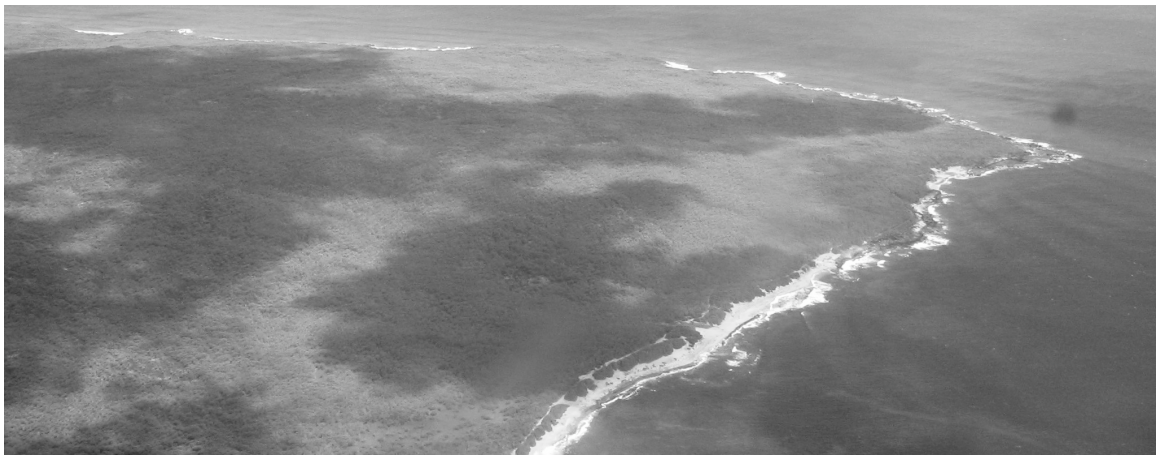
Kapukahehu to Hakina, Ahupua'a o Kaluako'i, Island o Moloka'i
(TMK 5-1-02-030)

Revised Monitoring Plan



Prepared for Molokai Properties, Limited
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July, 2007

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OVERVIEW OF LĀAU ARCHAEOLOGICAL PLANS

The archaeological plans for Lā'au include four sections for cultural resource needs that will arise in relation to 192 sites within the proposed development and preserves.[1] The plans are:

Preservation – Procedures for protecting and preserving 157 cultural sites.[2] Actions range from the immediate to the perpetual, and include site condition evaluation, stabilization, short and long-term protection, protocol education, periodic field checks, and data collection. The focus is on conservation of cultural landscapes, rather than isolated sites.

Data Recovery – Procedures and research issues for mapping and excavation of 21-24 sites within the road/infrastructure corridor and proposed subdivision lots. Since the most significant sites are being preserved, data recovery sites mostly consist of very simple agricultural modifications, lithic scatters, and more recent historical sites. All sites will undergo data recovery or, more likely, preservation, and samples within sites will be more robust than minimal SHPD requirements.

Monitoring – Procedures and responsibilities for archaeological maka 'ala of development activity. In addition to ensuring that preservation areas are not damaged, monitoring detects previously unknown cultural deposits, and halts work in an area, to evaluate finds, and if necessary consult with SHPD and interested parties to establish a preservation buffer or recover data.

Burial Treatment – Procedures for dealing with known, suspected, and inadvertently discovered burial sites (with no revisions to the accepted 2001 plan). All burials will be preserved in place, and all sites of unknown function for which burial is a possibility will be preserved. Newly found burials trigger consultation with the Moloka'i Island Burial Council.

Because the plans are interrelated, and important part of the general approach is to define the **process and sequence**. The past two years of community meetings can be considered the first phase, and with ongoing consultation helps define what happens next. The Ranch has committed to planning for the entire project area, to maintain or expand upon previous preservation commitments, and to have this revision include plans for all of the affected parcels including proposed subdivision lots, whose future owners must also abide by the plans. The process continues:

- Supplemental data collection in the road corridor to verify and augment site records, and search for new sites. Unexpectedly significant finds may cause re-routing. Also, the Papohaku Ranchlands section of the corridor will be described and reported at inventory level for SHPD review.
- Next, short-term preservation measures will be implemented, such as establishing protective buffers and emergency stabilization.
- Next, data recovery will be implemented. At the same time, implementation of long-term preservation measures will begin.
- During the course of construction, monitoring will occur.

[1] 193 sites appear in Table 1 because Sites 53 and 655 refer to the same site. 12 of the 192 lack integrity and significance and are not included in these plans.
[2] Of these 157, only 152 are definitely to be preserved. The remaining 5 currently are slated for Data Recovery, but will be preserved if possible, and so Preservation Plans are included here to cover that option.

- Final reports for each plan will be submitted for community feedback and submitted to SHPD for review as required by rules and statutes.

The original version of this plan (*Kahaiawa to Hakina, Ahupua'a of Kaluako'i, Island of Moloka'i*, Major 2001) dealt with a proposed subdivision in the former "Alpha USA" parcel (TMK 5-1-2:030). Since then, a smaller proposed subdivision has necessitated some revisions. More fundamentally, the Ranch's decision to engage the community in master planning has resulted in a scaled-back development with a more conservation-oriented approach, and the proposed land trust, resource management staff, and cultural protection zones have required that the preservation and data recovery plans be augmented and revised. For the most part, the archaeological plans closely resemble the 2001 version, which was accepted by SHPD. Changes in the revised version include:

- Re-assignment of several Data Recovery sites to Preservation.
- Shift from defining buffers around individual or clustered sites to instead establishing a confined development corridor and preserving large Cultural Protection Zones and the shoreline.
- Increased emphasis on active cultural resource management, anticipating as a neighbor a community land trust employing a cultural resource staff person.
- Recommendation to collect data from preservation sites to provide a better baseline for monitoring and help expand our understanding of the chronology and nature of settlement in the area, and specifically to guide environmental restoration.

MONITORING PLAN EXECUTIVE SUMMARY

This plan provides the monitoring for 192 sites in TMK 5-1-02:030, a parcel encompassing the southwest corner of the Kaluakoʻi *Ahupuaʻa* (traditional land district) on the Island of Molokaʻi. State of Hawaii rules for historic monitoring (HAR 13-279) provide a framework for the plan, but community preferences and a desire on the part of the landowner to be a good steward of cultural resources have also shaped the plan.

Planning for a proposed residential subdivision (hereafter, the "Project Area") has already embodied historic preservation goals and cultural sensitivity, and thus the project area avoids all but a few sites. The majority of preservation sites occur in six "Cultural Protection Zones," large areas that encompass numerous individual sites and preserve them in the context of their natural settings and their neighboring sites. This allows preservation of settlement systems, rather than isolated sites, resulting in protection of entire ancient Hawaiian cultural landscapes. This approach also allows simplification of protective buffers, replacing a tangle of site-specific boundaries with a small number of larger buffers. Similarly, the Shoreline Conservation Zone surrounds the entire coastline makai of the project area, and protects most of the sites not already in one of the Cultural protection Zones.

In keeping with the regulatory requirements for Monitoring Plans (HAR 13-279-4), this document specifies the sites to be protected, the types and locations of cultural deposits that could be discovered during monitoring, the protection and documentation measures to be followed, the monitor's authority to halt work, a pre-construction meeting to ensure that project personnel are informed of monitoring protocols, the type of expected laboratory work, report preparation, and archiving of any collections.

The initial focus of monitoring will be on protection of Preservation sites within or adjacent to the proposed road corridor or subdivision construction. These will be buffered and fenced as described in the **Preservation Plan** (Major 2007), and archaeological monitors will be responsible for maintaining those buffers during construction.

The second monitoring task consists of inspecting any ground-breaking activity in the Project Area to search for traces of cultural materials, deposits, or features; these will be documented, and in some cases may be protected. Monitors will have the authority to halt work in the vicinity of any inadvertent find while that find is evaluated, necessary consultations are completed, and a final treatment is specified.

The final phase consists of site condition monitoring in preservation areas (individual preservation sites, Cultural Protection Zones, and the Shoreline Conservation Zone). This does not involve traditional construction monitoring, and instead will be a process of examining sites to evaluate their stability and integrity relative to baseline site descriptions put together as the **Preservation Plan** is implemented.

INTRODUCTION

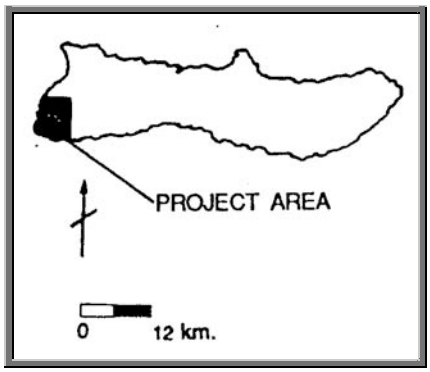

Figure 1. Project Area Location

This Monitoring Plan comprises one component of a set of integrated mitigation plans for TMK 5-1-02:030, a portion of which is being proposed for residential subdivision. The three types of monitoring covered in this plan represent interim and long term activities intended to enhance the preservation programs, comply with state rules for archaeological monitoring (HAR 13-279), and provide immediate response to inadvertent finds. These types of monitoring activity include:

- Site protection
- Documentation and evaluation of inadvertent finds during construction
- Site integrity and condition assessment.

Most sites within the project area will be preserved—152 compared to 138 in the 2001 plan and 46 originally recommended in the 1993 inventory report, an increase of 330%. In addition, eleven sites considered "not significant" in the 1993 report will be preserved by default, due to their locations within the Shoreline Conservation Zone, Cultural Protection Zones, or the Rural Landscape Reserve.[3] Finally, five sites (738, 761, 1125, 1136, and 1145) that have been recommended for Data Recovery may be preserved once their precise location in relation to subdivision lots and the road corridor be determined. Conceivably, then, the total number of sites to be preserved may be as high as 167, a 363% increase over the 1993 recommendation, and 87% of the total number (192) of sites in the overall parcel.

Perhaps the most profound change embodied in this revision, though, is change in outlook from the traditional practice of defining a site and surrounding it with a protective buffer to defining a development area with few or no sites and enclosing it within what the Cultural Committee came to call a "bubble." By reversing the approach from "Keep out of the fenced sites" to "Do not stray beyond the development corridor," the current plans should result in two major preservation benefits: reduction of inadvertent archaeological finds, and increased preservation of cultural landscapes rather than site "islands" in a sea of development. Monitoring forms an important component of this overall approach to preservation in a development context, since it is monitoring that will protect these cultural landscapes.

[3] These sites include: 677, 740, 759, 766, 767, 781, 1129, 1137, and 1138 in the RLR, 1165 in the Hakina CPZ, and 1140 in the SCZ.

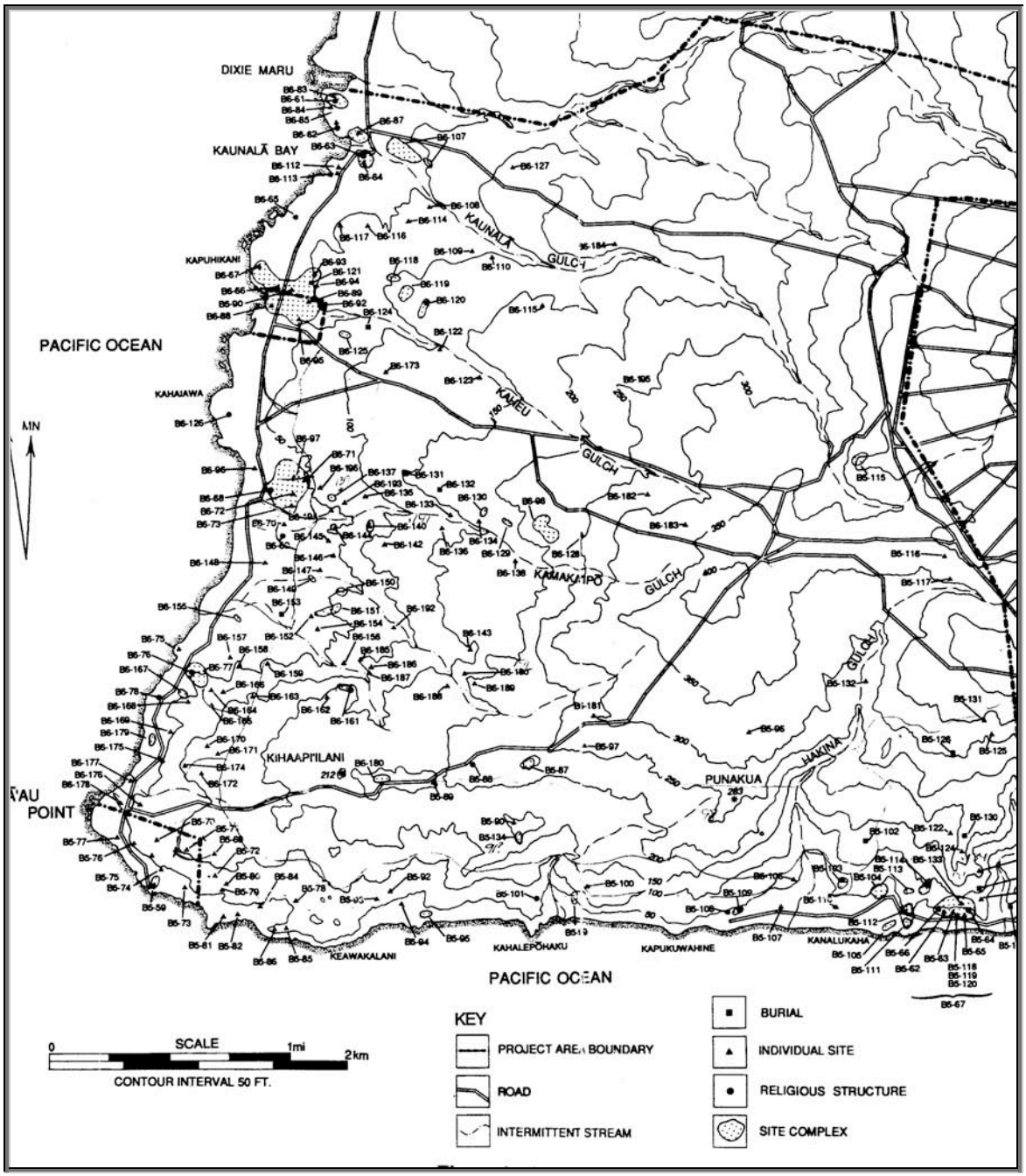

Figure 2. Archaeological Inventory Sites in TMK 5-1-02-030. From Dixon and Major 1993.

Figure 2 (above) depicts the sites located during archaeological inventory of the property encompassing the Project Area, using the Bishop Museum site numbers assigned in the early 1990s. Figure 3, a larger folio map attached with this plan, provides the State of Hawai'i site numbers, with their locations relative to the Project Area. As that map shows, the large majority of sites within TMK 5-1-02:030 are located outside the Project Area, and therefore are not at risk during development.

Table 1. Site Numbers and Mitigation Treatments

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
48	B6-61	X		
49	B6-62	X		
50	B6-63	X		
50	B6-64	X		
51	B6-65	X		
52	B6-66	X		
53	B6-68 and -97	X		
54	B6-69 to -73	X		
56	B6-76 and -77	X		
57	B6-78	X		
639	B6-67	X		
640	B6-74	X		
641	B6-83	X		
642	B6-84	X		
643	B6-85	X		
644	B6-86	X		
645	B6-87	X		
646	B6-88	X		
647	B6-89	X		
648	B6-90	X		
649	B6-91	X		
650	B6-92	X		
651	B6-93	X		
652	B6-94	X		
654	B6-96	X		
655 (aka 53)	B6-97	X		
656	B6-98	X		
657	B6-107	X		
658	B6-108	X		
659	B6-109	X		
660	B6-110	X		
661	B6-111			X
662	B6-112	X		
663	B6-113	X		
664	B6-114	X		
665	B6-115	X		
666	B6-116	X		
667	B6-117	X		
668	B6-118	X		
669	B6-119	X		
670	B6-120	X		
671	B6-121	X		
672	B6-122	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
673	B6-123	X		
674	B6-124	X		
675	B6-125	X		
676	B6-126	X		
677	B6-127			X
678	B6-128	X		
679	B6-129	X		
680	B6-130	X		
681	B6-131	X		
682	B6-132	X		
683	B6-133	X		
684	B6-134	X		
685	B6-135	X		
686	B6-136	X		
687	B6-137	X		
688	B6-138	X		
689	B6-139	X		
690	B6-140	X		
691	B6-141	X		
692	B6-142	X		
693	B6-143	X		
694	B6-144	X		
695	B6-145	X		
696	B6-146	X		
697	B6-147		X	
698	B6-148		X	
699	B6-149	X		
736	B6-150	X		
737	B6-151	X		
738	B6-152	?	?	
739	B6-153	X		
740	B6-154			X
741	B6-155	X		
742	B6-156	X		
743	B6-157		X	
744	B6-158	X		
745	B6-159		X	
746	B6-160		X	
747	B6-161	X		
748	B6-162	X		
749	B6-163		X	
750	B6-164	X		
751	B6-165	X		
752	B6-166	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
753	B6-167	X		
754	B6-168	X		
755	B6-169		X	
756	B6-170		X	
757	B6-171			X
758	B6-172		X	
759	B6-173			X
760	B6-174		X	
761	B6-175	?	?	
762	B6-176		X	
763	B6-177	X		
764	B6-178	X		
765	B6-179	X		
766	B6-180			X
767	B6-181			X
768	B6-182	X		
769	B6-183	X		
770	B6-184	X		
771	B6-185	X		
772	B6-186	X		
773	B6-187	X		
774	B6-188	X		
775	B6-189	X		
776	B6-190	X		
777	B6-191	X		
778	B6-192	X		
779	B6-193	X		
780	B6-194	X		
781	B6-195	X		
782	B6-196	X		
1100	B5-59	X		
1101	B5-60	X		
1102	B5-62	X		
1103	B5-63	X		
1104	B5-64	X		
1105	B5-65	X		
1106	B5-66	X		
1107	B5-67	X		
1109	B5-69	X		
1110	B5-70	X		
1111	B5-71	X		
1112	B5-72	X		
1113	B5-73	X		
1114	B5-74	X		
1115	B5-75	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
1116	B5-76	X		
1117	B5-77	X		
1118	B5-78		X	
1119	B5-79	X		
1120	B5-80	X		
1121	B5-81		X	
1122	B5-82	X		
1123	B5-83	X		
1124	B5-84		X	
1125	B5-85	?	?	
1126	B5-86	X		
1127	B5-87	X		
1128	B5-88	X		
1129	B5-89			X
1130	B5-90		X	
1131	B5-91		X	
1132	B5-92		X	
1134	B5-93		X	
1135	B5-94			X
1136	B5-95	?	?	
1137	B5-96			X
1138	B5-97			X
1139	B5-98	X		
1140	B5-99			X
1141	B5-100		X	
1142	B5-101	X		
1143	B5-102	X		
1144	B5-103	X		
1145	B5-104	?	?	
1146	B5-105	X		
1147	B5-106	X		
1148	B5-107	X		
1149	B5-108	X		
1150	B5-109	X		
1151	B5-110	X		
1152	B5-111	X		
1153	B5-112	X		
1154	B5-113	X		
1155	B5-114	X		
1156	B5-115	X		
1157	B5-116	X		
1158	B5-117	X		
1159	B5-118			X
1160	B5-119	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
1161	B5-120	X		
1162	B5-121	X		
1163	B5-122	X		
1164	B5-123	X		
1165	B5-124			X
1166	B5-125	X		
1167	B5-126	X		
1168	B5-127	X		
1169	B5-128	X		
1170	B5-129	X		
1171	B5-130	X		
1172	B5-131	X		
1173	B5-132	X		
1174	B5-133	X		
1175	B5-134	X		
1176	B5-135	X		

NOTE: Treatments with an outlined X signal post-2002 changes in status from Data Recovery to Preservation status. Sites slated for Inventory will all be recommended for Preservation. Question marks (**?**) indicate sites currently recommended for Data Recovery that may change to Preservation, pending precise site location.

Project Area Components

The physical scope of the cultural resource management plans in this series remains limited to those portions of Kaluakoʻi *ahupuaʻa* that could be directly affected by the proposed subdivision (hereafter referred to as the "Lāʻau Subdivision"), rather than all lands affected by the recent community planning process. Specifically, the revised cultural resource plans focus on the 1,492-acre project area described in the Ranch's petition to the State Land Use Commission, which requests a 613-acre area to be changed from Agricultural to Rural designation, 10 acres from Conservation to Rural (for a park), and 252 acres from Agricultural to Conservation.

In addition, this plan covers a proposed Rural Landscape Reserve, which corresponds to the remainder of TMK 5-1-02:030, the 6,350-acre parcel surveyed in 1991. All of the proposed Lāʻau Subdivision lots will derive from that original parcel, although development activity will affect only a limited portion of it—400 acres of house lots and 153 acres of roads, infrastructure and parks, or less than 10% of the original parcel area.

A combination of official zones and project-specific landscape designations have been adopted as a way of managing cultural resources.

- The **Project Area** covers approximately 400 acres, and consists of three components:

- **Road Corridor** – All areas potentially affected by construction of the road and any adjacent utilities. As many as six preservation sites are in or near this corridor, but will be protected.
- **Subdivision Lots** – All lots designated in the Lā'au Point Subdivision, including any where community-level facilities may be constructed. No preservation sites lie within lots, although some site buffers may extend into lots, and will be duly protected.
- **Undeveloped Land** – Areas within the Project Area, but outside of the Road Corridor and Subdivision Lots. The only preservation sites in this area that are not dealt with in the SCZ or CPZ categories below are three suspected burials at the southeastern end of the Project Area.

- The **Shoreline Conservation Zone (SCZ)** fringes the entire Project Area and is subject to multiple jurisdictions, rules and statutes within its 465 acres. It merits special attention archaeologically because of the richness, diversity, and potential vulnerability of sites there.
- **Cultural Protection Zones (CPZ)** have been devised as a means of protecting cultural and archaeological sites by encompassing their larger landscape settings. This preservation zone overlay will direct immediate and long-term land use in areas where cultural resources are concentrated. The majority of sites in TMK 5-1-02-030 are in CPZs, which extend to the Project Area and Shoreline Conservation Zone in several places. The total area of these areas will exceed 1,000 acres.
- The **Rural Landscape Reserve (RLR)** comprises the remainder of TMK 5-1-02-030, and therefore is outside of the Project Area. There are 11 significant sites in this area, five of which are being preserved.

SEE ATTACHED FOLIO MAP

Figure 3: Lā'au Subdivision Project area, Sites, and Cultural Protection Zones

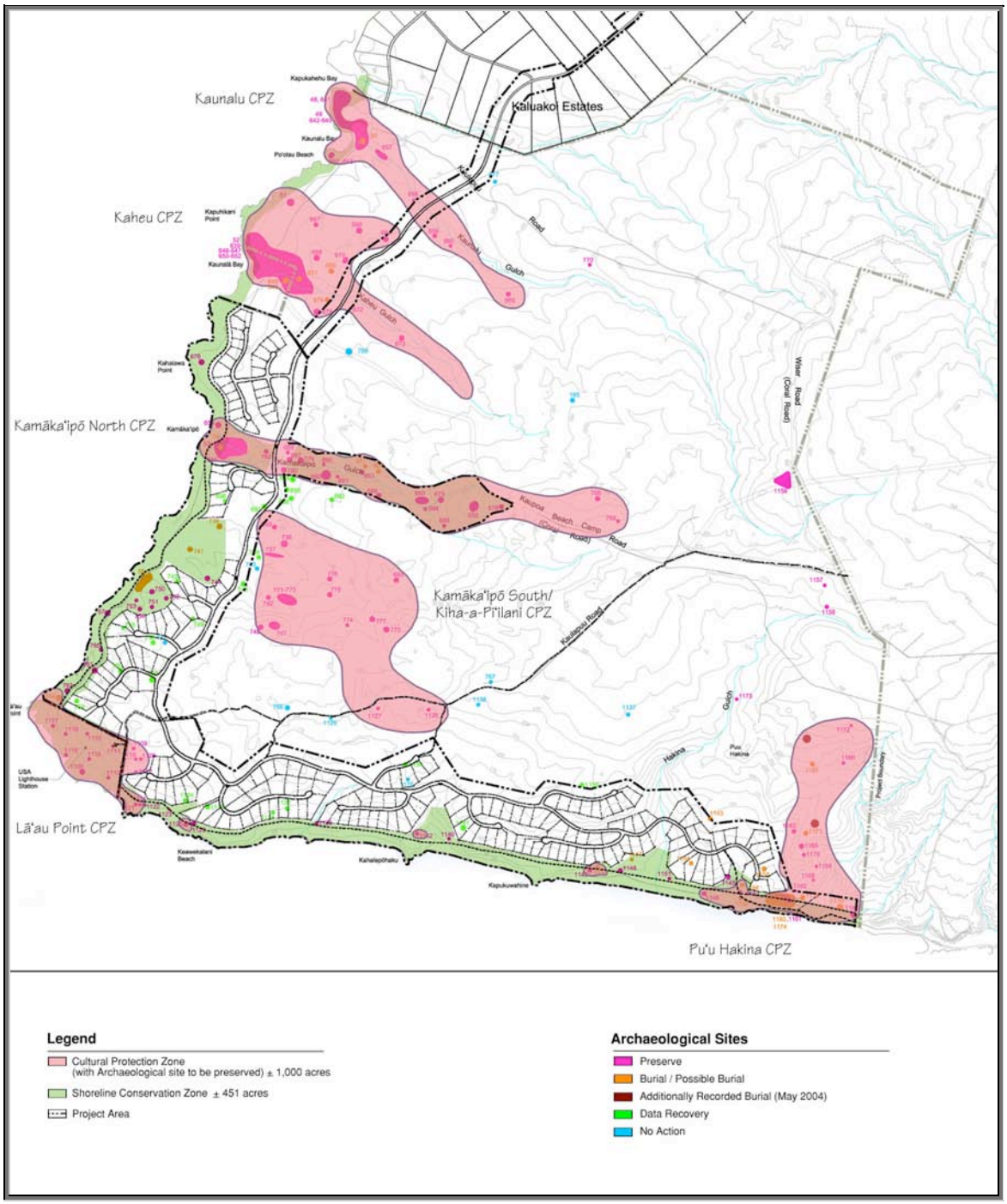

Figure 4: Cultural Protection and Shoreline Conservation Zones at Lā'au.

Likelihood of New Finds

Areas where monitoring would have the highest probability of encountering new finds have been eliminated from the Road Corridor and Subdivision Lots. All available data indicate that these development areas exclude the settings with the highest opportunity for new finds, such as the coastal flat and dunes, gulch interiors, and quarried ridges. Settlement patterns and traditional land use has been discussed in detail in the **Preservation Plan** (Major 2007), but can be summarized

in this way: stable settlement concentrated on the bays of the west coast, in what is now the Lā'au Point lighthouse parcel (outside the scope of this project), and along the south coast at the eastern end of the Project Area. The size, diversity, and quantity of archaeological features decreases rapidly *mauka* of the coastal flat and the cliffs and finger ridges immediately above it. The large majority of sites more than 100-m from the current shoreline are either part of the large Kamāka'ipō alluvial flat settlement, or are associated with agricultural use of the gulches (where soil and water are more abundant) and quarrying activity on selected ridges. Other sites are ancillary to these functions (such as trail markers or temporary habitations), or reflect modern hunting activity. The exception to this pattern occurs at Sites 1127 and 1128, which appear to be ritual sites associated with birth.

Sites *mauka* of the immediate coastal settlement zone tend to have extremely limited cultural materials. Excavations conducted during inventory revealed a pattern of very short term occupation for the most part, although the more developed quarry areas showed repeated occupations, and sometimes very large quantities of debitage (Dixon and Major 1993, Dixon et. al, 1995). However, even the more abundant deposits did not exhibit much diversity of cultural materials.

Monitoring during construction of an ecotourism camp at Kaheu Bay (commonly known as the location of Kaupoa House, a historic Molokai Ranch retreat) revealed that the features on the southern and *mauka* periphery of the coastal settlement there were agricultural in function. Despite constant monitoring of grading and uprooting of hundreds of trees there, almost no cultural materials were found (Major 1998). Along with the surface data from the inventory, this observation provides evidence that cultural deposits are rare outside of the settlement complexes.

Historic over-grazing by livestock and a large naturalized deer population has facilitated extensive wind and rainfall-induced erosion in southwest Kaluako'i, resulting in large areas that lack intact soil or sediment. No precise estimate on the eroded area is available, but widespread presence of deflated surfaces is evident, and hardpan is frequently exposed. Along with the decrease in feature density as distance from the coast increases, this factor reduces the likelihood of archaeological monitors encountering new finds. Monitoring at Kaupoa revealed frequent lenses of ash indicative of widlfire, another factor in the de-vegetation and erosion of sediments in the proposed monitoring area.

Expectations for monitoring are that finds will be infrequent and isolated. The settings most likely to yield cultural materials will be gulch interiors (where buried agricultural modifications or sediments may occur), and possible outliers to the quarries, where flakes or other lithic debitage may occur either buried in sediments or on deflated surfaces previously obscured by vegetation.

Despite the relatively limited expectations for archaeological finds, monitoring will be done when ground disturbing activity occurs within all of TMK 5-1-02:030. This was specifically requested by OHA, reflecting a strong preservationist sentiment that is common in the Moloka'i community.

MONITORING SCOPE

Subdivision Project Area

Within the Project Area boundary are 26 sites requiring monitoring because they are designated for Preservation and are within 50 meters of possible construction areas. An additional three sites (1125, 1136, and 1145) currently slated for Data Recovery that will be preserved if possible, and may be subject to protective monitoring as well. Other sites in the Project Area are either Data Recovery sites, or are well outside the area of potential impacts, and do not require protective monitoring. Procedures for establishing buffers and other interim protective measures have been specified in the **Preservation Plan**.

Table 2. Project Area Preservation Sites outside of Cultural Protection and Shoreline Conservation Zones.

Site Number 50-60-01-							
744	1144	1155					

Table 3. Cultural Protection and Shoreline Conservation Zone Sites within 50 meters of development.

Site Number 50-60-01-							
57	664	739	751	752	754	763	764
765	780	782	1101	1106	1107	1112	1122
1123	1142	1149	1150	1151	1152	1154	

Monitoring in the Project Area will also include observation of all ground-breaking activity regardless of site proximity. Some portions of the Project Area have a higher likelihood of encountering buried, unrecorded cultural materials, but high likelihood areas such as the coastal sand flats, settlement peripheries, gulches, and quarries have been eliminated from the Project Area during the design process. The monitoring scope, therefore, represents an expansion of monitoring commitment beyond the minimal requirements, and reflects the property owner's sensitivity to community concerns, as well as a specific request by OHA that any ground disturbance be monitored. Monitoring outside of known site areas will focus on documentation and evaluation of inadvertent finds, rather than protection of known resources.

Condition and long term monitoring of sites in the project area is described in the next section because most of the sites also fall within a Cultural Protection or Shoreline Conservation Zone. However, condition monitoring according to thse procedures will also occur for Sites 744, 1144, and 1155, all of which are outside said zones.

Cultural Protection and Shoreline Conservation Zones

As mentioned above, some sites within these zones also lie within the boundary of the Project Area, but both the Cultural Protection Zones (CPZ) and Shoreline Conservation Zone (SCZ) group large numbers of preservation sites within larger landscapes that extend beyond the Project Area.

Sites within these zones that could be within 50 m of development activity (i.e., within 50 m of the proposed road or subdivision lot boundaries) have been included in the **Project Area** section above. Those more than 50 m from construction will not require protective monitoring, and the appropriate protective measures have been addressed in the **Preservation Plan**.

Monitoring of sites in the Shoreline Conservation Zone will consist entirely of protective monitoring, since construction is not being proposed within that zone, and thus the potential for inadvertent finds is absent.

Because existing dirt roads may be improved for emergency access, protective monitoring may also be required there. These roads traverse the *mauka* portion of the Kamāka'ipō North CPZ and the southern tip of the Kamāka'ipō South – Kiha-a-Pi'ilani CPZ (See Figure 3). The **Preservation Plan** has already specified that road maintenance in those areas should not diverge from the existing corridor, but monitoring will occur during any grading to those roads. Sites subject to protective monitoring in those areas include: 678, 1127, and 1128. Additionally, monitoring ins those areas will document and evaluate any inadvertent discoveries.

Monitoring will document any inadvertent discoveries within portions of the road traversing the Kaunalu, Kaheu, and Kamāka'ipō North CPZ's, as well as any grading of the dirt roads described in the previous paragraph. Any finds will be evaluated in terms of significance, and the appropriate consultations completed as described below under **Methodology**. Burials are very unlikely to be among the finds, but if they occur will be subject to the **Burial Treatment Plan**.

Condition and integrity of sites in the SCZ and CPZ will also occur. This will consist of periodic examination of the sites in these zones to determine whether they are deteriorating or stable. Data from these observations will guide long term and emergency preservation management. The specific actions involved in this type of monitoring, as well as the intervals between inspections are described below under **Methodology**.

Rural Landscape Reserve

Very few sites occur within the Rural Landscape Reserve, and as the **Preservation Plan** specifies, their treatment will consist of passive preservation. Ground disturbance within this area will not go beyond grading of existing dirt roads, an activity that will be monitored. The lone site that could potentially be affected by road maintenance is 1156, a quarry adjacent to a coral-paved road at the mauka edge of TMK 5-1-02:030 (see Figure 3).

Ground disturbance associated with the development of the subdivision and emergency access to it will be monitored in the RLR, and may include protective monitoring at 1156. Condition and integrity monitoring is not specified for the RLR in the context of this project.

METHODOLOGY

Pre-Construction Meeting and Work Stoppage

Prior to construction commencing, the archaeologist will meet with field personnel and the project manager to clarify the monitor's role and responsibility. As the person on site responsible for maintaining the integrity of protected areas and to document and evaluate (and if necessary, mitigate) new discoveries, the archaeological monitor will have the authority to call temporary work stoppages in specified areas.

If intact cultural deposits or buried features are inadvertently discovered, the monitor will stop work in the vicinity and evaluate the finds. This will include examination of both the excavated sediment and the hole or graded surface. The archaeological monitor has the authority to propose mitigation measures, including data recovery excavation, site recording, or preservation and avoidance. The SHPD will be called upon discovery of significant sites, and will review site records, significance evaluations, and treatment recommendations.

Consultation

The archaeological monitor will serve as a liaison with SHPD and/or the Burial Council if they need to be consulted, and will consult with members of the appropriate ethic group (Native Hawaiians, in the anticipated scenario). Finds that could either change the significance of a known site, or that pertain to a previously unrecorded site, will lead to consultation with SHPD and the appropriate ethnic group. Since OHA has taken a strong interest in the project and has cultural staff on Moloka'i, they will be the initial contact with the Hawaiian community, although they may ask the monitor to talk with other community members, and the monitor may find that other individuals or groups have an interest and should be consulted as well.

Because of the expedited time frame involved with finds made during construction, deciding on the requirement for mitigation and the specific form it should take will be the responsibility of SHPD, in accordance with HAR 13-280-3, although the archaeological monitor will make every effort to aid SHPD with input from community consultation and the monitor's own assessment of the find.

Coverage

Should construction activities involve simultaneous ground disturbance in multiple areas having sediments with the potential to contain cultural deposits or features, additional monitors will be brought on site. It is the client's responsibility to notify the primary monitor (designated by the consulting archaeologist) with enough lead-time to bring in additional monitors.

If monitored construction activity in a given area has already resulted in removal or complete disturbance of sediment capable of containing intact cultural deposits, then subsequent work in that area may not be monitored. Such activities may include excavation or grading of sterile subsoil or bedrock, as well as introduction of outside fill. To ensure that such work does not stray into an area not previously disturbed, the monitor may erect flagging or fencing at the outer edge of the previously disturbed and monitored area. If the work may involve disturbance of any sediment capable of containing cultural materials, then monitoring will be required.

Documentation

The monitor will examine excavated sediments, as well as the profiles and bases of excavated and graded areas. The excavated volume will be sorted through as much as possible by hand, with trowels and shovels, and (where known deposits are being impacted, or the likelihood for undiscovered deposits is particularly high) sifted through one-quarter inch screens. Previous excavations in southwest Moloka'i this far from the coast have yielded mostly lithic artifacts and occasional shell, which does not require smaller mesh.

Excavation of remnant or intact features and deposits will consist of controlled hand digging by natural and cultural layers, with screening of all matrix through 1/4 inch mesh, until the culturally sterile subsoil had been excavated at least 10 cm. In settings where apparently sterile sediment could have been deposited over a buried cultural deposit or surface horizon, a shovel probe will be dug as deep as is required to demonstrate that deeper cultural deposits are not present. The total area of excavation will be determined by the size of the buried feature or deposit. Because such excavation will constitute the final chance for controlled data recovery, large samples will be preferred, but excavation need not be done for 100% of all deposits, and the upper threshold will be determined in terms of the usefulness or redundancy of data.

The monitor will keep a field notebook describing the areas monitored and the nature of the work being monitored in each. When construction results in archaeological finds, the monitor will document these with written descriptions of the types of materials encountered, their vertical and horizontal distribution, their location, and any other pertinent details. All finds will be plotted on a map of sufficient detail to pinpoint their location later. Where buried features or deposits are found and enough remains intact to do so, profiles will be drawn to scale and photographed. The sediment matrix containing artifacts, cultural layers, or buried features will be described according to standard practice in Hawaiian archaeology. Although such finds are not anticipated, those which reveal a horizontal shape will be mapped to scale in planview.

Laboratory Work

The majority of processing, describing, and analysis of materials collected during the project will be done on Moloka'i. Few specialized analyses are likely to be required, and the bulk of lab tasks will be to measure, weigh, photograph, and describe the materials, which are likely to be dominated by basalt debitage. The basic task will be to build a quantitative and qualitative data table for the Monitoring Report.

Because of the desire to have a broader foundation for interpretation, as well as the Land Trust's desire to re-vegetate areas with native (and possibly Polynesian introduced) species, charcoal will be of particular importance. It will be separated from non-charcoal, dried, and stored in foil according to each collection context. Once entered in the collections log (see **Archiving Collections** below), selected charcoal samples will be sent to an outside lab for taxonomic identification. Some of these will be sent to another lab for radiometric dating, most likely by the accelerator mass spectroscopy technique given the anticipated small sample size. The bases for this selection will be: confidence in the recovery context, a preference for feature contexts (or other well-defined events to be dated) rather than general layers, short-lived taxa (to avoid in-build "old wood" ages), and relevance to interpreted areas and themes.

Basalt flakes and other debitage will form the majority of the collection. Given the known importance of west Molokaʻi as a lithic resource area, the Monitoring Report will endeavor to draw whatever conclusions it may about the procurement of stone from the area, the degree to which it was worked there, whether any indications of local use are apparent, and whether our understanding of the process of lithic production can be expanded based on the data. If resources allow, samples may be sent to the University of Hawaiʻi at Hilo, which has the facilities to do noninvasive geochemical source analysis on basalt. This has some potential to reveal stone from outside sources, although that is not expected, and instead would contribute to the statewide awareness of lithic quarry distribution.

Monitoring Report

At the conclusion of archaeological monitoring, the project Principal Investigator will prepapre a report, to include all of the elements described in HAR 13-279-5.

Archiving Collections

It is not anticipated that a large volume of material will be collected during archaeological monitoring. Those that are recovered, however, will be maintained as a single project collection, and will be kept on the island. The total volume is expected to be less than 2 cubic feet, and thus can probably be stored in a single box. While the exact location has not been determined, it is likely to be in a Molokai Ranch or Molokai Properties office in Maunaloa, the closest secure facilities to the project area. Prior to completion of the monitoring, the collections may be housed in the Molokaʻi office of the archaeological monitoring firm. In both cases, the collection shall be kept in a matter that protects the materials from loss or deterioration.

Collections shall be stored in bags, foil, or other containers bearing basic information to include (at a minimum) the site and feature number, a unique number (assigned to individual specimens or lots), the stratigraphic context designation (either "surface," a layer number, or a feature designation), the name of the specimen type, and the date collected. A log of all collected artifacts and samples must me maintained by the monitor. This will include the fields named above, as well as the material type, the collector, and comments. The log will also provide a means to note when objects or samples are removed for analysis, community education, or any other reason, it will specify when and why anything is removed, and to whom it went. Artifacts should not be removed from the Island of Molokaʻi.

The exception to this will be any materials that must be sent elsewhere for analysis, such as wood charcoal that must be sent to laboratories on Oʻahu, the mainland, and Hawaiʻi Island for taxonomic identification and radiometric dating of charcoal and geochemical sourcing of stone. It is expected that radiometric dating will be done on at least a small number of samples, and since the process consumes the charcoal, it will not be returned to the collection.

Burials

Should human remains be encountered, construction in the vicinity will be stopped while the SHPD Burials Program and the Molokaʻi Island Burial Council are notified and consulted. The preferred treatment for burials will be to preserve them in place and divert development around them. It is not likely that burials will be encountered during this project, but if they are, the general **Burial Treatment Plan**

will be amended to reflect the specifics of each case. Rules for the treatment of human remains (HAR 13-300) are the basis for that plan and for any actions taken in the field.

The landowner and community both have expressed a strong desire to avoid removal and reinterrment of burials, and the preferred option should any such find occur will be in situ preservation.

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Papohaku to Hakina, Ahupua'a o Kaluako'i, Island o Moloka'i
(TMK 5-1-02-030)

Revised Preservation Plan

Prepared for Molokai Properties, Limited
by
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July, 2007

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OVERVIEW OF LĀʻAU ARCHAEOLOGICAL PLANS

The archaeological plans for Lāʻau include four sections for cultural resource needs that will arise in relation to 192 sites within the proposed development and preserves.[1] The plans are:

Preservation – Procedures for protecting and preserving 157 cultural sites.[2] Actions range from the immediate to the perpetual, and include site condition evaluation, stabilization, short and long-term protection, protocol education, periodic field checks, and data collection. The focus is on conservation of cultural landscapes, rather than isolated sites.

Data Recovery – Procedures and research issues for mapping and excavation of 21-24 sites within the road/infrastructure corridor and proposed subdivision lots. Since the most significant sites are being preserved, data recovery sites mostly consist of very simple agricultural modifications, lithic scatters, and more recent historical sites. All sites will undergo data recovery or, more likely, preservation, and samples within sites will be more robust than minimal SHPD requirements.

Monitoring – Procedures and responsibilities for archaeological maka ʻala of development activity. In addition to ensuring that preservation areas are not damaged, monitoring detects previously unknown cultural deposits, and halts work in an area, to evaluate finds, and if necessary consult with SHPD and interested parties to establish a preservation buffer or recover data.

Burial Treatment – Procedures for dealing with known, suspected, and inadvertently discovered burial sites (with no revisions to the accepted 2001 plan). All burials will be preserved in place, and all sites of unknown function for which burial is a possibility will be preserved. Newly found burials trigger consultation with the Molokaʻi Island Burial Council.

Because the plans are interrelated, and important part of the general approach is to define the **process and sequence**. The past two years of community meetings can be considered the first phase, and with ongoing consultation helps define what happens next. The Ranch has committed to planning for the entire project area, to maintain or expand upon previous preservation commitments, and to have this revision include plans for all of the affected parcels including proposed subdivision lots, whose future owners must also abide by the plans. The process continues:

- Re-survey the road corridor to verify and augment site records, and search for new sites. Unexpectedly significant finds may cause re-routing. Also, the Papohaku Ranchlands section of the corridor will be described and reported at inventory level for SHPD review.
- Next, short-term preservation measures will be implemented, such as establishing protective buffers and emergency stabilization.
- Next, data recovery will be implemented. At the same time, implementation of long-term preservation measures will begin.
- During the course of construction, monitoring will occur.
- Final reports for each plan will be submitted for community feedback and submitted to SHPD for review as required by rules and statutes.

[1] 193 sites appear in Table 1 because Sites 53 and 655 refer to the same site. 12 of the 192 lack integrity and significance and are not included in these plans.

[2] Of these 157, only 152 are definitely to be preserved. The remaining 5 currently are slated for Data Recovery, but will be preserved if possible, and so Preservation Plans are included here to cover that option.

The original version of this plan (*Kahaiawa to Hakina, Ahupua'a of Kaluako'i, Island of Moloka'i*, Major 2001) dealt with the former "Alpha USA" parcel (TMK 5-1-2-030). Since then, changes in the project area and the size and location of proposed subdivision lots have necessitated some revisions. More fundamentally, the Ranch's decision to engage the community in master planning has resulted in a scaled-back development with a more conservation-oriented approach, and the proposed land trust, resource management staff, and cultural protection zones have required that the preservation and data recovery plans be augmented and revised. For the most part, the archaeological plans closely resemble the 2001 version, which was accepted by SHPD. Changes in the revised version include:

- Re-assignment of several Data Recovery sites to Preservation.
- Shift from defining buffers around individual or clustered sites to instead establishing a confined development corridor and preserving large Cultural Protection Zones and the shoreline.
- Increased emphasis on active cultural resource management, anticipating as a neighbor a community land trust employing a cultural resource staff person.
- Recommendation to collect some data from preservation sites to provide a better baseline for monitoring and help expand our understanding of the chronology and nature of settlement in the area, and specifically to guide environmental restoration.

PRESERVATION PLAN EXECUTIVE SUMMARY

This plan provides the preservation treatments for 157 sites in TMK 5-1-02-030, a parcel encompassing the southwest corner of the *Ahupua'a* (traditional land district) on the Island of Moloka'i. State of Hawaii rules for historic preservation (HAR 13-277) provide a framework for the plan, but community preferences and a desire on the part of the landowner to go beyond mere compliance have also shaped the plan.

Planning for a proposed residential subdivision (hereafter, the "Project Area") has already embodied historic preservation goals and cultural sensitivity, and thus the project area avoids all but a few sites. The majority of preservation sites occur in six "Cultural Protection Zones," large areas that encompass numerous individual sites and preserve them in the context of their natural settings and their neighboring sites. This allows preservation of settlement systems, rather than isolated sites, resulting in protection of entire ancient Hawaiian cultural landscapes. This approach also allows simplification of protective buffers, replacing a tangle of site-specific boundaries with a small number of larger buffers. Similarly, the Shoreline Conservation Zone surrounds the entire coastline makai of the project area, and protects most of the sites not already in one of the Cultural protection Zones.

In keeping with the regulatory requirements for Preservation Plans, this document specifies the sites to be protected, the scope and results of community consultation, the form of protection, how buffers will be established, interim protection measures, and long term preservation measures. These appear in sections entitle **Consultation** and **Preservation Actions**. The requirement for site specific preservation plans has been detailed in a section by that name, in which site-specific plans are shown in a table, and described in groupings corresponding to their physical locations and management needs. In addition, the plan includes elements that are not required, but help its users understand the community foundations of the plan, the details of implementation, and so on. These appear in the **Introduction** and sections entitled **Preservation Goals**, **Preservation Phases**, and **Supplemental Data Collection**.

INTRODUCTION

Organization of this Plan

This Preservation Plan represents an expansion upon the minimal elements required by the State of Hawaii Administrative Rules for preservation of archaeological and historical sites (HAR 13-277). These elements include the following:

- Identify the form of preservation
- Specify protective buffers for sites
- Specify interim or short-term protective measures
- Describe the process and results of public consultation
- Specify long-term protective measures

The current plan places most of these elements in the **Site Specific Plans** (see Table of Contents). Because the Moloka'i community has had much to say regarding cultural resources, and the landowner has invested substantial time and effort in seeking their opinions and advice, and because few of the public comments have dealt with specific sites, the **Consultation** section is presented early in the Plan, at a project-wide level. Any consultation results specific to a site or area will be repeated in the appropriate site-specific section.

Additional sections of the Preservation Plan are presented at the project-wide level to avoid redundancy and to provide a high level of certainty with regard to the definition and phasing of preservation activities proposed herein. These include the following sections in order of appearance:

- **Introduction:** Synthesizes the archaeological knowledge of the place with historical and cultural accounts, as well as the physical environment. Summarizes the history of cultural resource management activity for the parcel.
- **Consultation:** Describes the process and scope of public input regarding cultural resources for the project area and surrounding lands, and presents a summary of the content.
- **Preservation Goals:** Provides a clear statement of objectives that shape this plan. Although not a required element, this section presents the foundations of a plan that is shaped not just by the rules, but by community values and the landowner's desire to move beyond minimal requirements.
- **Preservation Phases and Responsibilities:** Outlines the process and sequence of implementation of the plan, and states the entity responsible for each phase.
- **Preservation Actions:** Defines and describes each proposed activity related to preservation.
- **Site-Specific Plans:** Groups sites according to geographic and management categories, and specifies the **Buffers**, **Interim Measures**, and **Long-term Measures** for each.

- **Site Descriptions (Appendix):** Because the original inventory survey for the parcel is limited to a very few manuscript copies, site summaries have been included for the aid of SHPD and other readers who may want to know more about the preservation sites in the plan. The quantity of maps and data would make the body of the plan unwieldy, and as with the Data Recovery Plan for the same parcel, these data are presented as an appendix.

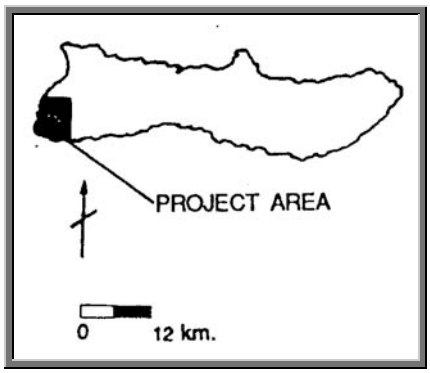

Figure 1. Project Area Location

Historic Preservation Review History

This Preservation Plan represents the culmination of a process that has evolved over several years as the landowner's plans have altered, as the scope of planning has grown to encompass most of western Molokaʻi, and as the community has become more deeply involved in the process. Despite this recent history of change, many elements of the plans remain as they were in 2001 when SHPD undertook review of the initial draft plan:

- Preservation continues to be the most common treatment for archaeological sites,
- A process of verification and augmentation of existing inventory survey data precedes development activity, and
- Procedures for preservation remain much as they were in the original plans.

While the landowner and the community have engaged in far-reaching discussions about land use and resource management across a large portion of the island, this document focuses only on the southwest corner of the island in a portion of the *ahupuaʻa* of Kaluakoʻi (TMK 5-1-02-030). Companion volumes for the same parcel include a Data Recovery Plan (approved by SHPD in February, 2007), as well as Monitoring and Burial Treatment Plans currently under review.

Although information about sites had been reported sporadically during the 20th Century, and Catherine Summers (1971) had compiled this information along with her own field observations and research, explicit focus on sites as "cultural resources" to be preserved and otherwise managed did not occur until the 1980s, when Marshall Weisler (1984) undertook the systematic survey, recording, and evaluation of sites in portions of Kaluakoʻi. This work led to the establishment of the Southwest Molokaʻi Archaeological District (Site 50-60-01-803, also referred to as the "SMAD"), a series of sites and areas that were listed on the State and

National Registers of Historic Places, and therefore afforded some protection against future development and alteration.

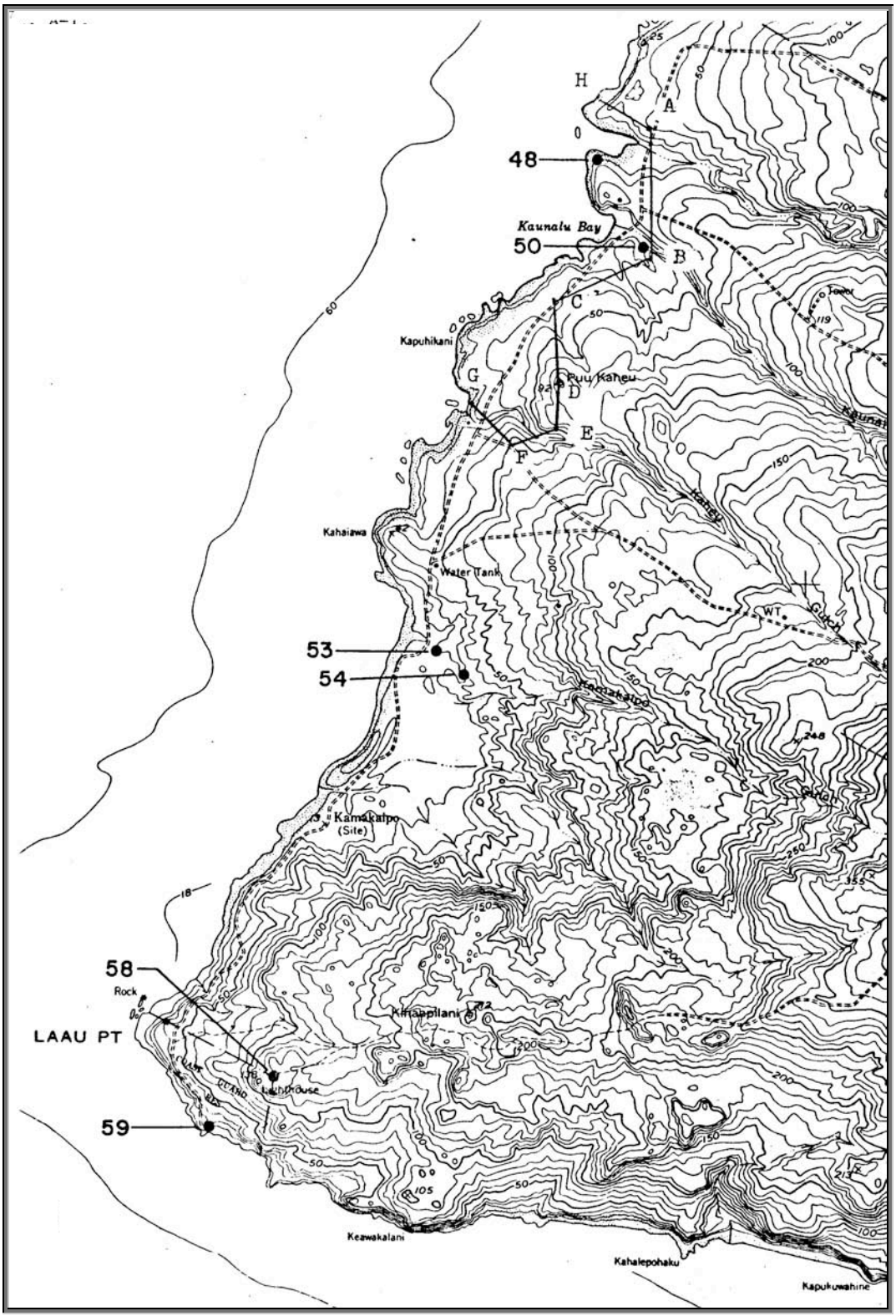

Figure 2: Southwest Molokai Archaeological District sites and areas. From Weisler 1984.

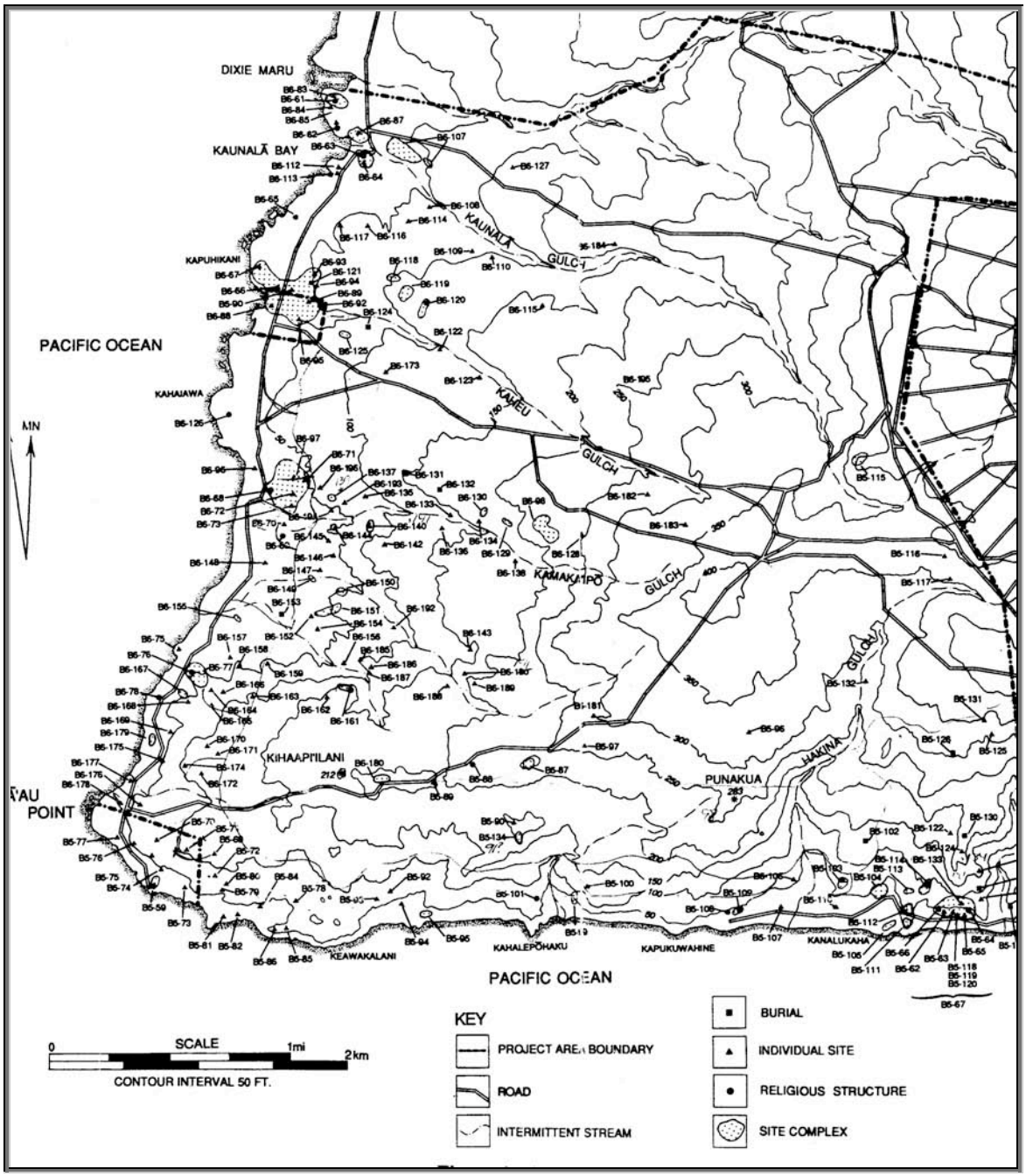

Figure 3. Archaeological Inventory Sites in TMK 5-1-02-030. From Dixn and Major 1993.

Several years later (in 1991), after the Japanese real estate company Alpha USA had purchased a 6,350-acre section of southwest Kaluakoʻi intending extensive development there, Bishop Museum's Applied Research Group performed archaeological survey of the parcel, describing sites well beyond those recorded by Weisler, as well as providing significance evaluations and treatment recommendations for each site (Dixon and Major 1993). The majority of the nearly 600 recorded features in 192 sites deserved further investigation or data recovery in the case of development plans that would have caused damage, a small number (due to more recent origin or very poor site integrity) were considered not

significant, and 46 sites were recommended for permanent preservation. The inventory, evaluations, and recommendations were reviewed and accepted by the State Historic Preservation Division (SHPD) in 1994.

A decade after the Bishop Museum survey, Alpha USA had sold the property and Cultural Landscapes was retained by the new owner to create a set of management plans for the property, including a Preservation Plan, a Data Recovery Plan, a Monitoring Plan, and a Burial Treatment Plan (Major 2001). These plans provided detailed mitigation and protection treatments for sites covered by the 1993 inventory report, and were intended to minimizing impacts; meanwhile, the development plans had downsized from a large resort to a residential subdivision. Although the 1993 report recommendations served as the starting point, the new plans emphasized avoiding rather than mitigating impacts, and so the number of sites slated for preservation grew from 46 to 138, including all of the sites outside the proposed subdivision as well as those between the new lots and the ocean, a large preserve encompassing a settlement system from the shore to an inland quarry, and sites within the proposed subdivision amounting to an estimated 10 – 15% of the area within subdivision parcels.

Shortly after SHPD had reviewed the 2001 plan (the Moloka'i Island archaeologist had provided verbal acceptance, but an official letter had not yet been generated), the landowner decided to change the subdivision plan by altering the proposed access road alignment, and Cultural Landscapes produced an addendum to the plans (Major 2002). Rather than having the new road meet up with the existing road from Maunaloa town to Hale o Lono Harbor on the eastern edge of the parcel, there would be a single entry to the subdivision from the north, from an old subdivision known as Papohaku Ranchlands. (Of that subdivision, shown as "Kaluakoi Estates" on some maps, the affected lots would be TMK 5-1-08-4, -5, and -14).

At that time, an archaeological reconnaissance had been carried out in the Papohaku Ranchlands subdivision for the Army, since the area had been a target range during and after WW II. The study's authors believed it would not meet inventory standards, and the client had not released the report or submitted it for SHPD review at the time of the Lā'au addendum. On the basis of a draft report recording 27 sites (Burtchard and Athens 2000), five of which were in or near the proposed Lā'au subdivision access road, the 2002 addendum proposed inventory survey within 30 m of either side of the proposed road centerline. These sites included one with habitation and agricultural features (Site 50-60-01-520), one habitation (Site 1784), one agricultural site (Site 1758), an isolated lithic artifact (Site 1760), and a possible burial (Site 1761); all except for 1760 had been deemed significant for their information content and recommended for inventory survey (ibid). The 2002 addendum to the Lā'au plans suggested that all of these sites could be preserved in place, and recommended that fieldwork be done that would bring the records up to inventory standards, but also begin implementation of site preservation measures such as establishing protective buffers, avoidance, and stabilization (Major 2002). Because the Papohaku Ranchlands subdivision does not yet have an accepted inventory, the current plans do not address this parcel except for its contextual value.

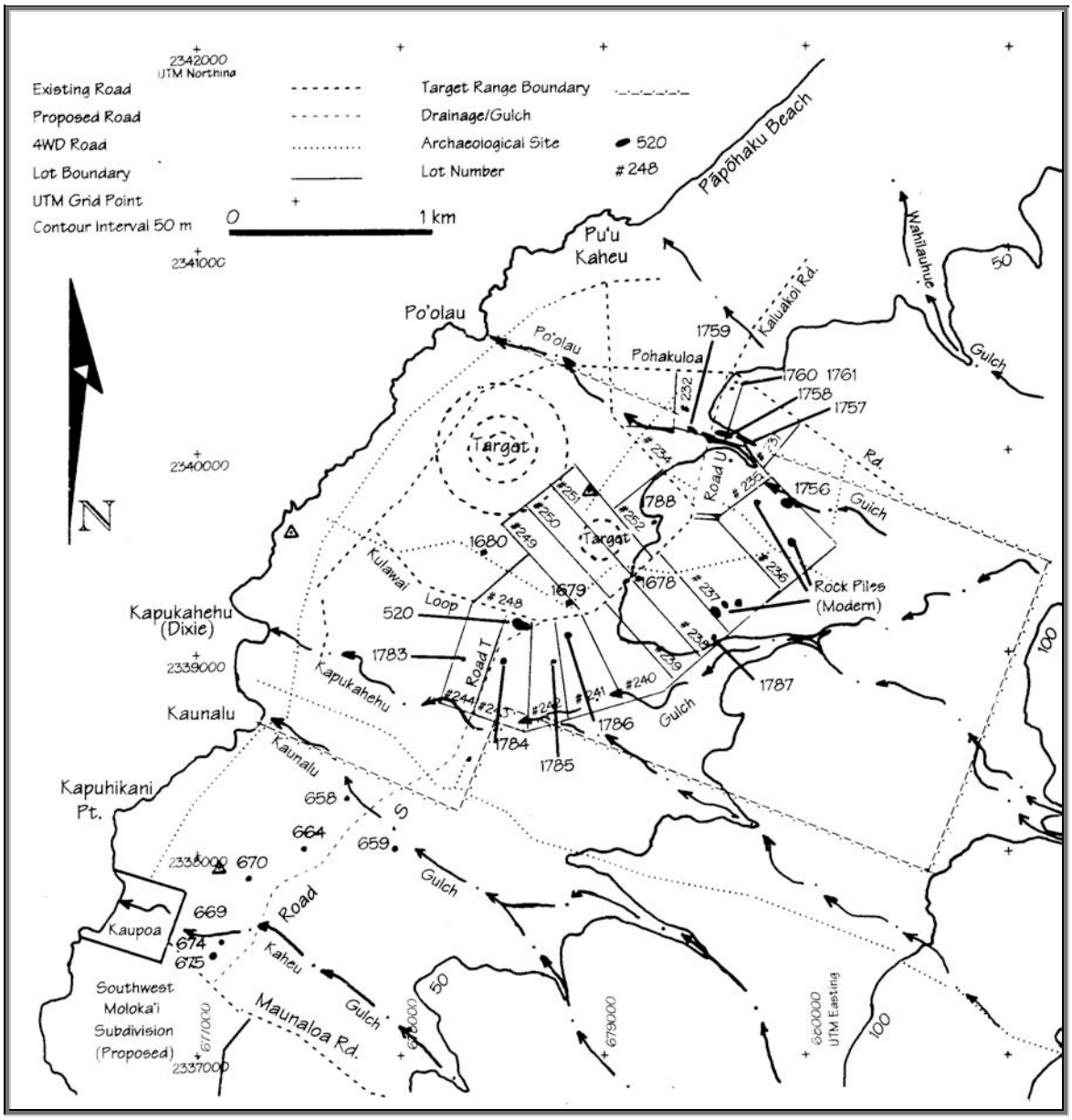

Figure 4. Sites located in the Papohaku Gunnery Range archaeological reconnaissance. Access road corridor proposed for the Lā'au Subdivision follows Roads S, T, and U and the intervening section of Kulawai Loop Road. Adapted from Burtchard and Athens 2000, USGS 1983 Molokai West, and Molokai Ranch maps.

The most recent period of cultural resource management has witnessed a new willingness on the part of the landowner to engage in master planning for all of their holdings and a greatly increased role for the community. Since 2004, a series of meetings with both the general public and of smaller committees composed of Molokai Ranch staff, representatives of various Hawaiian organizations, and interested members of the public have worked on plans to conserve and manage cultural, biological and other natural resources. The Cultural Committee formed during this process called on Cultural Landscapes to provide information regarding sites on Ranch lands, archaeological and regulatory concerns regarding cultural resources, and planning for a much-expanded preservation program. Besides

further reducing the scope and potential impacts of development, this process sought to increase preservation as a cultural resource management goal by establishing a community land trust tasked with preserving natural and cultural resources within lands deeded to it, by creating conservation easements and cultural overlay districts on privately held land, and by writing codes, covenants, and restrictions for the proposed subdivision that would help preserve sites therein and establish procedures for a management partnership between the new population of subdivision dwellers and Hawaiians who have been on Moloka'i for generations.

The proposed changes in land use, a reduced footprint for the subdivision, and the new approach toward managing cultural resources necessitated the 2006 revision of the 2001 plans and the 2002 addendum. Many elements of the existing plans remain the same, and this set of plans simply adjusts the plans to fit the current situation. So while most of the preservation measures remain the same, reconfigured boundaries make the status of some sites different; for example, the most recent subdivision plan, being smaller than before, changes the status of some sites from data recovery to preservation, and others from the more protection-oriented preservation of sites within subdivision lots to the avoidance-oriented preservation measures associated with sites outside of development areas. Responsibilities for implementation of some preservation measures have changed with the advent of greater community participation and the proposed establishment of a land trust employing a cultural resource staff person.

Given the more robust management program envisioned by the landowner and community, some measures have been added or augmented, such as: expanded data collection to aid preservation management and use of GPS to update site locations. In response to community concerns, the landowner has committed to additional archaeological fieldwork in advance of the road corridor construction, leading to a reorganization of the workflow envisioned in the 2001 plans. Because the 1993 report (Dixon and Major, for TMK 5-1-02-030) completed the inventory, evaluation, and treatment recommendations for the subdivision parcel, and was approved by SHPD, road corridor fieldwork consists of "supplemental data collection." This type of archaeological investigation exceeds regulatory requirements, and serves the landowner's and community's desire that final engineering and construction be based on an enhanced understanding of the archaeological sites in and near the proposed development corridor, as well as the imperative to base preservation measures and interpretation upon more detailed and refined data.

For the parcels north of the parcel being subdivided (TMK 5-1-08-4, -5, and -14), road corridor survey will in fact constitute an inventory survey, and the data collected from those areas will be prepared as a normal inventory report with site significance evaluations and treatment recommendations, all of which will be submitted to SHPD for review according to the Hawaii Administrative Rules, section 13-13-276.

Most sites within the project area will be preserved—152 compared to 138 in the 2001 plan and 46 originally recommended in the 1993 inventory report, an increase of 330%. In addition, eleven sites considered "not significant" in the 1993 report will be preserved by default, due to their locations within the Shoreline Conservation Zone, Cultural Protections Zones, or the Rural Landscape Reserve.[3]

[3] These sites include: 677, 740, 759, 766, 767, 781, 1129, 1137, and 1138 in the RLR, 1165 in the Hakina CPZ, and 1140 in the SCZ.

Finally, five sites (738, 761, 1125, 1136, and 1145) that have been recommended for Data Recovery may be preserved once their precise location in relation to subdivision lots and the road corridor be determined. Conceivably, then, the total number of sites to be preserved may be as high as 167, a 363% increase over the 1993 recommendation, and 87% of the total number (192) of sites in the overall parcel.

Perhaps the most profound change embodied in this revision, though, is change in outlook from the traditional practice of defining a site and surrounding it with a protective buffer to defining a development area with few or no sites and enclosing it within what the Cultural Committee came to call a "bubble." By reversing the approach from "Keep out of the fenced sites" to "Do not stray beyond the development corridor," the current plans should result in two major benefits: reduction of inadvertent archaeological finds, and increased preservation of cultural landscapes rather than site "islands" in a sea of development.

SEE ATTACHED FOLIO MAP

Figure 5: Lā'au Subdivision Project area, Sites, and Cultural Protection Zones

Project Area Components

The physical scope of the cultural resource management plans in this volume remains limited to those portions of Kaluako'i *ahupua'a* that could be directly affected by the proposed subdivision (hereafter referred to as the "Lā'au Subdivision"), rather than all lands affected by the recent community planning process. Specifically, the revised cultural resource plans focus on the 1,492-acre project area described in the Ranch's petition to the State Land Use Commission, which requests a 613-acre area to be changed from Agricultural to Rural designation, 10 acres from Conservation to Rural (for a park), and 252 acres from Agricultural to Conservation. In addition, this plan covers the "Lā'au Mauka" Rural Landscape Reserve, which corresponds to the remainder of TMK 5-1-02-030, the 6,350-acre parcel surveyed in 1991. All of the proposed Lā'au Subdivision lots will derive from that original parcel, although development activity will affect only a limited portion of it—400 acres of house lots and 153 acres of roads, infrastructure and parks, or less than 10% of the original parcel area.

A combination of official zones and project-specific landscape designations have been adopted as a way of managing cultural resources.

- The **Project Area** covers approximately 400 acres, and consists of three components:
    - **Road Corridor** – All areas potentially affected by construction of the road and any adjacent utilities. As many as six preservation sites are in or near this corridor, but will be protected.
    - **Subdivision Lots** – All lots designated in the Lā'au Point Subdivision, including any where community-level facilities may be constructed. No preservation sites lie within lots, although some site buffers may extend into lots, and will be duly protected.
    - **Undeveloped Land** – Areas within the Project Area, but outside of the Road Corridor and Subdivision Lots. The only preservation sites in this area that are not dealt with in the SCZ or CPZ categories below

are three suspected burials at the southeastern end of the Project Area.

- The **Shoreline Conservation Zone (SCZ)** fringes the entire Project Area and is subject to multiple jurisdictions, rules and statutes within its 465 acres. It merits special attention archaeologically because of the richness, diversity, and potential vulnerability of sites there.
- **Cultural Protection Zones (CPZ)** have been devised as a means of protecting cultural and archaeological sites by encompassing their larger landscape settings. This preservation zone overlay will direct immediate and long-term land use in areas where cultural resources are concentrated. The majority of sites in TMK 5-1-02-030 are in CPZs, which extend to the Project Area and Shoreline Conservation Zone in several places. The total area of these areas will exceed 1,000 acres.
- The **Rural Landscape Reserve (RLR)** comprises the remainder of TMK 5-1-02-030, and therefore is outside of the Project Area. There are 11 significant sites in this area, five of which are being preserved.

Environmental Setting

Southwest Kaluakoʻi lies on the flanks of Mauna Loa, the extinct shield volcano that formed the west side of Molokaʻi prior to the eastern (Koʻolau) volcano. Mauna Loa, like most other Hawaiian volcanoes, formed through a series of bedded basaltic lava flows MacDonald et. al. 1983:412). The project area includes portions of the western and southern slopes of Mauna Loa, as well as traversing the southwest rift zone, a line of greater activity where vents and flows created a ridge between the summit and Ka Lae o Lāʻau (Lāʻau Point, the southwest tip of Molokaʻi).

Although Mauna Loa is older, the drier conditions have produced less topographic variation than on the Koʻolau side of Molokaʻi, where heavier rainfall has cut spectacular valleys. The gulches of Mauna Loa are relatively shallow, interspersed with broad, relatively undissected landscapes. Many of the smaller gullies between and feeding into the larger gulches are very young, the result of drought and overgrazing that denuded surface vegetation in the 19th and 20th Centuries, leaving it vulnerable to violent erosion during occasional downpours. Other consequences of this period of erosion have been exposure of hardpan subsoils on high ground and accumulation of wind and water-borne silt in leeward low areas and gulch bottoms.

Rainfall is concentrated during the winter months, but has amounted to an average of only 15 inches per year in modern times; on the lower slopes of the southwest region, that figure is lower (Baker et. al. 1968). One aspect of the local climate not mentioned in rainfall data is the typical cloud cover, which consists of a line of clouds parallel to and directly above the island. In dry periods, it barely extends past the high Koʻolau mountains, but often extends past the west coast. During wetter periods, this line of clouds brings rainfall that seems to be concentrated over the gulches of Kamākaʻipō, Kaheu, and Kaunalā. The tradewinds that cause these clouds to pile up over the island dominate, but on the south shore there is frequently little or no wind. When tradewinds are absent, land and sea breezes are more noticeable, and convection clouds (with occasional rain) may occur if humidity is sufficient. A traditional name for a wind of Kaluakoʻi is "Haleolono,"

which is also a place name for the land just east of the project area (Nakuina 1992:68).

Although there were reportedly a few springs in the past (Summers 1971, Kaimikaua personal communication 1999), there is no reported evidence of perennial streams that would support typical wetland taro agriculture. Another indication of the aridity of the project area is that there are no traces of traditional coastal fishponds, which generally were constructed where some fresh water input fostered plant growth. However, the wetland just behind the dunes at Site 1146 shows that at least brackish water is present at some coastal locations.

The general soil types of the project area are low humic latosols interspersed with lithosols (Foote et. al. 1972). Soil series represented in the project area are dominated by very stony eroded soil in the north and the interior, Kapuhikani along the southern shore to just south of Kamāka'ipō, and Mala silty clay in the Kamāka'ipō Gulch bottom (ibid.). Both Baker and Foote mention deep soils on the west end, but field experience shows that the project area generally has a very shallow soil cover, with rocky and hardpan areas exposed rather frequently, and substantial accumulation of sediments occurring only in the lower reaches of gulches. The 1991 excavations rarely went more than 50 cm in depth before reaching extremely hard clay.

The soil classifications interpret the project area as having very low productivity Baker et. al. 1968, Foote et. al. 1972). This may be true for modern forms of agriculture and animal husbandry, but it is likely that higher rainfall occurred prior to upland deforestation, providing enough moisture and could cover to grow the less thirsty Polynesian crops such as *'uala* (sweet potato, *Ipomoea batatas*), *'ipu* (gourd, *Lagenaria siceraria*), and the thatching grass *pili* (*Heteropogon contortus*). George Cooke (1949), who managed Molokai Ranch in the first half of the 20th Century, saw Hawaiian *kō* (sugar cane, *Saccharum officinum*) growing in an old household garden at Kamāka'ipō. Terraces, planting circles, and areas cleared of stones show that Hawaiians once practiced agriculture within the gulches, and to a more limited extent, on the sloping lands. Monitoring at Kaupoa, then old ranch house on the outskirts of an ancient village at Kaheu gulch, revealed deposits of loamy soil sometimes exceeding 30 cm in depth, soil that appeared to have a relatively high organic content and held onto moisture for weeks after rainfall—attributes that would have been attractive to ancient farmers.

Currently, vegetation is dominated by *kiawe* (*Prosopis pallida*) forest, which sometimes forms dense thickets, but may also be open. *Lantana* (*Lantana camara*) forms an understory in the forested areas, and also occurs in the open areas. There are occasional grasslands, with various pasture and weedy species that have become naturalized. Chili peppers (*Capsicum frutescens*), bittermelon (*Momordica* species), and basil (*Ocimum* species) are also naturalized, representing historic household garden introductions, but possibly from elsewhere on Moloka'i, since birds readily disperse each. The native flora are much diminished, although hardier shrubs that are adapted to dry and disturbed conditions are still present; these include: *'uhaloa* (*Waltheria indica*), *'ilima* (*Sida fallax*), and *ma'o* (native cotton, *Gossypium sandvicense*).

Insects and other arthropods dominate fauna of southwest Kaluako'i, and it is beyond the expertise of the archaeologists to list or evaluate these. Bird life includes game species introduced by Kamehameha V, and later by the territory and state, as well as exotic songbirds such as cardinals, mockingbirds, and mynahs. Herds of Axis deer, another of the king's introductions, wander Moloka'i's west

end, and along with the other introduced ungulates (cattle, sheep, and goats—only the former of which is still present) have affected the ecology significantly. More important to the human inhabitants of old was the marine fauna, from pelagic species at the offshore Penguin Banks, to reef fish, to shellfish and echinoderms found on the coast, and even the turtles that hauled up on shore.

The character of the southwest Molokaʻi shoreline merits attention, not least because this is where ancient and historical people settled. Sand beaches cover most of the coastline, although basaltic ridges do extend to the shore in a few locations, with those at Lāʻau Point and along the south shore being highest. Low dunes occur as well, although sand mining depleted those at the eastern end of the project area's south coast. Sandstone and limestone underlie the sand and are visible in many locations. Slabs of this material appear in ancient and historic construction, but the more consistently important aspect of such stone is that the shoreline and shallow waters where it occurs are riddled with holes and cracks that form excellent habitat for fish, lobsters, and other food. Because canoes formed the backbone of the ancient transportation system, the presence of numerous channels through the reef and sandy beach landings would have been an attractive trait of this shoreline in ancient times. The waters of Lāʻau Point, however, remain notorious to this day, as currents traveling down each coast collide in a choppy, swirling mix that makes paddling dangerous.

In the reconnaissance of the gunnery range, Burtchard noted highly eroded areas and charcoal indicative of wildfire (2000). It is no great stretch to infer that live fire practice could have ignited vegetation in this parched landscape, and an aerial photo from 1965 shows what appears to be a recent burn area in the range. The reconnaissance also noted several graded and bulldozed areas, piles of stone, and military dumps. In an analysis of Burtchard's report; Dixon and Major's 1993 report; 1955, 1964, 1965, and 1969 aerial photos; Molokai Ranch color aerial photos from the 1990s; the publication *Detailed Land Classification – Island of Molokai* (Baker et. al., 1968); and USGS quad sheets from 1924 and 1983, Cultural Landscapes has been able to estimate the minimum extent of disturbance in and around the new corridor.

Between Poʻolau and Wahīlauhue Gulches, only a small, unnamed gulch appears to have escaped disturbance prior to the mid-1960s. Between about 100 and 250 feet in elevation, numerous dirt roads criss-cross the landscape here. Poʻolau Gulch itself appears to have escaped much direct impact, except where roads crossed it—Burtchard's discovery of intact agricultural sites in the gulch is consistent with this. (His Site 1760 is a single adze preform in "an erosional scar" that may in fact be in a dirt road visible on aerial photographs.) South of Poʻolau Gulch, almost everything inland of the old coastal road, north of where the south arm of Kulawai Loop meets Pohakuloa Road, and below about 250 feet in elevation has been heavily disturbed. Grading to clear the target areas, construct roads, and build observation towers and bunkers has obliterated nearly everything inside of Kulawai Loop, and as far east as the rock piles recorded as Sites 1683-1687. The single contra-indication to this situation may be Site 1788, a concentration of boulders including a slab that was interpreted as a fallen upright from a shrine (Burtchard 2000). Low, seasonably wet ground nearby (interpreted as a spring with which the shrine would have been associated) may have saved this area from grading, and is visible on air photos due to the vegetation.

South of Kulawai Loop, the situation changes markedly, and several sites were present beginning between the road and Kapukahehu Gulch. Sites have been

recorded in and between Kapukahehu and Kaunalu Gulches, with a few *mauka-makai* roads being the only disturbance to the intervening ridge. The ridge south of Kaunalu Gulch, however, has been disturbed as far down as 100 feet in elevation, and the 1965 aerial photograph shows a series of lines following the contours from this elevation up to nearly 200 feet. It is uncertain what these are, although they appear to have a few intact trees, and may represent grubbing of pasture, an attempt at erosion control, or both. Kaheu Gulch and south appears to be far less disturbed, except for the road down the ridge to Kaupoa.

History and Archaeology

To achieve a more comprehensible and holistic understanding of southwest Kaluakoʻi's past, this document combines historical and archaeological background. This discussion summarizes what is currently known about the project area, and then offers a brief regional overview as a framework for the research plan. Site particulars appear with the detailed site mitigation plans below, to avoid redundancy and the need to flip pages constantly. A more developed discussion of overall patterns will be included in the final data recovery report.

The name of the *ahupuaʻa* containing all of these places, Kaluakoʻi, refers to the pits or quarries ("lua") from which adzes ("koʻi") were made. Kumu Hula John Kaimikaua notes that the largest quarries were inland at "Amikopala, Kahinawai, Koholalele, and Kamakahi," and that the best types of stone were named "Awalau…Awaliʻi, and Awauli" (Kaimikaua 1997:4). He also relates that when the Maui *aliʻi* (chief) Kiha-a-Piʻilani ruled over Molokaʻi, he stationed his men in all of the coastal villages of Kaluakoʻi "to secure the mining rights of the valuable koʻi as an added wealth for the high chief," and that access to and security over the quarries was the reason he built his famed trail ("KealapūpūoKihaaPiʻilani, See Summers 1971:12-13) around the west end (Kaimikaua 1997:4).

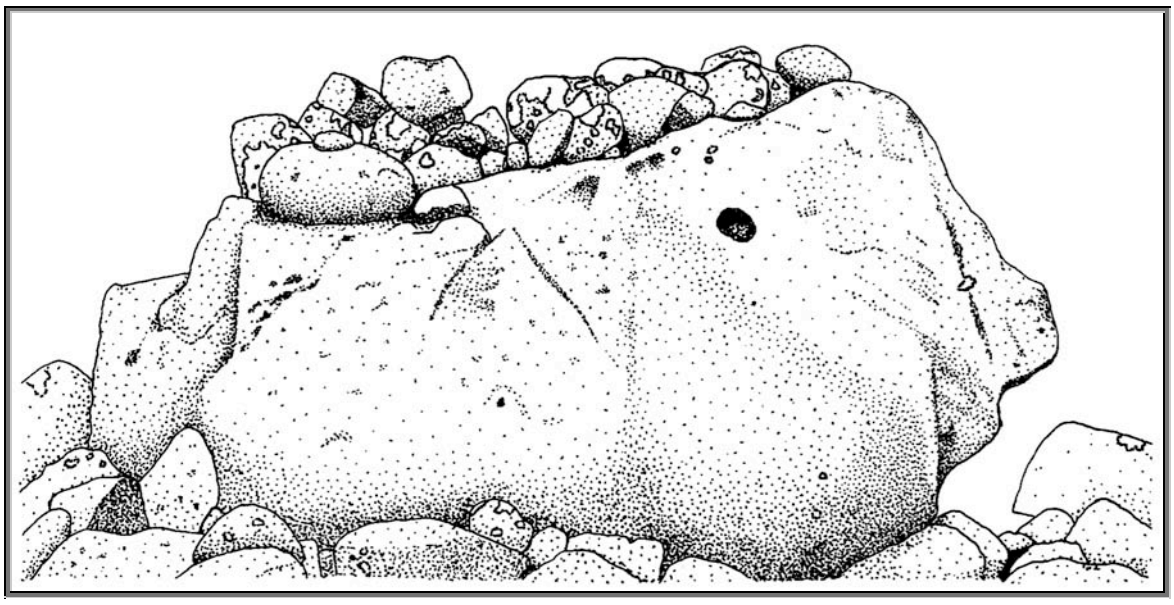

Figure 6. Trail marker at North Kamākaʻipō

One of the Molokaʻi chiefs who provided labor for the trail, Kamākaʻipō, was immortalized in the name of the gulch and bay north of Lāʻau Point. Kamākaʻipō

was also the name of an owl who lived at the place, and whose droppings appeared as a type of gray clay found there. Two Kamāka'ipō places known from traditional oral history that may have identifiable archaeological sites associated with them are a *heiau* dedicated to Hina that is supposed to be small and circular, and a hill named Ahoaho, a small hill where chiefs were buried (Kaimikaua 2001, personal communication).

By the time Europeans found the Hawaiian Islands, western Moloka'i was not heavily populated, although both the Cook and Vancouver expeditions noted that a small population was present prior to AD 1800 (see Dixon and Major 1993:9). Moloka'i also became a battleground in the struggles between Maui, Hawai'i, and O'ahu, and during the latter 18th Century lost much of its population due to warfare; a Hawaiian told the surgeon of the Vancouver expedition that Kamehameha had decimated the island (Menzies 1920:115, 118). Another source indicates that a generation earlier, the O'ahu chief Peleioholani raided and burned Moloka'i in revenge for his daughter being killed on the island (Fornander, cited in Summers 1971:18). Ash exists widely on the west end, observed in buried layers from at least Po'olau (Burtchard and Athens 1999) to Kaheu (also known as Kaupoa, Major 2000). An older explanation of the barrenness and low population may be found in the story of 'Ami'ikopalā, which said that the wells dug by that supernatural crab dried up when he was killed (Kaimikaua, personal communication 1999). Another *mo'olelo* told that other water sources dried up when people carelessly, and later maliciously, poisoned springs with pieces of the Kālaipāhoa gods (Kaimikaua 1988).

Regardless of the causes, the view that Kaluako'i was a dry, thinly populated area found its way into archaeological literature, and is accepted today. Stokes (1909) stated that "inhabitants of the western end of Molokai deserted or were removed from their homes nearly half a century ago" (Stokes 1909:30), a period when Kamehameha V had begun ranching operations on the island. Stokes concentrated on religious features, and near the current project area recorded *ko'a* (fishing shrines) on the coast at Kamākaipō (Sites 53 and 55), Lā'au (Site 58, destroyed by lighthouse construction before 1909), Keawakalai (probably Keawakalani, Site 59), Kahalepohaku (Site 61), and Pu'u Hakina (Site 62). At the latter place, he also recorded Kalalua Heiau (Site 67), which had an unusual reef rock slab construction, and was reportedly used for human sacrifice (ibid:31-32). Stokes further reported that local people identified Kahalepohaku as the place where Kiha-a-Pi'ilani had been raised.

During the 1920s and 1930s, most Moloka'i archaeology was done by visiting scholars such as Fowke (who wrote a brief paper for the Bureau of American Ethnology in 1922), and Phelps (who produced a monograph on Moloka'i archaeology in 1941). The Phelps paper is more interesting for its consideration of environmental variables than its site recording. He divided the island into ecological regions, of which the western was the driest; Phelps highlighted this aspect by repeating a Hawaiian newspaper story about the 18th Century *ali'i* Kaiakea, who ordered a well dug with adzes near Ka Lae o Lā'au (Phelps 1941:57). He stated that the advantages of Kaluako'i were its namesake adze quarries and its fine fishing grounds (ibid:55-60). He used the *ahupua'a* of Kaluako'i to support his conclusion that land divisions with the greatest area had the least population, and that the absence of valleys to provide natural divisions was what made Kaluako'i the largest *ahupua'a* (ibid:75-76).

Few new sites were recorded prior to the 1950s, when the Bishop Museum and University of Hawai'i began working together on Hawaiian archaeology, and on educating a new generation of scientists. One of these students, William Bonk, reiterated the conventional wisdom in his master thesis, which included the lines, "this was a decidedly marginal land for the inhabitants of Molokai. Fishing and the quest for adze stone brought people into the area, and fighting probably sent refugees into it, but temporarily" (1954:139). His excavation of a house site at Kamāka'ipō (Site 54) revealed less than 10 inches of midden, leading him to conclude that the intensity of habitation had perhaps increased over time, but that the site represented a fisherman's house, and that the area had little more in the way of permanent habitation (ibid:51-52).

Catherine Summers compiled historical and archaeological documentation over the next two decades, and published the results in 1971. Few of the sites are within the current project area, but the book is notable as the first and last attempt to bring together knowledge about sites island-wide. *Molokai: A Site Survey* includes notes made by Stokes and other early site recorders, as well as Hawaiian myths and oral histories, unpublished accounts, and historical documents. Based on all of this information, Summers concurs with the portrayal of Kaluako'i as a land blessed with excellent adze stone and fishing grounds, but also where habitation was limited by aridity (1971:39-40). Also implicit in her maps and descriptions is a settlement pattern in which the most heavily used areas are clustered at the bays and high in the uplands. The current project area occasionally reaches the margins of the coastal settlements, but is largely in the "empty" middle elevations. The Statewide Inventory of historical properties began shortly after the publication of Summers, but consisted more of an effort to relocate previously recorded sites than to discover new ones, and added no new information.

The same year that *Molokai: A Site Survey* was published, a University of Hawai'i student named Hal Strong documented some of the Kamāka'ipō habitations. He described and photographed four house sites and a variety of associated features, including: *ahu* (stone mounds), shrines, *ko'a*, a stone pile, and scatters of midden and artifacts strewn on the surface (Strong 1971).

In the early 1980s, Marshall Weisler surveyed coastal southwest Moloka`i, relocating and discovering eleven sites (State Sites 50-60-01-53 through –56, -655, 1118, and -1134) in or near what has become current project area. He reiterated an aspect of Phelps' settlement pattern in which topography was key—sites were concentrated in gulches and the bays where they met the sea—and added that there was a correlation between the size of the bay and the quantity and diversity of features (Weisler 1984:27). Another pertinent outcome of Weisler's work, creation of the Southwest Moloka`i Archaeological District (hereafter SMAD, Site 50-60-01-803) included some sites (53, 54, and 56), in or near the project area. This district is now on the State of Hawai'i and National Registers of Historic Places, meaning that sites within it are afforded additional protection.

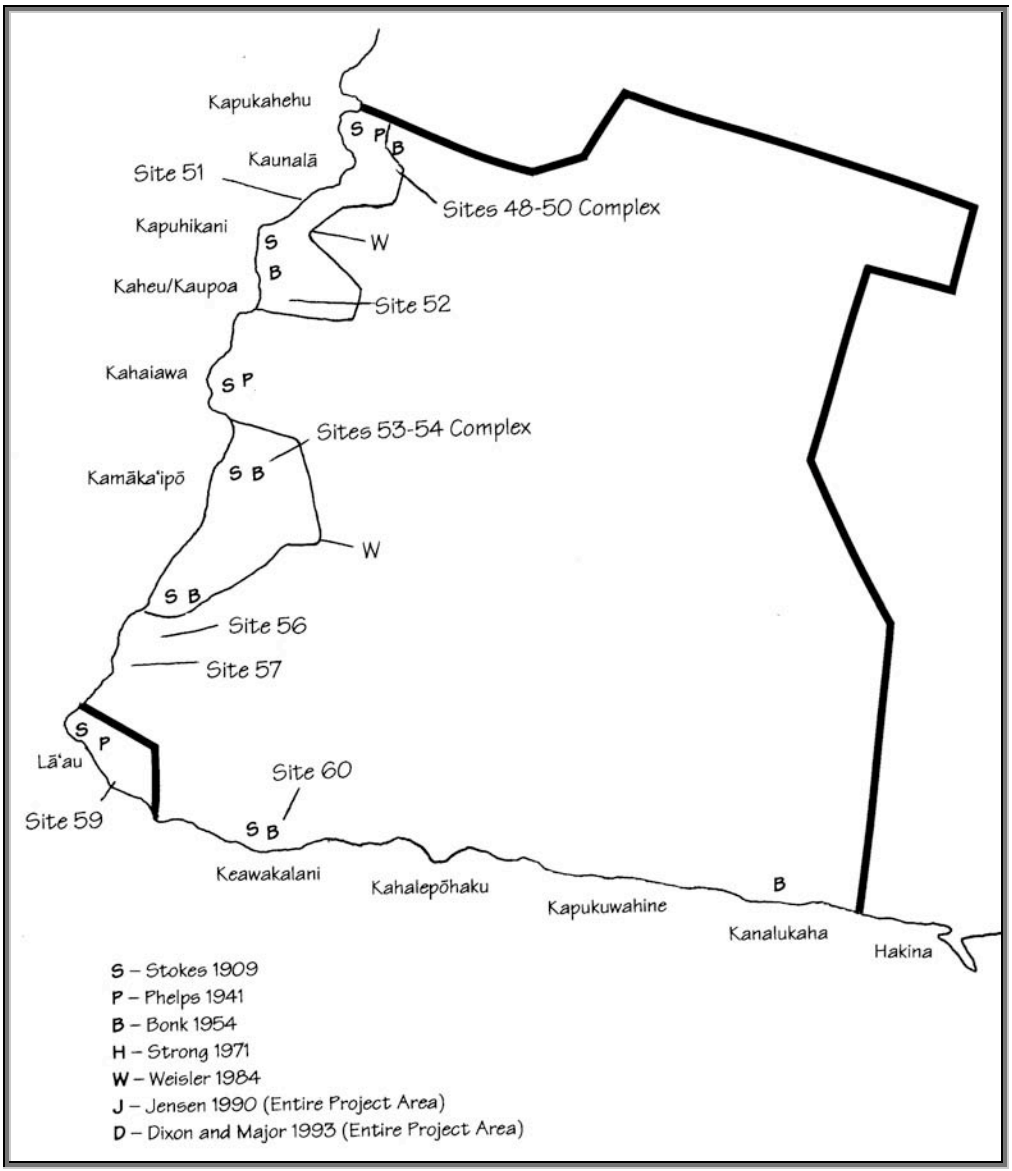

Figure 7. Previous archaeological study areas. (Note: Burtchard and Athens project area is north of this, and is shown in the Papohaku Ranchland map earlier in this report.)

In 1991, a survey of 6,350 acres of southwest Moloka'i done by Bishop Museum encountered features throughout southwest Moloka'i, including the current project area (Dixon and Major 1993, referred to in this report as the "1991 inventory" and the "1993 report"). This survey provided the most complete coverage of southwestern Kaluako`i to date, and the settlement pattern model that emerged from the inventory reinforces the main pattern mentioned above, that sites cluster around bays and gulches (Dixon and Major 1993:337). However, having a survey area that extended well inland from the coast, it was possible to refine the model. For example, although the inland margins of sites had the expected agricultural areas and lithic work stations, they had a surprising number of "temporary and semi-permanent residential compounds" (ibid:337).

Discovery of large, multi-roomed enclosures near the 100 foot elevation also went against conventional wisdom that inland features were marginal and ephemeral.

Two such enclosures occur in the Site 771-773 complex, each with six or more rooms, some of which display massive, well-built walls. Excavation revealed evidence of lithic manufacture (over 3,000 flakes from a single 100 by 50-cm excavation unit), while presence of a metal pick-ax head suggests that this could be a site that transcends the era of contact between Hawaiians and Europeans. A potential explanation for the anomalous development of this inland area is the traditional association of the locale with Kiha-a-Piʻilani, the child of Maui high chief Piʻilani, sent here to be raised in isolation from the frequent warfare on his home island (Kaimikaua, personal communication 1999). Although current vegetation makes it difficult to know how visible the multi-roomed enclosures would have been in the past, their relative seclusion and distance form the coast, as well as their position along a ridge would have made it possible to spot arriving canoes well before anyone could get to the sites, thus making them a defensible location. Furthermore, the intensity of lithic production here outstrips the local needs, and could be an indicator of a chiefly influence on the local economy. These sites remain enigmatic, but seem to suggest a degree of permanence or intensity previously not recognized on the west coast, and certainly not at that elevation.

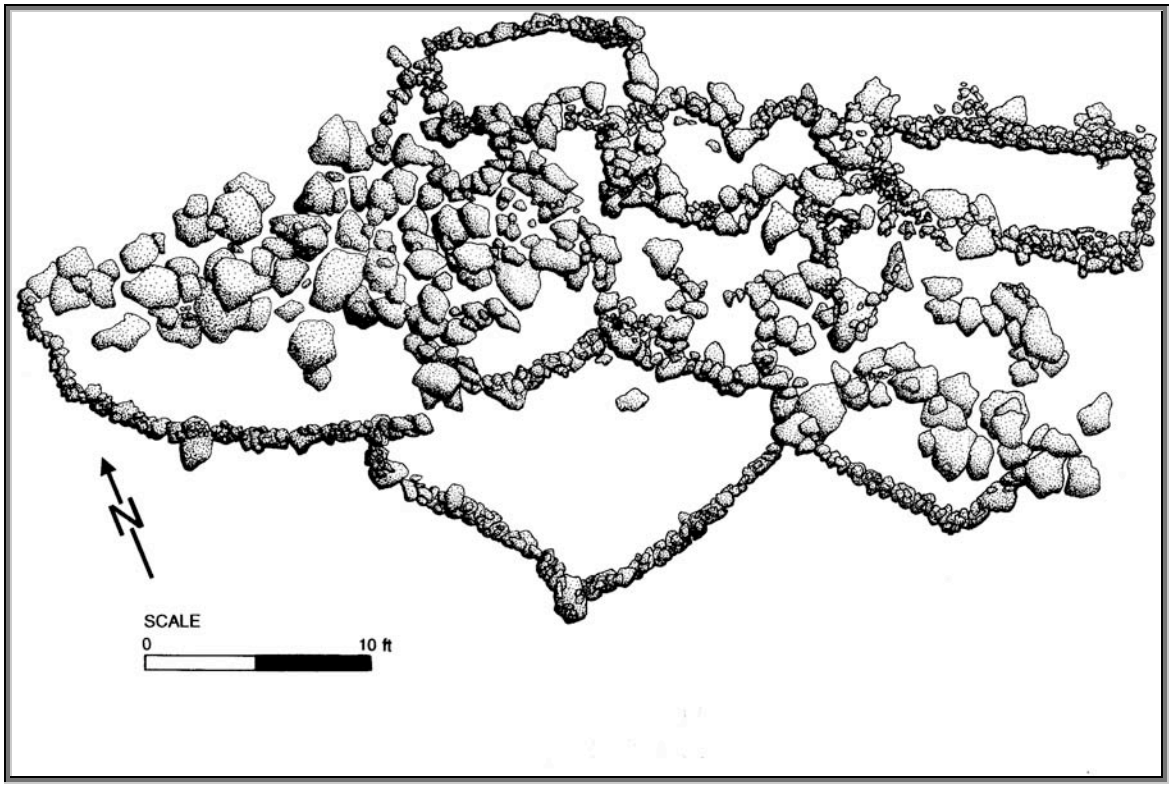

Figure 8. Site 771, a multi-room enclosure on a ridge above Kamākaʻipō. Adapted from Dixon and Major, 1993.

The 1991 project also documented variation between west coast settlements (where features clustered at the bays and stretched inland to gardening or quarrying areas) and south coast settlements (where habitations were spread laterally along the coast), indicating that the causes again related to topography (ibid:337-338). Analyses of subsistence strategies and lithic production, paired with the form and

distribution of features, suggested that rather than a temporarily occupied, culturally peripheral area, southwest Kaluakoʻi was probably permanently occupied late in prehistory, and that its access to fishing grounds and adze quarries meant that it was integrated into island-wide society (ibid:240-344). A more recent study including part of the north end of the current project area concluded that coastal habitations must have been permanent (Burtchard and Athens 1999). Presence of extensive occupations in the uplands (Summers 1971, Major 2000) and of major specialized features such as *heiau* (temples) and *holua* (sledding courses) in the lowlands (Summers 1971) provide evidence that the Kaluakoʻi area had permanent, perhaps socially stratified, occupants.

Traditional wisdom among archaeologists has also concluded that this region would have been settled only after sweet potato was available, and after population densities had risen in the wetter areas, probably no earlier than about AD 1500 (Kirch 1985). Radiocarbon dates suggest somewhat earlier occupation may be possible, although the limited data make it hard to discern sporadic early use from a stable early habitation. An inland quarry yielded a radiocarbon date of AD 1260-1440, and the south Kamākaʻipō coastal site was dated between AD1410-1955. A subsequent, unpublished date from the 1991 excavations at Site 654, in a coastal *imu* that Weisler originally recommended dating, provided an even earlier date of AD 1019-1211 (Major and Dixon 1993), confirming the suspicion that coastal areas were used much earlier than they were permanently settled. The material dated in this instance was charred grass, which eliminates the possibility of an in-built age.

The condition of Site 654, eroding from an exposed dune face, may be a result of the 1946 tsunami. The Cookes (1948, 1961) both wrote of the effect that this wave had on the west coast, impacting Kawakiu heavily and working its way a half mile inland at Pāpōhaku beach; it could easily have come well inland at Kamākaʻipō, where the alluvial flat is severely eroded. Even without tsunami, however, many sites at Kaluakoʻi have been damaged by erosion, itself catalyzed by cattle and deer grazing since the mid-Nineteenth Century and several periods of severe drought.

Because the archaeology of Kaluakoʻi is relatively well known, mitigation plans may be based not only on particular knowledge of the sites, but on the patterns evident in southwest Kaluakoʻi. Because the current project area mostly runs *mauka* of the sites, the data that will be recovered will be skewed toward traces of peripheral activities and agriculture. In the Data Recovery Plan, the effect of this on the techniques of data recovery and the research issues will be evident.

PROPOSED SITE MITIGATION MEASURES

The forms of mitigation dealt with in this and the accompanying Lāʻau plans derive from the process outlined in HAR 13-13-284, which describes the historic preservation review process in Hawaiʻi. **Data Recovery** pertains to sites that are significant for their information only, and covers pre-construction actions such as mapping, excavation, and surface collection, so that any damage during development is offset by gains in knowledge. **Monitoring** means having an archaeologist present during ground-disturbing activities, and the objectives are twofold: to prevent incursion and impacts to preservation areas and damage to sites, and to document and evaluate any inadvertent finds that may occur during construction. **Preservation**, the subject of this plan, differs from the other treatments in that sites are protected, and there is no impact to mitigate. Options within this treatment revolve around the degree and type of protective measures to be implemented, and whether the preservation is to be passive or active. **Burial**

treatment concerns not only the actions taken for sites that have documented or possible burial sites, but also measures that will be followed should an inadvertent discovery of human remains occur. Like monitoring, the procedures for burial treatment apply throughout the project area. Table 1 shows all sites in the project area and their disposition relative to these categories.

Because the final alignment of the proposed road corridor has not yet been designated, some treatments may change later pending community and SHPD approval. All such changes will be from Data Recovery to Preservation, and no objections are anticipated. Any site thought to be near the road or within a proposed subdivision lot has a detailed mitigation plan. At least 14 sites recommended for data recovery in the 2001 plan are now slated for preservation due to the road realignment and the revised approach to subdivision, and as many as 8 more appear likely to experience the same shift. SHPD has already expressed a favorable attitude regarding changes from Data Recovery to Preservation, and will be notified of any additional ones as they become final. As mentioned above, the preliminary road corridor will be resurveyed prior to finalizing the plan, and every effort will be made to realign it around significant sites.

A few inventory sites lack specific mitigation measures described in this plan. Some are sites recorded prior to 1991 that could not be located or were destroyed by then (State Sites 55, 653, 1108, and Bishop Museum Sites B5-58 and B5-61). However, most are sites that lacked cultural or archaeological significance (primarily recent hunting blinds), and a few of which have been too heavily damaged to retain physical integrity. Other gaps in the site numbers—653, 1133, 59-638, 700-735 and 783-1099—have been assigned to sites elsewhere on Moloka'i, and do not actually denote gaps in the 1993 site records.

Table 1. Site Conversions and Mitigation Treatments

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
48	B6-61	X		
49	B6-62	X		
50	B6-63	X		
50	B6-64	X		
51	B6-65	X		
52	B6-66	X		
53	B6-68 and -97	X		
54	B6-69 to -73	X		
56	B6-76 and -77	X		
57	B6-78	X		
639	B6-67	X		
640	B6-74	X		
641	B6-83	X		
642	B6-84	X		
643	B6-85	X		
644	B6-86	X		
645	B6-87	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
646	B6-88	X		
647	B6-89	X		
648	B6-90	X		
649	B6-91	X		
650	B6-92	X		
651	B6-93	X		
652	B6-94	X		
654	B6-96	X		
655 (aka 53)	B6-97	X		
656	B6-98	X		
657	B6-107	X		
658	B6-108	X		
659	B6-109	X		
660	B6-110	X		
661	B6-111			X
662	B6-112	X		
663	B6-113	X		
664	B6-114	X		
665	B6-115	X		
666	B6-116	X		
667	B6-117	X		
668	B6-118	X		
669	B6-119	X		
670	B6-120	X		
671	B6-121	X		
672	B6-122	X		
673	B6-123	X		
674	B6-124	X		
675	B6-125	X		
676	B6-126	X		
677	B6-127			X
678	B6-128	X		
679	B6-129	X		
680	B6-130	X		
681	B6-131	X		
682	B6-132	X		
683	B6-133	X		
684	B6-134	X		
685	B6-135	X		
686	B6-136	X		
687	B6-137	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
688	B6-138	X		
689	B6-139	X		
690	B6-140	X		
691	B6-141	X		
692	B6-142	X		
693	B6-143	X		
694	B6-144	X		
695	B6-145	X		
696	B6-146	X		
697	B6-147		X	
698	B6-148		X	
699	B6-149	X		
736	B6-150	X		
737	B6-151	X		
738	B6-152	?	?	
739	B6-153	X		
740	B6-154			X
741	B6-155	X		
742	B6-156	X		
743	B6-157		X	
744	B6-158	X		
745	B6-159		X	
746	B6-160		X	
747	B6-161	X		
748	B6-162	X		
749	B6-163		X	
750	B6-164	X		
751	B6-165	X		
752	B6-166	X		
753	B6-167	X		
754	B6-168	X		
755	B6-169		X	
756	B6-170		X	
757	B6-171			X
758	B6-172		X	
759	B6-173			X
760	B6-174		X	
761	B6-175	?	?	
762	B6-176		X	
763	B6-177	X		
764	B6-178	X		
765	B6-179	X		
766	B6-180			X

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
767	B6-181			X
768	B6-182	X		
769	B6-183	X		
770	B6-184	X		
771	B6-185	X		
772	B6-186	X		
773	B6-187	X		
774	B6-188	X		
775	B6-189	X		
776	B6-190	X		
777	B6-191	X		
778	B6-192	X		
779	B6-193	X		
780	B6-194	X		
781	B6-195	X		
782	B6-196	X		
1100	B5-59	X		
1101	B5-60	X		
1102	B5-62	X		
1103	B5-63	X		
1104	B5-64	X		
1105	B5-65	X		
1106	B5-66	X		
1107	B5-67	X		
1109	B5-69	X		
1110	B5-70	X		
1111	B5-71	X		
1112	B5-72	X		
1113	B5-73	X		
1114	B5-74	X		
1115	B5-75	X		
1116	B5-76	X		
1117	B5-77	X		
1118	B5-78		X	
1119	B5-79	X		
1120	B5-80	X		
1121	B5-81		X	
1122	B5-82	X		
1123	B5-83	X		
1124	B5-84		X	
1125	B5-85	?	?	
1126	B5-86	X		
1127	B5-87	X		
1128	B5-88	X		
1129	B5-89			X

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
1130	B5-90		X	
1131	B5-91		X	
1132	B5-92		X	
1134	B5-93		X	
1135	B5-94			X
1136	B5-95	?	?	
1137	B5-96			X
1138	B5-97			X
1139	B5-98	X		
1140	B5-99			X
1141	B5-100		X	
1142	B5-101	X		
1143	B5-102	X		
1144	B5-103	X		
1145	B5-104	?	?	
1146	B5-105	X		
1147	B5-106	X		
1148	B5-107	X		
1149	B5-108	X		
1150	B5-109	X		
1151	B5-110	X		
1152	B5-111	X		
1153	B5-112	X		
1154	B5-113	X		
1155	B5-114	X		
1156	B5-115	X		
1157	B5-116	X		
1158	B5-117	X		
1159	B5-118			X
1160	B5-119	X		
1161	B5-120	X		
1162	B5-121	X		
1163	B5-122	X		
1164	B5-123	X		
1165	B5-124			X
1166	B5-125	X		
1167	B5-126	X		
1168	B5-127	X		
1169	B5-128	X		
1170	B5-129	X		
1171	B5-130	X		
1172	B5-131	X		
1173	B5-132	X		
1174	B5-133	X		

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Preserve	Data Recovery	No Action
1175	B5-134	X		
1176	B5-135	X		

NOTE: Treatments with an outlined X signal post-2002 changes in status from Data Recovery to Preservation status. Sites slated for Inventory will all be recommended for Preservation. Question marks (**?**) indicate sites currently recommended for Data Recovery that may change to Preservation, pending precise site location.

One clear message from the community has been that prior preservation commitments must be honored. Both the original and revised plans actually commit to more extensive preservation than originally recommended, and no site previously slated for preservation will be removed from that status. Most changes result from the decisions that possible burial mounds will be preserved, rather than tested, and that many sites will be avoided and preserved rather than undergo data recovery. The Southwest Moloka'i Archaeological District (hereafter SMAD, Site 50-60-01-803), a discontinuous set of sites listed on the National Register of Historic Places (NRHP) in 1986 will continue to be indicated on plats and deeds, and will continue to be preserved within a larger preservation landscape. Being listed on the NRHP distinguishes sites with formal recognition of their significance, but does not provide site-specific treatment plans, which are therefore included here.

CONSULTATION

As mentioned previously, the current revised plan reflects priorities expressed in hundreds of hours of community-side meetings, as well as mediated discussions between the landowners and community leaders (some for, and some opposed to the proposed subdivision) and conclusions of a Cultural Committee chaired by Collette Machado, the Moloka'i OHA (Office for Hawaiian Affairs) Trustee. In addition to the "official" meetings and discussions, the author has solicited comments and opinions informally from Native Hawaiian residents of Moloka'i. This updated plan embodies community preferences regarding preservation, and therefore contains sections not required or normally included in some Preservation Plans.

As part of its master planning process, Molokai Ranch engaged the Conservation Fund (a land conservation organization) to assess natural and cultural resources on their land and to mediate a series of community meetings and focused discussion groups. The Cultural Committee, chaired by OHA Trustee Collette Machado assisted by Hālona Ka'opuiki, focused on issues regarding cultural aspects of the landscape, particularly with regard to the effects of proposed development and conservation areas. In addition to recommending that the Ranch donate large tracts to a community-based land trust, the Committee advised the creation of cultural conservation zones that would overlay lands regardless of their eventual ownership and land use zoning. After consulting with a wide array of community members, the Cultural Committee advised that the revised preservation plan increase the level of data collection associated with preservation, leading to the commitment to re-survey the road corridor, to salvage and in some cases excavate data from fire

features to help learn about former vegetation, and to more clearly identify roles and responsibilities relative to sites in the Cultural Protection Zones where they either overlay or abut the subdivision project area. Similarly, the Committee and community at large recognized a need for this plan to address sites in he Shoreline Conservation Zone, which borders many subdivision lots. Community and Cultural Committee input has already fostered preservation, causing redesign of the infrastructure corridor and the subdivision boundaries to decrease the number and extent of proposed lots.

Through the Cultural Committee members and meetings, several organizations have contributed their *mana'o* (thoughts) regarding preservation at Lā'au. These include OHA, the Moloka'i Archaeological Society, Hui Aloha. The author apologizes for not having a complete list of organizations that may have been represented officially or informally by members. The original plan was also submitted for review by the Moloka'i Island Burial Council and a Kūpuna Advisory Committee. (None of the Burial Treatment Plan has changed since that time.)

Several individuals living on Moloka'i have offered opinions, proposed measures, and spoken with the author regarding preservation at Lā'au during the past decade. Most frequent among these has been Hālona Ka'opuiki, a Moloka'i kama'āina ("child of the land," born to a family that has been on the island for many generations) who has taken a strong, sustained interest in the well-being of cultural sites in central and west Moloka'i. Members of the Aki *'ohana* (Harry, Lawrence and his wife Catherine) also shared their *mana'o* regarding southwest Kaluako'i and supported cautious methodologies such as the use of string trimmers to achieve more thorough survey and preservation of possible burials rather than testing. Another long-term contributor to the discussion of preservation in Lā'au and elsewhere has been Walter Ritte, who spoke with the author directly and indirectly. More recently, a face-to-face talk story session with OHA trustee Collette Machado and Billy Akutigawa of the Molokai Archaeological Society helped clarify issues regarding access to sites, coastal preservation, and more. Also at that session was Alvin Burrows, a descendant of the original lighthouse keeper at Lā'au, whose opinion about this place holds a unique value. Though not always speaking directly to the Lā'au landscape, John Kaimikaua and Opuulani Albino have both been gracious enough to speak with this *haole* boy regarding the cultural significance of land and cultural places. Finally, though not directly commenting on the project, Davianna McGregor reviewed the most recent draft of the plans, and elicited further public opinion.

In addition to the Moloka'i community, the author sought advice from preservation professionals in an effort to ensure that the current plan is at the forefront of cultural preservation in Hawai'i. *Mahalo* to Myra Tomonari-Tuggle for general advice and a model of excellence. Sara Collins provided thoughtful review comments on the 2001-2002 plans in her capacity as the Moloka'i Island archaeologist at the State historic Preservation Division and since her departure from that position has responded to additional queries on a personal level. Alan Carpenter, an archaeologist at State Parks and long-time supporter of community-based preservation and cultural resource management efforts, offered reactions to the provisions of this plan and can be credited with "reversing the polarity" and advocating for circumscribed development areas rather than buffering numerous individual sites.

In the final analysis, the revised draft has become a more robust outgrowth of the original principals due to consultation with these groups and individuals. Many

preservation actions far exceed the minimal standards expressed by the state rules for preservation (HAR 13-13-277) because of the willingness of Molokaʻi Hawaiians to stand up and express their *manaʻo*. Consultation resulted in a plan that protects places and landscapes rather than site numbers, and which represents a great advance not just in acreage, but in the diversity and intensity of preservation actions proposed relative to the recommendations of 15 years ago, not to mention other islands to this day. Admittedly, a persistent minority opinion on Molokaʻi—that no development ever occur on this island—could not be accommodated, but the desire to minimize the effects of development at every step has been a guiding principle for this plan. Another opinion—that cultural sites should be much more fully opened to cash-driven cultural tourism—was rejected after the majority objected strongly.

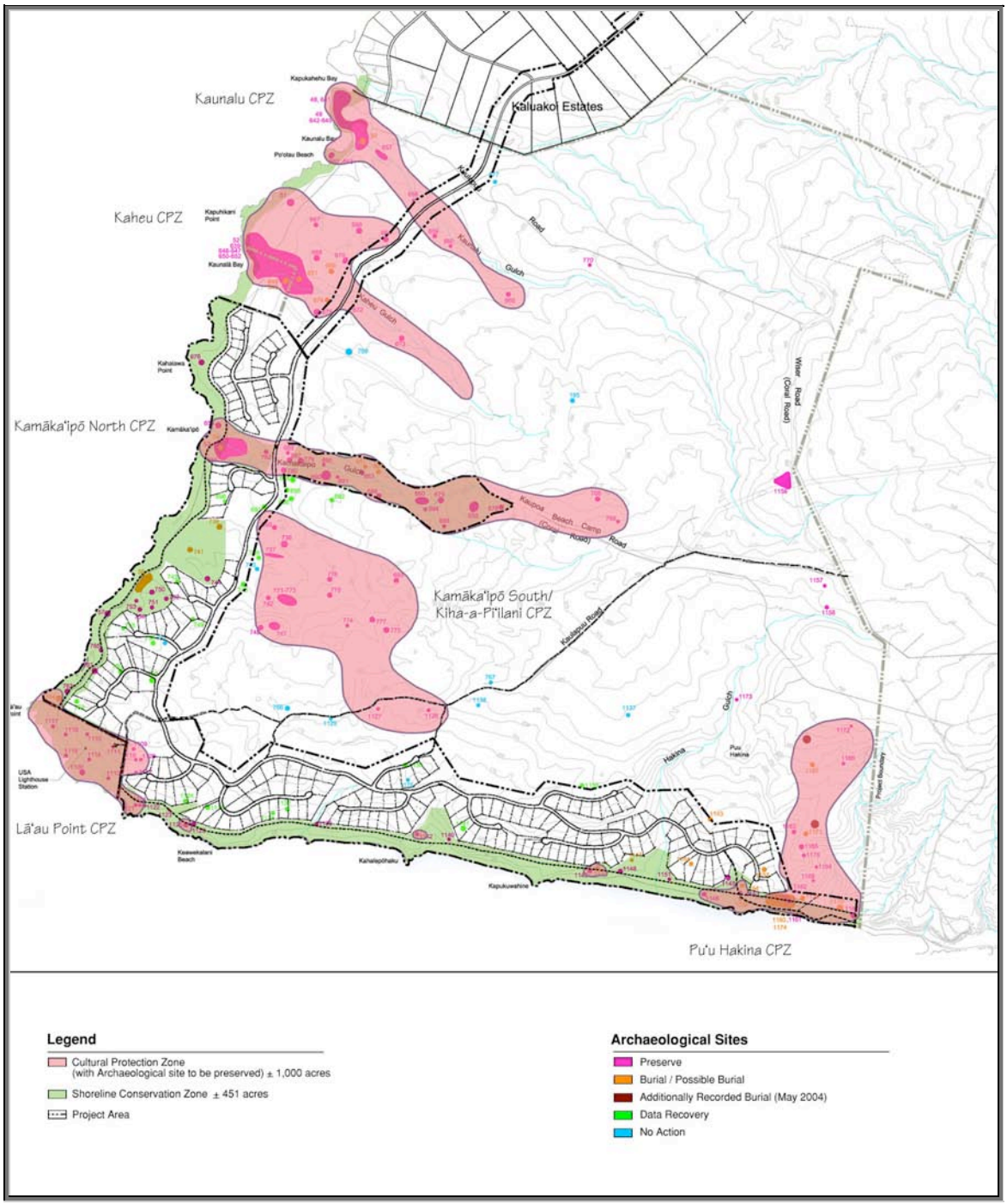

Figure 9: Cultural Protection and Shoreline Conservation Zones at Lā'au. Creation and expansion of these zones resulted from strong community input, and caused many sites to be changed to Preservation Status. Based on map produced by PBR.

PRESERVATION GOALS

Ongoing broad-based community consultation and focused Culture Committee meetings have yielded a consensus that site preservation serves the larger community goal of offsetting change with a renewed attention to Moloka'i heritage and culture. The Hawaiian renaissance of language, arts, agriculture, and culture in

general has grown for more than a generation now, and to *mālama* (protect) the sites is to protect a physical link between the modern and ancient culture. At the same time, a Preservation Plan fits within regulatory and scientific frameworks (HAR 13-13-277), and some goals stem from those aspects as well. Whether an individual is most interested in preserving a place for its *mana* (spiritual power) or its data, however, the goals listed here serve the interest of preservation.

- **Hana Like / Consult the Community** – Through the ongoing discussions of the past year, the process of consulting with Hawaiians and other interested parties is already well under way. As events move from generalities and plans to details and implementation of cultural resource preservation, however, it is important that community input be integrated with the archaeological viewpoint.
- **Hoʻomau / Perpetuate** – Preservation of archaeological sites allows future generations of Hawaiians a link to their forebears. A preserved site may be a place to feel the *mana*, to appreciate the heritage, or to learn in ways that disembodied awareness and knowledge do not; *places* are important.
- **Hoʻopaʻa / Stabilize** – For sites subject to erosion, traffic, or other ongoing threats, stop the immediate damage and avert future impacts.
- **Kapu / Protect** – Protection of sites within or adjacent to development or high traffic areas means erecting barriers in the field and clearly marking sites on construction plans and deed maps.
- **Noho Pono / Behave** – Basic rules for what can and cannot be allowed within preservation areas need to be established clearly. Although they should apply generally, it is especially important that protocols be supplied to subdivision lot owners and the conservation staff. Protocols should be consistent with (and perhaps simplified versions of) management plans devised for the overall conservation areas.
- **Maka Ala / Monitor** – Archaeological monitoring is necessary for ground-disturbing activity adjacent to preserves or in data recovery areas. A second type of monitoring is the annual field-check of site conditions in public use areas and for particularly sensitive sites.
- **Respect Preservation Commitments** – The 2001/2002 plans, like the 1991 inventory, carry through with the preservation commitment made when the SMAD was listed on the State and National Registers of Historic Places. Additional recommendations made to preserve sites since then, although not formalized through listing on the National Register, should continue to be respected and implemented.
- **Management-oriented Evaluation** – Rather than static site significance assessments, management evaluation aims to identify old or ongoing preservation problems such as erosion or damage from animal or human traffic, as well as to evaluate opportunities for protective measures and data collection. This mode of evaluation should be continued into the future to maintain a preservation program that does not fall behind developing issues and problems.
- **Data Collection** – As opposed to data recovery done in a regulatory context, the preservation process is guided by a desire to not let information about the past disappear. Implementation of the preservation plans will involve salvage of data during stabilization, as well as mapping or excavation done

to better interpret sites of interest to the Hawaiian community, to provide re-vegetation plans with information about the ancient environment, or other bona fide management purposes.

PRESERVATION PHASES

Preservation of sites representing the long past of Lā'au itself represents a long-range effort, responding not just to immediate issues, but perpetuating the protection and *mālama* for generations. Historic preservation rules acknowledge this in the requirement to state both short and long-term measures in a Preservation Plan (and as this plan does in the next section), but Moloka'i residents have moved beyond this simple two-part approach in cultural resource planning. This section presents a sequence according to which preservation measures will be implemented.

Ongoing – Communication and Evaluation

During each of the phases listed below, it is important to continue to keep lines of communication open with Hawaiians and other interested parties in the community. Having Moloka'i people as resource staff is a major step in this direction, as is answering public queries and making the process as transparent as possible.

Ongoing evaluation is important to good resource management. Inevitably, unforeseen circumstances, field conditions, and other factors lead to situations in which strict adherence to plans does not serve preservation goals. Field personnel should be allowed some flexibility as long as changes or alterations are minor and are reported to supervisors. Should a larger problem arise (such as, operational changes that would require a new permit), evaluation and discussion among staff and relevant experts should precede any change in procedures. Periodic monitoring should also feed into evaluation, so that the preservation and conservation programs continue to achieve their goals over the long run.

At the present time, a Cultural Committee chaired by Collette Machado and Hālona Ka'opuiki has taken the lead role in advising the landowners regarding cultural sites. In previous projects, such as the Kaupoa Camp re-survey and monitoring, a Kūpuna Advisory Council was consulted regarding cultural resources. Both groups have functioned well, providing archaeologists with the cultural perspective and wisdom necessary to protect cultural sites. Experience on Kaua'i involved a combination of the two, a group of people with cultural expertise to oversee normal operations, and a council of kūpuna to consider broader issues and provide the benefit of experience and wisdom.

Phase I – Relocate and Verify Archaeological Sites

A qualified archaeologist should relocate known sites thought to be in proximity to proposed subdivision lots, and if necessary refine site boundaries for preservation purposes such as marking permanent buffers. Once located, vegetation should be cleared 5-m beyond structures and the vicinity examined thoroughly to determine final site boundaries. If sediments merit, transects of shovel tests may be done to discover whether buried deposits or features occur beyond the surface features. (This means digging holes at 1 to 10-meter intervals as appropriate, screening the soil, and determining whether cultural deposits are present beyond the limit of surface features, which typically represent only the most recent phase of activity at a site.) If there are features with maps or records inadequate for preservation

management purposes, they should be augmented at this time. In addition, all surface features, visible deposits, and site settings should be photographed. Finally, verified site boundaries will be clearly flagged with their State inventory numbers, and GPS reference points established to update the location.

An additional area of verification will be the examination of the proposed road and utility corridor associated with the subdivision. Archaeological investigation of the corridor will occur during the planning process, so that any archaeological sites, if present, may be avoided. Because roads and utilities necessitate excavation and grading, the entire corridor will be covered, rather than just known sites. Wherever the proposed route enters a site, alternative routes will be investigated as well, to ensure the rerouting does not cause other impacts. Methods for verifying sites near the road will be the same as those described in the previous paragraph. Should any new features or artifacts be found during this process, the existence of a previously accepted inventory means that they technically will be classified as inadvertent finds, but the advantage of an early re-examination of the development corridor is to allow adequate time to assess the potential outcomes of such finds, allowing time for community and SHPD consultation as necessary, and adjust development plans accordingly to minimize any impacts.

Phase II – Re-evaluate Sites and Prioritize Actions

Sites in and adjacent to proposed infrastructure corridors and subdivision lots should now be evaluated with regard to general mitigation and specific treatments. It should be noted that Significance Evaluations have already been accepted, and this stage of the process instead focuses on a few cases where treatment may change from Data Recovery to Preservation, as well as examining sites in detail to make informed decisions regarding the type, extent, and priority of implementing specific preservation actions.

The sites proposed for Data Recovery in 2001 mostly consist of 20th Century sites, small areas of basalt flakes, possible planting areas, and modified outcrops; they were assigned to this category only if they appeared very marginal in importance, suffered diminished integrity due to previous damage or erosion, or were relatively recent. This point in the process is when subdivision planners must decide whether to retain data recovery as the site mitigation, or simply move the site to preservation status. Sites subject to this process are 738, 761, 1125, 1136, and 1145.

For Preservation sites, this is the time to assess particular needs in terms of stabilization, details of establishing permanent barriers, or data collection. Also sites should be prioritized so that those most at risk of erosion or other impact will be dealt with first.

Phase III – Stabilization and Protection

This is the time to erect fences or other barriers for interim protection of sites, to mark site boundaries and buffers, and to note restrictions to be placed on construction plans, parcel maps and deeds. Stabilization measures will be implemented so that sites at risk do not continue to degrade. Some data collection, such as recovery of eroded data or salvage of unstable deposits may be best accomplished in conjunction with these activities.

Phase IV – Data Collection and Permanent Barriers

Once sites have been verified, stabilized, and protected, further data collection may be done. Rather than the salvage of information that may occur during construction of a retaining wall, for example, this phase would consist of controlled excavations done to recover data from features or deposits not at immediate risk, but subject to long-term degradation (for example, cultural deposits at risk from unusually high surf).

Limited excavation may be done to support re-establishment of native vegetation or animals, since fire pits contain identifiable native and Polynesian charcoal and animal remains in an area dominated by exotic species today, or to gain better understanding of long-term environmental conditions. Interpretive questions identified during previous phases can be addressed at this time, such as excavation done to determine the relative or absolute age of a structure, or the intensity and timing of lithic production.

Permanent fences or other buffers will be installed during this phase. Wherever such buffers require ground disturbance, an archaeologist must be present to monitor the activity, recommend alterations to protect sites, and salvage data as necessary.

Phase V – Management Plan and Detailed Interpretive Plan

Building on the experience of the initial phases and the evaluations of those involved, the Management Plan can now be produced. The two main components of this document will be a report of all the findings and activities thus far, and a manual for the continued management of the archaeological preservation areas (North Kamāka'ipō Gulch, Shoreline, Sites in Subdivision Lots, Sites Straddling Lot/Conservation Boundaries, and Outliers).

Unlike this preservation plan, the Management plan will focus less on regulatory compliance than on integration of long term processes in the Project Area with preservation activities undertaken by the neighboring Land Trust, and refined policies regarding maintenance and ongoing evaluation. This document is intended for practical application by Land Trust staff, subdivision residents and maintenance personnel, and other individuals who may not have a historic preservation or archaeology background. The Management Plan will not change the measures proposed in the Preservation Plan, but will help distill and translate that Preservation Plan in order to facilitate implementation over the long run. A major element of the Management Plan will be a set of maps showing the final maps of preservation sites, so that any refinements or augmentations can be recorded as baseline data for future site condition monitoring.

Development of a Detailed Interpretive Plan is being proposed as an addendum or supplement to the current Preservation Plan for several reasons. First, implementation of the core Preservation Plan will yield additional data and situational awareness that may alter or augment understanding of the archaeological and cultural sites to be interpreted. For example, recovery of charcoal during Phases III and IV will expand our understanding of settlement chronology and environmental change. Because public accessibility to interpreted sites in North Kamāka'ipō and Pu'u Hakina will be more intense, the goal is to provide a richer interpretive program than inventory data allow. Also, as the Preservation Plan is implemented, community attention will be drawn to the area, and elicitation of residents' memories of the region, oral histories, and community preferences regarding the content and style of education and interpretation are sure

to emerge. While specific interpretations could be proposed at this time, waiting until later will result in a more informative, culturally appropriate program.

Interpretive planning is covered by the HAR 13-277 rule for preservation, but SHPD has allowed phased submittal of Detailed Interpretive Plans in the past. The current plan covers the more immediate site protection and specific preservation planning commitments that are urgent, and asks that SHPD accept this plan as is, including a commitment to prepare a Detailed Interpretive Plan based on community consultation for future SHPD review.

PRESERVATION ACTIONS

Preservation often means more than simply leaving a site alone. Between simple avoidance and interpretive restoration lie numerous preservation measures. Choosing which of these to apply requires consideration of the site's basic characteristics, its significance, its physical surroundings, and its context within landowner plans. These actions comprise both short and long-term measures that will protect sites during the subdivision process and for years to come.

General Preservation Categories

The basic division of Preservation treatments distinguished between "Avoidance and protection" (or "conservation") from "Active" (HAR 13-277-3-(1)). The latter includes stabilization, rehabilitation, restoration, reconstruction, interpretation, and appropriate cultural use. Because of the variety of site types and functions, as well as the large area covered by this plan, treatments vary. Site-specific treatments are generally determined by factors such as proximity to development, whether a site is in a Cultural Protection Zone, and whether a site is in an area where significant public use or access is anticipated.

Active preservation measures proposed in this Plan include stabilization, interpretation, and appropriate cultural use. The latter category applies to all sites in Cultural Protection Zones, although current active use is limited to a very small number of *koʻa* where some fishermen continue to place offerings. As the sites in the project area become more accessible, it is likely that cultural use will increase. Stabilization needs have been estimated based on current knowledge of site conditions, and will be limited to measures that halt the deterioration and erosion of sites, without going further and restoring them. Interpretation will focus on the North Kamākaʻipō and Puʻu Hakina Cultural Protection Zones, each of which will be partially developed as a public beach access and park. A detailed list of active preservation measures is presented for each site in Table 2.

Sites for which avoidance and protection are the only treatments are primarily located away from the subdivision Project Area. These sites appear on Table 2 as well, with the only applicable treatments consisting of two or more of the following: Avoidance, Mapping, Temporary Buffers, Permanent Boundary, and Protocol Education. Sites in this group include the following: 48-52, 639-652, 657-675, 693- 695, 736, 738, 742, 747, 748, 770-778, 1100, 1102-1111, 1113-1117, 1125, 1136,1139, 1146, 1153, and 1155-1174. Of these, Sites 738, 1125, and 1136 are currently slated for Data Recovery, although it is possible that they may be preserved if development activity can avoid their locations.

Supplemental Data Collection

Two types of archaeological investigation that are not required by the regulatory historic preservation process will be done in association with the Lā'au subdivision. While elements of each have been part of the plans from the outset, the recent period of community consultation have made it clear that they are a priority to many residents and most Native Hawaiians on Moloka'i. The function of supplemental data collection is to refine and augment site records to a level at which they can aid in preservation management, which requires more detail and a thorough baseline understanding of sites, sometimes beyond the ability of Inventory level data to accommodate

First, because construction of a new road and utility corridor represents the greatest single potential for impact, and is the initial step in construction for the new subdivision, the landowner has committed to re-examine the corridor, which as already been through the an accepted archaeological inventory.

The second form of data collection relates to preservation sites within and close to proposed subdivision lots, where the process will amount to a thorough investigation of sites that are to be protected within or in close proximity to new house lots. Because this type of work is to be done as part of the Preservation Plan implementation, it will be described in more detail there, but it is important to note that it will be done well in advance of any house construction, and therefore any new or augmented finds may be considered in the design and construction process, so that new houses need not damage old sites. An overview for this process is included below.

Road Corridor

As described in the **Introduction**, the first fieldwork associated with these plans will be to re-examine the road corridor and verify descriptions of known sites, gather additional data if possible, and search for unrecorded archaeological deposits or features now observable due to changes in surface visibility. A preliminary plan for the road corridor has been prepared by engineers, the centerline of which will be staked on the ground by surveyors prior to commencement of archaeological fieldwork. The proposed road diverges from Kulawai Loop (an existing road in the Papohaku Ranchlands subdivision), and then runs roughly southwest to a point just south of the Kaupoa House lot where the subdivision begins, and then more or less follows the shoreline down the west south coasts to the vicinity of Site 1155, south of Pu'u Hakina (see map). Along the way, 12 short spur roads depart from the main corridor, providing access to subdivision lots. No connections to the Hale-o-Lono harbor road or other existing roads are planned, and the old coastal road—a roughly graded, unpaved jeep trail—will be abandoned as part of the development plan due to its alignment through several archaeological sites and erosion-prone environments.

As noted above, the portion of the road corridor north of TMK 5-01-02-030 has not been officially inventoried, and a report for that portion of the road corridor investigation will in fact be submitted separately to SHPD for review as an archaeological inventory with significance evaluations and treatment recommendations. Despite this procedural difference, techniques will remain the same throughout the road corridor.

The area for data collection consists of a 30 m wide swath on either side of the centerlines for the main and spur roads, and a 50 m radius surrounding each end point, where turn-arounds have been planned. The impact of road construction and

utility trenching will be less than the resulting 60 m wide corridor, but that width has been chosen both to provide the best archaeological understanding of the road and its context, and to provide intensive coverage that may be used to avoid additional survey or unexpected impacts should presence of sensitive sites within the corridor cause a need to adjust the alignment.

The survey team will consist of Moloka'i residents with archaeological experience and training led by the Principal Investigator, with additional archaeologists hired if necessary. The corridor will be divided into segments, and the crew will perform sweeps in each segment with a 5 m interval. Where grass is thick enough to obscure surface visibility, gas-powered string trimmers will be used to expose the surface within 10 m of the centerline, so that low-relief features such as pavements and lithic scatters will not escape notice. Vegetation will also be cleared around the periphery of any visible surface features found within the corridor (regardless of distance from the centerline) to allow their accurately augmented documentation.

Any sites within the corridor will be documented with scaled surface planviews, cross-sections and profiles as necessary, photographs, and descriptive notes. Where sediments occur that could contain buried cultural deposits, transects of probes will be employed to determine site boundaries and characterize site stratigraphy. Each probe is to be excavated with a shovel, by stratigraphic layer as far as practicable, with the entire volume screened through $^{1}/_{4}$-inch mesh. For each probe a representative profile will be drawn, referenced to the current ground surface. Any features encountered will be drawn and photographed in plan and profile and excavated as a separate stratigraphic context. All cultural materials will be collected, described, and recorded in a project inventory. Probe intervals will range from 1 to 5 m, depending on the area of sediment where buried features could occur, as well as the nature and density of the surface features and visible deposits. Probes will begin at the outer edge of surface features and radiate outward in at least two directions along grids established for each site (the orientation of which will be decided in the field by the PI according to topography and local conditions). Where probe intervals are greater than 2 m, follow-up probes will be used at tighter intervals to better determine the horizontal extent of the site.

For each site, a minimum of one datum point will be flagged and marked on site planviews to facilitate location on large maps. Initially, a GPS device will be used at each of these to provide a location; consumer-grade Garmin units used on property by Ranch staff have achieved accuracy to within 2-m of the UTM coordinates provided by survey grade GPS, and will be used during the re-survey to provide interim site locations. Subsequent to the initial fieldwork and prior to construction, these points will be plotted on lot surveys to provide accurate, precise control points for site and buffer locations. Each datum point will be integrated into the engineering consultant's CADD system, along with either an appropriately sized buffer. (Site-specific buffers, it should be noted, may often fall within larger buffers created for the Shoreline Conservation Zone or Cultural Protection Zones.)

Sites that have been previously recorded will be reported in the Preservation Management Plan, including any newly located features or artifacts found during fieldwork. Features not associated with known sites will be reported to SHPD as inadvertent finds, along with significance evaluations and treatment recommendations.

Subdivision Lots and Coastal Zone

Sites within proposed subdivision lots have accurate locations due to their proximity to coastal reference points, and many have been previously documented in detail by archaeologists. In order to ensure that all sites have been adequately recorded and those slated for preservation receive timely and effective preservation, land within and in close proximity to the subdivision lots will be re-examined as well. As with the road corridor, the aim is to verify extant site records, augment them as necessary, and record any previously unrecorded artifacts or features.

Methods for investigating and recording sites will be the same as well, although the project area differs. Rather than a corridor defined by the road centerline, this survey area consists of the proposed private lots and the lands makai of them. Inclusion of the coastal land (most of it already zoned Conservation, and the remainder to be so if the Ranch's petition to change some near-shore land from Agriculture to Conservation is approved) in this phase stems from two facts. First, some sites straddle the boundary between Shoreline Conservation land and lots. Second, as lots are occupied and coastal parks are opened, foot traffic through coastal sites will increase, subjecting them to a greater potential for impact than in recent decades.

Because so many sites have been recorded near the shoreline, this phase will begin with the known and work outward, annotating and augmenting site documentation as necessary, firmly establishing site boundaries. Areas between sites will be surveyed at 5-m intervals to search for any unrecorded features or deposits.

Vegetation clearing in this phase will focus on sites, exposing surface features and visible deposits to allow for mapping. However, clearing in Conservation lands will be limited to cutting grasses and vines, and native plants will be preserved. A sampling of high probability landforms (ridge-tops, natural terraces within gulches, and level ground above slopes) will be cleared to check for visually unobtrusive features in the private lots, but not within the coastal strip. In all cases, clearing will proceed with an awareness of soil, slope, and groundcover, to avoid exacerbating erosion.

In addition to the use of shovel probes to define site boundaries, some excavation will be done in this phase to help further the general conservation goals of the master plan and to better understand chronological and functional issues regarding the sites. Wherever hearths or *imu* are at risk from erosion, they will be excavated to reveal the stratigraphic relationship to other site components, and to collect charcoal for taxonomic identification, providing a basis for future re-vegetation efforts. Likewise, eroding deposits will be cleaned up to provide a representative vertical face for profile illustration, and a charcoal or other materials may be collected at this time.

Establishing Site Buffers

Currently, the boundary of each known site is a perimeter enclosing all of the features and intact cultural deposits, constituting the site as recorded in 1991. State Historic Preservation rules (HAR 13-13-277-4) specify that a buffer zone must be established to surround and protect significant sites. This will be the initial task of preservation, and will be all that is done for sites that are not being interpreted or that are far from potential impact areas. The folio map (Figure 4) shows the buffers proposed in this plan.

Zone Buffers

Because wording in the rule describing how Preservation Plans must specify buffers requires that the report "specify buffer zones around each significant historic property" (HAR 13-277-3-(2)), the usual practice is to assign site-specific buffers. In keeping with this, site-specific buffers are proposed below based on a series of systematic rules. However, this Plan proposes that buffers be recognized on the level of larger zones that encompass numerous sites and their buffers. Defining buffers at the perimeters of the Shoreline Conservation Zone and the six Cultural Protection Zones will result in radically larger buffered areas that protect sites in their landscape and inter-site contexts. Where these zones abut the Project Area, or where individual sites do not fall within the protection of a larger zone, the site-specific zones proposed below will pertain, and in no case will a SCZ or CPZ buffer be less than the minimum 7 meter buffers for typical sites or 9 meters (in the case of Sites significant under Criterion E).

Because the Shoreline Conservation and Cultural Protection Zones are so expansive and go well beyond where they would be subject to effects from subdivision or road development, placing permanent barriers along their entire length would be impractical, and likely to trigger more impacts than it would prevent. However, these Zones must be identifiable to future landowners, land use planners, and preservation managers, and markings on the ground and on maps are necessary.

Locations where sites in the zones lie in close proximity to potential development areas may require temporary protective fencing during construction, and permanent buffer markers after that. These cases have been identified and are reported in the table and text of Plan's the **Site-Specific** section.

Marking the buffers for Cultural Protection Zones where development is not a potential cause of impacts will be accomplished through a combination of land survey data and maps, marker posts, and signs. An archaeologist will first define the edges on the ground, ensuring that no site receives less than the mandated site-specific protection, and that the overall zone covers the area intended; this will be marked with highly visible flagging tape. Subsequently, the archaeologist will work with licensed land surveyors to mark the precise metes and bounds of the Cultural Protection and Shoreline Conservation Zones. These data will be transferred to maps of individual lots, the Project Area as a whole, and overview maps showing the Project Area in relation to the Shoreline Conservation Zone, the Cultural Protection Zones, and the Rural Landscape Reserve. The zone-level protective buffers will be recorded with the Bureau of Conveyances to ensure that they persist beyond any change of ownership.

Physical markers will consist of metal T-posts or durable wooden posts placed at intervals sufficient to relocate them on the ground using a map of the zone. In some of the heavily vegetated gulches, the interval may be as close as 10 m, while in the more open uplands they may be 10 times that far apart. Placement will be sufficient to mark any turns in the boundary, and an archaeologist will be involved to ensure that the markers to dot impinge on the visual integrity of sites, and that their installation does not cause any adverse impacts. Each post will have a metal tag indelibly marked with the name of the Zone being marked.

Where roads traverse sections of Zones, signs will be installed informing drivers and maintenance crews that they are entering Cultural Protection Zones, and notifying them that they may not drive beyond the extant road or otherwise disturb the ground or cultural resources. These will be placed along the main subdivision

access road where it traverses the Kaunalu, Kaheu, and North Kamāka'ipō CPZs, as well as where extant dirt road (potential access routes for emergency vehicles) traverse sections of the North Kamāka'ipō, South Kamāka'ipō – Kiha-a-Pi'ilani, and Pu'u Hakina CPZs. Signs will also be placed at the north edge of the tourist eco-camp at Kaupoa where people could walk into the Kaheu CPZ, as well as at the far extremes of TMK 5-1-02-030, where shoreline pedestrian traffic will enter the Kaunalu CPZ at the south end of Kapukahehu Bay (north end of the west coast) and at Pu'u Hakina CPZ (at the east property boundary on the south shore). Signs will also be posted at the edges of the North Kamāka'ipō, Lā'au Point, and Pu'u Hakina CPZs where they abut subdivision lots. Test for the signs is shown in Appendix C.

Site-specific Buffers

For some sites (primarily those near the road corridor and those being interpreted), the first action will be to verify site boundaries. This is an extra safeguard to ensure that site components that may have been hidden by vegetation in 1991 are included, and will consist of intensive field checks of site boundaries, and possibly some additional vegetation clearing.

Once the boundaries have been verified, buffers will be established. For the majority of sites, buffers will consist of a 7 m strip extending radially out from the boundaries. In the case of single-feature sites, the buffer will be a 7 m radius extending from the feature edges. For burials and shrines, the radius will extend to 9 m; in the case of *ko'a* shrines, an additional aspect of the buffer will be a requirement to keep an open view plane toward the ocean. Another exception is the *Mauka-Makai* preserve at Kamāka'ipō, where the entire area will be a buffer, so that the overall character of the cultural landscape can be preserved. This preserve will be traversed by the subdivision access road at a single location; archaeological survey will be done prior to identify a corridor where no features will be impacted, and the corridor will be fenced to prevent any further encroachment into the preserve; this corridor will be narrower than the 100-m survey corridor. In cases where a site buffer radius extends into an old road grade or eroded area which has cut down to the culturally sterile substrate, the buffer may be moved closer to site boundaries. This will not only avoid the unnecessary "protection" of what has already been lost, but will also minimize overall project impacts by allowing use of existing roads. However, a minimum 2 m buffer from remaining features will be retained even where damage has reached all the way to site boundaries. Construction plans need to consider all buffers and avoid ground alteration that could cause erosion to cut into them.

Generally, no vehicles or ground altering activities will be allowed within buffers. In certain cases, such as developing an interpretive walking trail or stabilizing sediments, it may be useful to enter the buffers for the benefit of site preservation. Installation of signs and/or fencing around buffers will also involve ground disturbance. For all of these activities, written plans shall be submitted to the Kūpuna Advisory Committee and SHPD for review, and an archaeologist shall monitor implementation. For sites within the subdivision lots (the large common lot excepted) that are not near any planned construction, buffers will be marked with bright-colored flagging tape on which the site number is included. For sites near areas of potential impact, temporary fencing will be used as described below and in Table 2. The table also shows which sites will have permanent buffer markings as described below.

As stated above, most sites fall within the protective buffers of larger Culutral Protection Zones. In keeping with the technical requirements for site-specific

buffers, the following information is provided for sites that depart from the standard 7 m buffers. The exceptions to the standard site buffers are as follows:

48-52 is 10 m excepting previous grading and erosion, with a clear view to the ocean unless obscured by existing vegetation
639 is 7 m north and south, but otherwise goes from the road to the coast
641 is 9 m in all directions except *makai*, where it extends to the coast
645 is 7 m north and south, but otherwise goes from the road to the coast
648 is 9 m with an open view to the coast (excepting existing vegetation)
649 is 9 m with an open view to the coast (excepting existing vegetation)
651 is 7 m except for a 9 m radius around the shrine (Feature 18)
670 is 7 m except for a 9 m radius around the shrine (Feature 1)
671 is 9 m on all sides
674 is 9 m on all sides
1104 is 9 m to the east and west, and between the road and the coast
1105 is 9 m to the east and west, and between the road and the coast
1106 is 9 m with an open view to the coast (excepting existing vegetation)
1107 is 9 m with an open view to the coast (excepting existing vegetation)
1128 is 9 m except where the existing road encroaches within 9 m
676 is 9 m with a clear view to the ocean unless obscured by existing vegetation
1101 is 9 m with a clear view to the ocean unless obscured by existing vegetation
1146 is 9 m east and west, and between the road and the coast
1157 is 9 m with a clear view to the ocean unless obscured by existing vegetation
56 is 9 m to the north and south, and between the road and 9 m *mauka* of the most inland cairn feature.
741 7 m except 9 m from Features 3 and 4
764 7 m except 9 m from Feature 2
1119-1120 7 m (possible shrines present, but not intact)
1142 is 9 m with a clear view to the ocean unless obscured by existing vegetation
1143-1144 is 9 m in all directions
1147 is 9 m in all directions
1149-1150 is 9 m with a clear view to the ocean unless obscured by existing vegetation
1154 is 9 m in all directions

Short Term Measures

Temporary Fencing and Protection

For sites that are in the area of potential impacts during construction, temporary buffers will be established. These will consist of brightly-colored construction fencing erected on the permanent site buffer boundary. Construction personnel will be alerted to their presence and significance, and will not be allowed to encroach. Once buffer zone markers are placed in the field, field personnel will be alerted to their presence and their meaning; no construction, ground-disturbing activity, traversing by vehicle, or stockpiling will be allowed within them. Buffers of this type differ from site boundaries, and extend 7 m or more beyond the outermost features of a site. An archaeologist will be present during ground-disturbing work in such locations to maintain the protective buffer, and to evaluate any inadvertent

discoveries that may occur nearby. The archaeologist will follow the procedures outlined below in **Monitoring: Methods**.

Evaluate Stability

Sites are part of a changing environment, and in Kaluakoʻi a widespread agent of environmental change is erosion; long dry periods and occasional downpours mean that many sites are vulnerable to sudden erosion. Generally, sites are at risk either from soil deflation or by more damaging collapses as gullies advance upslope; in fact several previously buried cultural deposits were initially recorded because erosion had exposed them. More rarely, low-lying sites may be covered with silt washed down from above. For these reasons, sites where erosion appears to be a factor will be evaluated with regard to the damage that has already occurred and the risk of further adverse impacts from erosion. In addition to the sediments, stone features will be evaluated to determine the degree to which collapse has occurred and may be expected to continue. Recommendations for stabilizing sediments and structures will be made.

Recover Eroded Data

As stability is being evaluated, eroded data will be found at some sites. Unless they appear to be in imminent danger of erosion, intact deposits will not be excavated. Midden, artifacts, and charcoal that have eroded from formerly buried deposits will be collected for analysis. Because such data have lost their depositional integrity, controlled excavation techniques will not be used, although sediments will be screened. In cases where findings are limited, or original context cannot be reasonably inferred, data will be recorded in the field without collection. Other cases where data will be recorded but not collected include culturally sensitive features and deflated (but horizontally stable) deposits. Sites where data will be recorded in situ are marked "I" on the **Preservation Measures Table 2**. A report summarizing findings will be produced.

Long Term Measures

As-Is Preservation

For sites that are outside the subdivision, as well as some within that can easily be planned around, the primary treatment will be simple avoidance. These are sites that have no construction or ground-disturbing activities planned nearby. Sites preserved in this manner will have 7 m buffers unless otherwise noted, but because they are usually remote, will not have physical boundary markers. Instead, these sites will be marked on topographic maps (see attached), and current and future landowners will be notified of their presence, and of the buffer zones.

Mapping

Many sites, especially those where public access or frequent use may be expected, would benefit from accurate mapping. The inventory survey included plane table and alidade mapping of some sites, but most were only sketched. Mapping techniques for structural features will conform to those described in **Data Recovery: Methods**. Maps will become baseline illustrations of sites, allowing landowners to re-identify them and evaluate their condition in the future, as well as to recognize site buffers, which will be depicted on parcel plats. Copies of each map will be submitted to the SHPD office as part of a Preservation Report.

Physical Stabilization

For sites where erosion or historic development has resulted in an unstable deposit, measures may be taken to prevent further impacts. Physical stabilization refers to actions that replenish eroded sediments or create barriers preventing further erosion. Soil from upland pineapple fields may be introduced at some locations to cover deflated surfaces or fill in erosional gullies. No fill will be taken from archaeological sites. For features, previously toppled stones may be re-stacked to repair collapsed sections, but only to the degree that it prevents further degradation; complete restoration of walls or other features will be done only after SHPD has reviewed and accepted a site specific restoration plan. In a few cases, imminent damage may require use of retaining structures. These will consist of alignments or stacked stone facings, and will incorporate natural materials erected in traditional mortarless construction; to avoid confusion of stabilizing features with older sites, they will generally make use of a different type of stone so that they can be readily distinguished. Kiawe or other logs may also be used. Prior to implementation, specific treatments involving alteration of site landscapes will be submitted in writing for SHPD review. Subsequent to implementation, all forms of physical stabilization will be annotated on site maps, described specifically in a letter to SHPD, and identified in any educational materials that are developed for stabilized sites.

It should be noted that in all instances where Stabilization is specified as a treatment in Table 2 below, this is contingent on the Evaluation of Stability. Although the Site Treatment Table provides the best estimate of stabilization needs based on existing records, it is conceivable that fieldf checks will reveal that some sites do not need stabilization.

Vegetative Stabilization

In sites where soil and water availability make it possible, plants will be used to stabilize damaged sites and prevent erosion of intact sites. In some cases where it is being recommended, it may not be practical to plant vegetation, due to hardpan surfaces or lack of water. In such cases, the approach will be to encourage growth of extant plants, particularly native plants and grasses that have become naturalized and help bind the soil. The technique will be to allow low-growing varieties to stay, rather than introducing them. Vegetation that is brought in and planted will consist of native and Polynesian introduced shrubs and groundcovers that are well suited to the dry environment. Shrubs may include species common in the project area, such as *maʻo, ʻilima,* and *ʻuhaloa*, as well as others that would have been expected prior to historic changes, such as *ʻakoko, ʻauhuhu, ʻāweoweo, maiapilo, naupaka,* and *ʻūlei*. Ground covers will also include known and likely former species, such as *ʻākulikuli, hinahina, ʻihi, ʻiliʻeʻe, nanea, pōhuehue,* and *pōhinahina*. Choices of species for particular sites will depend on the availability of the varieties, physical environment, and consultation with ethnobotanical and botanical specialists.

Permanent Boundary

For some sites where public use is expected to be relatively high, permanent boundaries around site buffers are appropriate. Boundaries will more often be visual reminders of site preserves than actual fences. At some, openings will allow public access, and boundary markers will serve to direct foot traffic rather than prevent it. Boundaries will be wood post and rail construction, with any posthole digging to be monitored by a qualified archaeologist who will ensure that the

proper placement is achieved, and who will examine the excavated volume for cultural materials. Stone walls will not be used, to avoid confusion with the sites themselves. Access to and around boundaries will be planned on a local basis to minimize the potential for impacts. Signs at buffers will identify sites and advise visitors regarding protocol. (See Appendix.)

Interpretation

Because it is not immediately obvious to many people what a site is, selected sites will be interpreted, particularly in the North Kamāka'ipō and Pu'u Hakina Cultural Protection Zones. To the extent that available data and contextual knowledge allow, a site will be interpreted regarding its function, age, and cultural significance. Representative functional types including households, *ko'a*, *heiau*, agricultural areas, and stone tool manufacturing sites will be included among the interpreted sites. The overall theme will be that ancient Hawaiians developed cultural adaptations to the dry leeward landscape, including a *mauka-makai* settlement pattern that made use of ocean, gulch, and ridge environments and resources. Because of the number of sites and the predominance of thorny vegetation between them, only certain accessible sites are being chosen for interpretation, but an effort has been made to represent the range of site types in the project area, including several sites in the Southwest Moloka'i Archaeological District. North Kamāka'ipō will be the main interpretive area, since it is being preserved as a *mauka-makai* system. Because of its proximity to Hale-o-Lono boat harbor (where an annual canoe race draws hundreds of visitors, and where other boaters and island residents frequently visit), the landowner has also planned a public park at Pu'u Hakina, where interpretation will focus on settlement in the relatively broad sandy flat of the south shore.

An important consideration for interpretation is that not all sites should be presented to the public. Some, such as burials, will not be publicly accessible, although descendants may of course visit their *kūpuna*. Others, such as the *ko'a* mentioned above, are also sensitive, although community input suggested that Hawaiians and perhaps other fishermen should be allowed to visit them freely, and that a sample should be made known to visitors since they are such a strong aspect of the culture, but that not all should be known to outsiders. The *ko'a* being interpreted will restrict access beyond a respectable distance and include signage that asks visitors to respect the sanctity of the place.

In addition to brochures and other off-site interpretation, signs will be used at sites both for protection and interpretation (See Appendix C for examples), as well as to communicate Hawaiian place names to those who may not be familiar with them. The exception is for burials—other than those present in the North Kamāka'ipō area, where they are amid other sites being interpreted, they will not be subject to interpretation. Currently, cultural tours are available on adjacent lands owned by Molokai Ranch. Should organized activities such as this occur in this parcel, tour organizers must follow the cultural protocol and minimize the potential for adverse effects. This includes consultation with *kūpuna* and cultural experts regarding proper behavior, not using vehicles (including mountain bikes), and educating visitors regarding the importance of appropriate behavior and penalties for damaging sites.

To protect sites that are publicly accessible (ie., adjacent to roads or in public areas), signs will be posted at or outside of buffer perimeters identifying sites as significant and warning that damage to sites is punishable under Hawaii Revised Statutes Chapter 6E-11. Placement will be determined by accessibility and

visibility, and may occur at sites not otherwise interpreted. Printed interpretive materials will also include the legal message.

As stated elsewhere in this Plan, a **Detailed Interpretive Plan** will be developed at a future date to provide the specific interpretive messages that are to be communicated. This will be based on community consultation, especially with *kūpuna* familiar with the regional history, as well as archaeological investigations done during implementation of the Preservation Plan. In addition to interpretive content, the plan will specify the location, appearance, and maintenance considerations for interpretive locales. The interpretive program will not be implemented until SHPD approval has been received.

Protocol Education

All sites being preserved have significance at least for the information they can offer to our understanding of Molokaʻi history. In some cases they also represent of a unique function or style, and many are valued for their cultural significance to *kanaka maoli* (indigenous Hawaiians) and other groups. For these reasons and the fact that they show the last physical traces left by former inhabitants, it is important to communicate new residents the importance of helping protect and respect ancient sites. As interpretive materials are developed, therefore, information on how to properly behave in sites will be included on printed materials and signs. From an archaeological perspective, this means leaving things as they are and avoiding actions that could damage or destabilize sites. Hawaiian cultural protocol builds on this to include other behaviors, especially with regard to *koʻa* and burial sites, and therefore the Kūpuna Advisors and cultural experts will be consulted. It is anticipated that protocol education will consists of two parts: a general notice for people to respect sites and leave them as they find them, and more detailed information about sites with religious or burial features.

Management Plan

Following completion of other preservation measures, a Management Plan will be produced to help lot owners, Land Trust staff, and others with the ongoing management of preservation sites. The primary purpose of this document will be to provide a smaller, more user-friendly distillation of this compliance-oriented Preservation Plan that will be more suited to practice. In addition to the simpler presentation of measures described here, the Management Plan will include details regarding management of the two proposed parks, which are currently only conceptual, and which will require additional preservation measures such as specification of landscape maintenance procedures as garbage removal. The second purpose will be to provide a set of detailed baseline maps and photos to preservation managers—these will include the refined and augmented maps produced during Preservation fieldwork.

Because the Management Plan will describe some measures covered by the HAR 13-277 preservation rule, it will be submitted as a Supplemental Preservation Plan for SHPD review.

Appropriate Cultural Use

Currently, the only site known to the author to be actively in use is the *koʻa* Site 676. It is possible that other *koʻa* are used similarly by fishermen who place offerings on or in front of them and as landmarks used by people at se locating

certain fishing grounds. As access becomes easier to the archaeological sites in the area, it is likely that cultural practice by Native Hawaiians will increase.

The paradox of designating "culturally appropriate use" as a preservation treatment is that authors of the plans (this one included) are typically not born into the culture, and are not adequate judges of what is appropriate. For that reason, "appropriate" is not strictly defined here, and must remain a matter of community standards, especially on the Island of Moloka'i, where the *kanaka maoli* population is grounded by tradition. In the author's experience, this means that within families, *kūpuna* exercise control over the younger individuals by teaching them how to behave, and by sanctioning inappropriate behavior. On a community level, *kūpuna* and the more culturally inclined people exercise the same controls on a larger social scale. It is very likely that these mechanisms will continue to shape the appropriate cultural use of sites.

From a historic preservation standpoint, some activities should not be included under blanket permission for cultural use. One is removal of artifacts or stones from sites—the traditional belief that taking such things is to *'aihue* (to steal), already provides a check on such behavior, with sanctions that range from community disapproval to retribution by the spirits and guardians of the place. Another action that is inconsistent with historic preservation is to alter a site. This presents more a contradiction between traditional practice and historic preservation, since many Hawaiians wish to honor a site by repairing and cleaning it. Such activities can amount to a loss of physical integrity or reconfiguration of a site in a way different than it was originally built; both effects are adverse impacts from a strictly preservationist perspective. To allow for the urge to take care of sites and perhaps rebuild them, it is recommended that any such effort be preceded by a Restoration Plan that specifies exactly what is proposed, and is submitted for SHPD review.

Culturally Appropriate Use is not a treatment that can be applied to one site and not another, since appropriateness is a community (and in this case, Native Hawaiian) parameter.

SITE-SPECIFIC PLANS

This section provides details of preservation actions being recommended for each site. The total population of archaeological sites has been broken down into groups reflecting the categories mentioned in the **Introduction** to this plan, so that sites with similar locations and levels of potential for impact may be dealt with together, and needless repetition may be avoided.

Table 2. Site Preservation Measures

(I denotes recording data in the field without collection)

Site (50-60-01-)	Avoidance	Temporary Buffers	Mapping	Evaluate Stability	Recover Eroded Data	Physical Stabilization	Vegetative Stabilization	Permanent Boundary	Interpretation	Protocol Education
48	X									X
49	X									X
50	X									X
51	X									X
52	X									X
53		X	X	X	X	X	X	X	X	X
54		X	X	X	X	X	X	X	X	X
56			X	X		X	X	X		X
57			X	X		X		X		X
639	X									X
640	X									X
641	X									X
642	X									X
643	X									X
644	X									X
645	X									X
646	X									X
647	X									X
648	X									X
649	X									X
650	X									X
651	X									X
652	X									X
654		X	X	X	X	X	X	X	X	X
655		X	X	X	X	X	X	X	X	X
656			X	X		X			X	X
657	X									X
658	X	X								X
659	X	X								X
660	X									X
662	X									X
663	X									X
664	X	X								X
665	X									X
666	X									X
667	X									X
668	X									X
669	X									X
670	X									X

Site (50-60-01-)	Avoidance	Temporary Buffers	Mapping	Evaluate Stability	Recover Eroded Data	Physical Stabilization	Vegetative Stabilization	Permanent Boundary	Interpretation	Protocol Education
671	X									X
672	X									X
673	X									X
674	X									X
675	X									X
676			X	X		X		X	X	X
678			X	X		X		X	X	X
679			X	X		X		X	X	X
680			X	X		X		X	X	X
681			X	X		X		X	X	X
682			X	X		X		X	X	X
683			X	X		X		X	X	X
684			X	X		X		X	X	X
685			X	X		X		X	X	X
686			X	X		X		X	X	X
687			X	X		X		X	X	X
688			X	X		X		X	X	X
689		X	X	X		X		X	X	X
690			X	X		X		X	X	X
691			X	X		X		X	X	X
692			X	X	X					
693	X									X
694	X		X							X
695	X									X
696	X									X
699			X	X	X	X				X
736	X		X							X
737			X	X						X
738	X									X
739			X	X		X		X		X
741			X	X	X	X		X		X
742	X									X
744		X	X	X					X	X
747	X									X
748	X		X							X
750		X	X	X				X		X
751		X	X	X				X		X
752		X	X	X				X		X
753		X	X	X				X		X
754		X	X	X				X		X
761	X	X	X	X	I			X		X
763	X	X	X	X						X
764		X	X	X	I	X	X	X	X	X
765		X	X	X				X		X

Site (50-60-01-)	Avoidance	Temporary Buffers	Mapping	Evaluate Stability	Recover Eroded Data	Physical Stabilization	Vegetative Stabilization	Permanent Boundary	Interpretation	Protocol Education
768	X		X	X	X	X		X	X	X
769	X		X	X	X	X		X	X	X
770	X									X
771	X									X
772	X									X
773	X									X
774	X									X
775	X									X
776	X									X
777	X									X
778	X									X
779			X	X	X	X		X	X	X
780		X	X	X	X	X		X	X	X
781	X		X	X	X	X		X	X	X
782		X	X	X	X	X		X	X	X
1100	X									X
1101		X	X	X	I	X	X	X	X	X
1102	X									X
1103	X									X
1104	X									X
1105	X									X
1106	X									X
1107	X									X
1109	X		X							X
1110	X									X
1111	X									X
1112		X	X	X	I					X
1113	X									X
1114	X									X
1115	X									X
1116	X									X
1117	X									X
1119			X	X	I	X				X
1120			X	X						X
1122		X	X	X						X
1123		X	X	X						X
1125	X	X	X							X
1126	X	X	X	X						X
1127	X		X	X				X	X	X
1128	X		X	X				X	X	X
1136	X	X	X							X
1139	X		X							X
1142		X	X	X	I	X		X		X
1143		X	X	X				X		X

Site (50-60-01-)	Avoidance	Temporary Buffers	Mapping	Evaluate Stability	Recover Eroded Data	Physical Stabilization	Vegetative Stabilization	Permanent Boundary	Interpretation	Protocol Education
1144		X	X	X	X			X		X
1145		X	X	X	X			X		
1146	X								X	X
1147		X	X	X	I	X	X	X		X
1148		X	X	X				X		X
1149		X		X	I	X		X		X
1150		X	X	X		X		X		X
1151		X	X	X				X		X
1152			X	X	X	X		X		X
1153		X	X							X
1154		X	X	X	I			X		X
1155	X	X						X		X
1156	X									X
1157	X									X
1158	X									X
1160	X									X
1161	X									X
1162	X									X
1163	X									X
1164	X									X
1166	X									X
1167	X									X
1168	X									X
1169	X									X
1170	X									X
1171	X									X
1172	X									X
1173	X									X
1174	X									X
1176	X									X

Rural Landscape Reserve

Many of the sites encountered during inventory lie outside the project area altogether, in the large *mauka* portion of the original parcel. Sites are thinly distributed, consisting mostly of lithic quarries and work sites, temporary camps, and a few agricultural areas in the gulches. Other than a few sites in North Kamāka'ipō Gulch, which will be covered in the Cultural Protection Zone described below, these will receive be preserved as is.

This means that vehicles may not traverse sites (unless by existing road) and no ground disturbing activities may occur within 7 m of features. The 1993 inventory recommendations will not be changed, and these sites will not be reevaluated at this time. Future activity in site areas should be preceded by data verification and augmentation to provide more precise information about significant sites. Caution should be exercised in planning any ground disturbing activity in the vicinity of

these sites. If impacts are possible in site areas, an updated detailed mitigation plan will be submitted for SHPD review. Otherwise, no action beyond avoidance will occur.

Table 3. Preservation Sites in the Rural Landscape Reserve

Site Number 50-60-01-								
692	694	695	696	770	1139	1143	1156	1157
1158	1173	--	--	--	--	--	--	--

Sites in the Shoreline Conservation Zone

Sites along the coastal strip have unique preservation issues both physically and in terms of management. Although outside of the subdivision parcels, these sites will be subject to increased potential for damage as the number of beach users increases. Site protection measures cannot include barriers that prevent normal public access along the beach, but because the sites are above the high water mark, they are not on State of Hawai'i land and will be dealt with here.

Table 4. Preservation Sites within the Shoreline Conservation Zone

Site Number 50-60-01-							
56	57	676	739	741	750	751	752
753	754	761	763	765	1122	1123	1125
1126	1136?	1142	1147	1148	1149	1150	1151

First, the stability of a site and its surrounding soil will be evaluated, so erosion hazards can be identified. Where deposits are at risk of erosion, they will be stabilized. If there are active gullies heading into a deposit, they will be filled with soil from the old pineapple field in the uplands (where the local soil is silty clay) or sand from the beach (where the soil is sandy). Other sites will not be disturbed to provide fill. The decision to fill an eroded site will be based on the feasibility of doing so in terms of practicality and any applicable permitting process, and the potential for adverse impacts. If necessary, landscaping fabric or small retaining terraces using traditional mortarless stacking will be employed to halt erosion. Any such terraces will be identified as new on site records and in interpretive materials, so that they are not confused with the older site. Where possible, a distinct, but natural, type of material will be used for such terraces; for example, use of coral or sandstone slabs would differentiate new retaining walls from most sites, which are made of basalt stone.

Both the newly filled and existing surface will be stabilized. Although some use may be made organic landscape fabric for areas prone to severe erosion, the preference will be to encourage existing vegetation and plant additional vegetation. Because of the arid nature of the project area and the difficulty in obtaining water for irrigation, native xeriphytic groundcover and shrub species will be used.

Choices on which plants to use will depend on their availability, access to water, and consultation with the cultural advisors.

Once the stability of a *makai* site is not at risk, boundaries of a permanent buffer will be marked for those where foot traffic is likely, or where the sites are close to a proposed subdivision lot. Unlike buffers used during monitoring, these will be relatively unobtrusive. Wooden post and rail fencing such as that employed at sites near Kaupoa Camp (See Appendix B)) may be used, although other options are being considered. One is a rail fence of stacked natural logs, and another is a simple perimeter marking of *kiawe* logs laid on the ground. The advantage of these over the post and rail form is that no postholes need to be dug, and therefore the potential to encounter buried deposits is averted. In some cases, existing or new shrubs may also function as part of the buffer. Because many of the coastal sites are religious in nature and Native Hawaiians' access to them is protected by law, they will not be shut off completely. For the typical beach user, however, an access route around the site—rather than into it—should be the focus. For the sites that are not perched at the edge of the rocky shoreline, access routes will go on the *makai* side of the sites. This will be the case for Sites 654, 676, 1126, 1146, and 1152. Site 1101, a *koʻa* on Keawakalani Point, may not have an accessible route on the beach side. (Site 654 will be dealt with in a subsequent section, but is also included here due to its accessibility and location on the beach.)

Several sites in the Shoreline Conservation Zone will be within the Project Area as well. While these do not fall within the actual development area, steps will be taken to protect them when construction occurs in neighboring lots. Highly visible temporary fencing will be erected along margins of the site buffers or along the lot boundary, whichever provides the greater protected area.

Interpretation will focus on the coastal portion of the North Kamākaʻipō preserve, showing how the early date of Site 654 likely represents early temporary use of the Kaluakoʻi coastline by fishermen, and the habitation and religious sites show a later intensification to the point that there were several permanent residences. Just to the north, Site 676 will be identified as a fishing shrine; because it was in use when it was recorded in 1991, it will be maintained as an active, accessible site. Another feature in the North Kamākaʻipō preserve (B6-68, part of Site 53) has been identified in previous archaeological studies as a *koʻa*, but the form is atypical and that evaluation derives from the presence of coral alone; interpretive materials developed for this project will identify the feature and communicate this uncertainty. Site 1101, another *koʻa*, is close to a planned public access on the south coast in the Puʻu Hakina CPZ, and will also be identified as a shrine and cleared for viewing. (Clearing the *makai* side of *koʻa* is appropriate regardless of interpretive goals because an open line of site to and from the sea was an integral part of how such shrines functioned. Such clearing will be done for other *koʻa* unless it is likely to increase exposure to impact, but they will not be identified and made accessible to the public.) In a more general sense, coastal habitation and religious sites will figure into interpretive material that covers the project area.

Sites in the Proposed Subdivision Project Area

Because of the minimum 2-acre lot size and the practical and regulatory limitations that will apply to development within any lot, it should not be difficult to plan around sites within the subdivision. In fact, sites in the data recovery category are there primarily because they are either eroded (hence of limited integrity and difficult to preserve) or consist of small, temporary use areas (hence difficult for

non-archaeologists to identify, and most significant for their lithic data). Data verification and augmentation (See **Data Collection**) will establish site locations with greater precision than required for the inventory, presenting the most valuable preservation tool for subdivision lots, defining an avoidance zone for owners and architects. In practice the preservation areas will consist of features plus a buffer. Any future plans that could impinge on sites or their buffers must include notification of SHPD and, if required by that agency, a revised treatment plan. Even if direct impacts are not likely, future planners should consider and minimize sources of secondary effects, such as erosion, changes in drainage patterns, and traffic.

Table 5. Preservation Sites within the Project Area

Site Number 50-60-01-							
744	1136?	1144	1155				
The following sites are in or near the proposed road construction corridor:							
664	1152	1154					

In addition to getting a precise location, it will be necessary for most subdivision sites to produce a more detailed map to aid in preservation management and monitoring their condition. Mapping will also provide an opportunity to evaluate the stability of a site, and identify areas damaged by erosion. If warranted, sites may be stabilized and data collected or recorded at this time.

For sites that are agricultural fields, temporary camps or workshops, and modified outcrops, permanent fencing will not be erected, and their preservation zones will be identified on maps and with site tags and flagging in the field. For sites with a known or suspected burial, and for religious features, permanent boundaries will be marked 9 m from the outer walls or edges. For sites without permanent boundary markers, temporary markers should be placed 7 m from any feature during any construction activities. As mentioned in the4 Shoreline Conservation Zone section, sites adjacent to subdivision lots will also be protected with temporary fencing during construction, and with permanent buffer fencing if they are shrines or burials. The form that permanent markers take will consist of a wooden fence.

The subdivision project area also includes the road and infrastructure corridor. In a few cases, preservation sites may fall within the 60 m wide data collection corridor, but are far enough from the road alignment to allow preservation. Such sites will have temporary fencing erected at buffer perimeters during construction; the 150-foot setback from the road in which house construction cannot occur in lots will prevent impacts by lot construction, although fencing may be left in place to avoid impacts from driveway grading. (This would be a precautionary measure, since all preservation sites and buffers will be marked on parcel plats and future owners will be bound to maintain preservation commitments.) If the road encroaches on a buffer in its proposed alignment, it will be realigned unless it is clear that previous disturbance has compromised the integrity of sediments and potential cultural deposits, as described previously in this plan.

Details about preservation measures to be implemented where the proposed road traverses Cultural Protection Zones are described in the next section.

Cultural Protection Zones

Preservation Plans in Hawai'i typically focus on individual sites, but a convergence of landowner and community preferences, and the presence of large undeveloped landscapes offers a different opportunity here. Typical settlements in southwest Moloka'i consist of a core habitation zone by the shore, clustered around bays and beaches, with a periphery of temporary shelters and agricultural features. The latter usually decrease in density, size, and diversity as the distance from the coast increases, and most occur in or near gulches. In some cases, the presence of a quarry for tool-grade stone may result in a settlement system that reaches further mauka or beyond the confines of a gulch. The 75 to 120-foot elevations of a ridge south of Kamāka'ipō have uncharacteristically large, complex sites, in part due to lithic tool production, but perhaps also because of the presence of the Maui chief Kiha-a-Pi'ilani, who according to oral history lived in the vicinity.

By establishing Cultural Protection Zones, sites are protected and preserved in a larger context, so that not only the stone structures are preserved, but also their situation within the natural and cultural landscape, as well as their relationships to each other. By encompassing many sites within CPZs, the diminishment of preservation, scientific, and cultural value wrought by the usual approach of preserving only fragments is avoided. Future generations will be able to view, study, and experience Hawaiian land use systems as integrated wholes in the Cultural Protection Zones. Included within this plan are several such systems based on the Bay-Gulch landform, as well as one such system augmented by a mauka quarry, as well as another at Lā'au Point itself, another in the southern Kamāka'ipō uplands where Kiha-a-Pi'ilani may have lived, and another on the makai slope of Pu'u Hakina, where the system focuses more on a broad ridge than gulch.

The *ahupua'a* of Kaluako'i appears to be ancient, and is the land unit in the first historic documents that were cognizant of Hawaiian land divisions, such as the mid-nineteenth century Mahele land claims. It does include—as far as is possible on the relatively low and dry mountain of Mauna Loa—the classic cross section of ecological and resource zones from the mountain to the sea, but Kaluako'i covers the entire mountain and is not divided into the pie-shaped wedges associated with *ahupua'a*. This anomaly is usually attributed in archaeological literature to the absence of valleys and the presumed low population density of west Moloka'i (Kirch 1985, Summers 1971).

However, when looking at the settlement patterns of the west end, it is clear that Kaluako'i was divided. Although not recognized historically as distinct land units, the gulches of Kaluako'i are the foci of *mauka-makai* oriented landscape use. From north to south, the gulches and bays of Kawākiu, Kaka'ako, Pāpōhaku, Wahīlauhue, Po'olau, Kapukahehu, Kaunalā, Kaheu, and Kamāka'ipō are where sites cluster. Between these gulches, the ridges and flat lands have relatively few traces of human presence.

Although not all of these gulch systems have been surveyed, there appears to be a general pattern, which will provide the basis for interpretation. Beginning at the coast, there are sites beginning at the high water mark. At least some probably reflect very early visits by residents of other areas landing during fishing trips, but the most obvious aspect of coastal sites is that they became fairly well developed. For example, there are often multiple permanent habitations, fishing shrines, and abundant cultural deposits clustering around the bays. Inland of these, the lower gulches have a mixture of agricultural fields, temporary (or perhaps lower status) habitations, and work areas. Further inland, sites become more sporadic, and

multi-function sites are less common—small planting areas, lithic work areas, and trail markers are most common. The complete *makai-mauka* system ends up in the summit region where there are again rather numerous religious, habitation, agricultural, lithic, and other types of sites, but here the peaks and plateaus provide the foci for settlement, and gulches are less relevant. The *mauka* end of the gulch settlement system is often a source of stone quarried to make adzes and other tools. Beyond this there are few sites until the summit, although it is possible that the land was cultivated or otherwise used so that traces were minimal and easily obscured by historic pineapple cultivation.

Cultural Protection Zones will be marked on maps, but will also require some form of identification in the field. Metal tags with site numbers will be placed in sites, but boundaries of the area will also be marked. Because of the large size, markers such as those discussed in **Permanent Boundaries** are not feasible, although they may be used at the *makai* sites (53-54) near the public access. For the rest of the preserve, the boundary will be marked with signs located at the north and south edges of the gulch near site areas. Precise locations for these will be determined after sites have been visited and mapped, but the north edge will be approximately from Site 654 to 680 to 678, and the south edge from Site 655 to 690 to 686 to 684 to 688 to 678.

Although some of the most impressive sites in the Cultural Protection Zones have been mapped in detail, more detailed and precise maps are required for adequate preservation management of some sites. Mapping will be done with tape and compass for simple sites, and with plane table and alidade for those which are more complex. In conjunction with mapping, the condition and stability of each site will be evaluated. For some sites (such as 654, 655, 779, 780, and 782), it is already clear that enough erosion has already occurred that data should be collected as described in **Recovering Eroded Data** above.

The proposed road traverses Cultural Protection Zones in four locations where it crosses gulches: Kaunala, Kaheu, and North Kamāka'ipō. Because each of these zones extends well inland, rerouting around them would require several miles of additional road, the potential environmental impacts of which, not to mention the certain visual impacts, would exceed carefully planned and monitored traverses of the protection zones. Sites which may be in or near the 60 m road survey corridor are 664 (5 small agricultural mounds), 687 (habitation), 689 (L-shaped wall, possible temporary habitation), 780 (lithic tool-manufacture debris), and 782 (lithic tool-manufacture debris). Most of these appear to be outside of the 60 m corridor, but lingering uncertainty about their location at this time mean that their relocation will be an important mission of the re-survey. If they end up within 7m of the proposed road edge, the road will be rerouted.

Where the proposed road cuts through Cultural Protection Zones, several efforts will be made to minimize its physical and visual impacts. First, no turn-arounds, stockpiles, or other construction support features will be allowed within these zones—the intent is to make the affected area as narrow as possible, limiting impacts to the road and shoulder. Likewise, utilities buried in these zones should be as close to the road center as possible to avoid having multiple impact corridors. Once project engineers and field personnel have come to an agreement with the archaeologist on the narrowest possible development corridor, the edges will be clearly marked to prevent encroachment beyond. Because of the preservation intent and the fact that most of the traverses occur in gulches, road design and construction shall take into account the potential effects to run-off and drainage.

Given the past history of erosion, it should be possible to construct roadways that not only cause no adverse effects, but actually slow down runoff and stabilize nearby sediments. Finally, design and construction in the Cultural Protection Zones shall strive to minimize the visual impact of the road by avoiding an unnecessarily obtrusive roadbed and signs, and above-ground utilities. If roadside landscaping is planned, historic and modern introductions should be avoided, and viewplanes from traditional features should be maintained; in some cases vegetation may be useful as a visual screen to decrease the sense that a site is near a road. As the road enters a Cultural Protection Area, a sign should identify the place by its Hawaiian name. Where it crosses the Kamāka'ipō preserve, the road should provide a means for people hiking the interpretive trail to cross safely, preferably with means such as speed bumps or other signals on the road itself, with a minimum of signs.

Kaunalu

This northernmost Cultural Protection Zone extends from Kaunalu Bay up the gulch to about the 175-foot elevation. Most of the *makai* sites fall within the SMAD, and are concentrated on the north side of the bay below 30 fasl (feet above sea level). Site density and complexity decreases radically above this, although agricultural modifications are present in the gulch.

Table 6. Preservation Sites within Kaunalu CPZ

Site Number 50-60-01-							
48	49	50	641	642	643	644	645
657	658	659	660	662	663	665	--

Kaunalu CPZ will be an archaeological and cultural reserve, with passive preservation. Rather than clearing and interpretation, the focus will be on protecting the area from incursion. Toward that end, the CPZ will be marked on project maps, and those who buy lots in the proposed Lā'au subdivision will be edicated regarding the need to leave sites there alone.

This CPZ is well to the north of the Project Area, and the only potential effect caused by the proposed subdivision will be in the area of the road corridor, which traverses Kaunalu Gulch about 2200 feet from the coast. This location is about midway between Sites 658 (a single agricultural clearing mound) and 659 (a terrace alignment), sites separated by a gap of approximately 300 meters (1000 feet). This area is *mauka* of the settlement area, and the road will not have any adverse effect on the cultural landscape. To ensure that no such effects occur, the road corridor will be re-examined in this area, and may be re-routed if necessary to avoid significant archaeological resources. Should the proposed road pass within 100-m of a site, protective fencing will be put in place and the construction crews informed of the need to avoid impacts. Any work in or adjacent to the preserve will be monitored by a qualified archaeologist.

Kaheu

The Kaheu CPZ is also located north of the Project Area, with the only area of potential effect being where the proposed access road traverses it. The densest portion of the settlement is within the SMAD, although the inventory reported more features than were known when the SMAD was listed on the National Register. As

with Kaunalu, most of the features are located north of the bay and gulch, although it is possible that the early 20th Century construction of Molokai Ranch owner George Cooke's "Kaupoa House" south of the bay removed older sites there. Although the overall area of the settlement here exceeds that at Kaunalu, density and complexity also decreases rapidly away from the shore.

Kaheu CPZ will be an archaeological and cultural reserve, with passive preservation. Rather than clearing and interpretation, the focus will be on protecting the area from incursion. Toward that end, the CPZ will be marked on project maps, and those who buy lots in the proposed Lā'au subdivision will be edicated regarding the need to leave sites there alone.

Table 7. Preservation Sites within Kaheu CPZ

Site Number 50-60-01-							
51	52	639	640	646	647	648	649
650	651	652	664	666	667	668	669
670	671	672	673	674	675	--	--

The road is planned to pass just *mauka* of the northern lobe of the CPZ, where it may be within 100 m of Site 664, a group of five small agricultural clearing mounds; these will be protected with fencing during construction. At the point where the road crosses Kaheu Gulch, it will traverse a section of the Kaheu CPZ, but not in the vicinity of any sites. South of the gulch, the road data collection corridor (30-m on wither side of the proposed road center line) may include part of Site 675, a temporary habitation and group of planting circles. The location of 675 in relation to the road will be verified, and protective measures taken as appropriate.

Kamāka'ipō North

North Kamāka'ipō Gulch exemplifies settlement systems on the west coast of Kaluako'i; because it has a good array of sites that remain relatively undisturbed, this has been chosen for preservation. By preserving not just obvious archaeological features, but also the landscape connecting them (approximately 130 acres), this *mauka-makai* area will preserve the overall cultural landscape, valuable not just for study, but for seeing and experiencing a Hawaiian settlement.

Table 8. Preservation Sites within Kamāka'ipō North CPZ

Site Number 50-60-01-							
53	54	654	655	656	678	679	680
681	682	683	684	685	686	687	688
689	690	691	768	769	779	780	781
782	--	--	--	--	--	--	--

It is anticipated that most sites in North Kamāka'ipō need stabilization of some type, but for most it should consist of minor re-stacking and setting retaining

alignments. Because filling all of the deflated and eroded surfaces in sites like 53, 54, and 656 would require enormous (and impractical) amounts of fill, stabilization will focus more on preventing further damage than repairing past damage. For example, eroding banks where artifacts are being washed out may be covered with landscaping fabric or some other means of preventing further loss of sediment. Should parts of the site be opened for educational purposes, foot traffic would be routed to avoid any areas where it could cause erosion or collapse of features and deposits.

Interpretation in the North Kamāka'ipō preserve will consider particular sites within the context of the gulch system from the coast (Sites 53, 54, and 654) up to the quarry (Site 656). The coastal sites, being on either side of the public access to the beach, will be the primary focus of interpretation, with signs identifying various features and relating what is known of them. Information recovered during the current project will be synthesized with previous archaeological work from the project area and Kaluako'i, with Hawaiian oral traditions, and with other relevant research and information. Existence of a traditional trail up to the quarry provides an opportunity for an interpretive trail that can be used to better explain ancient adaptation to the *mauka-makai* continuum of habitats and resources.

Pending Kūpuna advisor and SHPD approval of a Detailed Interpretive Plan, an interpretive trail will wend its way through this preserve. Although the precise routing will depend on field inspections, site boundary verification, and consultation, the approximate route will go from Site 656 to 679 and 680 descending the north slope of the gulch, across to Site 686 and 691, back across to Site 685 and to the coast at Site 54. These sites are a series of basalt tool-making sites, shelters, and trail markers. The original trail will be followed to the extent that it can be identified and followed safely and without causing erosion. Features will not be traversed or breached, vehicles and bicycles will not be allowed, and clearing will be limited to opening sight lines without stripping the landscape. Parking at the top will be north and inland of Site 656 in a disturbed area. Access and parking at the lower end can occur at multiple locations without causing adverse impacts, since Site 54 is in fact a broad alluvial fan that consists of feature clusters interspersed with heavily eroded areas. Any development will occur outside of a 7 m buffer from features (9 m for shrines and burials).

Additional vegetation clearing may be done to increase visibility of sites without actually walking through features, but complete removal of canopy and surface vegetation will be avoided so that erosion risk is not increased. Because of the lack of water, plantings will be unfeasible or very limited, and is not anticipated beyond parts of Sites 654, 53, and 54. At other features, string trimmers will be used to get rid of tall grasses and encourage groundcover grasses as described in the Kaupoa Preservation Plan (Major 1997). Throughout the preserve, native species will be encouraged to maintain and spread their coverage. Some sites that are not part of the interpretive program will not be cleared.

South Kamāka'ipō – Kiha-a-Pi'ilani

This area extends from about 40-fasl at Site 699, just mauka of the Kamāka'ipō alluvial flat to 270-fasl at Site 1128, on a hill along the southwest rift zone of the Maunaloa volcano. Most of the sites are widely dispersed, but among them are the best examples of large-multi-roomed enclosures, a distinctive site type in this non-coastal setting. Oral histories suggest that this vicinity may have been the isolated outpost where the son of Maui paramount chief Pi'ilani was raised, a refuge from

the wars of his home island. Archaeological evidence shows that at least some of these features in Sites 771 – 773 and 747 were intensive lithic tool production shops, and fine basalt sources are also present. Furthermore, Site 1128 is known as a "*Piko* stone," a boulder with a natural cupboard in it that was used by certain families to place the umbilical cord of newborn children; it is also reported to have held fishhooks used by people traveling between Lā'au Point and the uplands. At the southeastern end of this CPZ, Site 1127 consists of a crescent-shaped boulder propped against another larger boulder, forming a seat that aces *makai* (south). A similar feature is described at the Moloka'i Museum as a birthing stone, and given the presence of each of 1127 and 1128 along the same ridge, on an east-west axis about 300 m apart, it is likely tat the same function pertains to this site. Politically, economically, and culturally, then, this area is more significant than its thin, dry soils would normally allow, and it represents a departure from the normal pattern in which the inland portion of settlement systems focused on gulches.

Table 9. Preservation Sites within South Kamāka'ipō – Kiha-a-Pi'ilani CPZ

Site Number 50-60-01-							
693	699	736	737	742	747	748	771
772	773	774	775	776	777	778	1127
1128	--	--	--	--	--	--	--

The far northwest extreme of this CPZ extends into the data collection corridor for the proposed road, although none of the sites themselves do, and it is anticipated that no individual site buffer would be encroached upon by that corridor. Neither does this preserve coincide with any subdivision lots. Nevertheless, a primary task of data collection will be to ensure that the development area does not encroach on site buffers. Site 699 comes closest to the road (approximately 100-m outside the data collection corridor, but will be fenced should it turn out to be within the area of potential effects.

An old dirt road that goes from Lā'au Point to Maunaloa along the southwest rift zone ridge passes through the Kamāka'ipō – Kiha-a-Pi'ilani Cultural Protection Zone, coming within 50 meters of Sites 1127 and 1128. Known to have been used at least as far back as the 19th Century, when the lighthouse keeper traveled it, the road likely follows (more or less) an ancient trail. Although it will not be a road open to subdivision or public traffic, the landowner wants to keep this as an emergency vehicle access route. No improvements have been specified, but even limited maintenance such as grading will be confined to the extant road corridor. Although any ground disturbing activity is automatically subject to monitoring in the CPZ, Sites 1127 and 1128 will be further protected by erecting permanent buffer fencing on the side toward the road, and will be identified as sacred places with on-site signs.

Lā'au Point

Most of the sites located at Ka Lae o Lā'au (Lā'au Point) are within the U.S. Coast Guard reservation, and therefore are neither part of the project area nor legally subject to this Preservation Plan. Because the cluster of sites in that parcel is contiguous with sites in the project area, however, and because the Coast Guard

has not taken an active role in the management of cultural resources, the Lā'au Cultural Protection Zone encompasses these sites as well. Lā'au is a special place in Hawaiian culture, being associated with myths and oral histories, as well as being a place where souls departed the physical plane.

Sites in the Coast Guard reservation cannot be actively managed, and therefore preservation for them will be entirely passive. To the north and east, however, preservation sites within the Lā'au CPZ will require more action. First, maps for these sites will be refined and augmented beyond inventory level, to be useful in condition monitoring and other preservation management goals such as defining precise locations relative to lot boundaries and roads.

Table 10. Preservation Sites within Lā'au Point CPZ

Site Number 50-60-01-							
764	1101	1109	1112	1119	1120	--	--
The following sites are within the US Coast Guard Lighthouse Reserve							
1100	1110	1111	1113	1114	1115	1116	1117

Sites 764 (a multi-roomed enclosure) and 1101 (a *ko'a*) are accessible to people walking the coastline, and will receive basic protective treatment in the form of permanent fences and signs identifying them as sensitive archaeological sites. Site 1112, which is close to the development area, will also have temporary protective fencing during construction and a permanent buffer fence thereafter.

Pu'u Hakina

Located on the southern shore at the far southeast end of the project area (as well as mauka of the project area, The Pu'u Hakina Cultural Protection Zone is the second area where public access and interpretation will make for a more active preservation program. Sites here include the only named heiau (Kalalua, Site 1104), as well a numerous and diverse indications of a long term settlement. The Pu'u itself, a hill reaching 300-fasl, is outside of the CPZ, but local residents generally refer to all the land to either side and makai of the hill as Pu'u Hakina. Oral history mentions the hill and the settlement, and the presence of at least two heiau (Kalalua reportedly having been a *luakini* class, used in human sacrifice), massive and well-constructed architecture, fishing shrines, a natural brackish pond, abundant evidence of lithic work, burials, and other feature types makes this perhaps the most densely settled portion of the entire parcel.

Table 11. Preservation Sites within Pu'u Hakina CPZ

Site Number 50-60-01-							
1102	1103	1104	1105	1106	1107	1146	1152
1153	1154	1160	1161	1162	1163	1164	1165
1166	1167	1168	1169	1170	1171	1172	1174
1176	--	--	--	--	--	--	--

Because of the abundant cultural and archaeological sites here, and the fact that this will be the location of the southern shoreline park and access point for pedestrians coming from nearby Hale-o-Lono harbor, both protective measures and interpretive efforts are appropriate here more than in remote preserves. Site-specific actions have been listed in the table at the beginning of the section.

The process will begin by marking a permanent buffer to protect sites from encroachment. Rather than marking this buffer radially from surface features of each individual site, this permanent buffer will correspond with the edges of the development area as defined by lot boundaries. If the lot boundaries themselves encroach on any individual site buffer, then the permanent boundary will extend into the lot. However, design of the subdivision has already anticipated the need for site protection, and the use of lot boundaries will result in a much larger buffer than the 7 – 9 meter radial buffers specified for individual sites. A single fence-line at the edge of the subdivision where it abuts the CPZ will prove less visually and physically disruptive than a series of individual site buffers, and will accomplish the site protection function for a continuous cultural landscape, rather than a fragmented series of site-specific buffers.

Buffers may also be required along the edges of an existing dirt road that follows the coastline through part of the CPZ. This road will not be open to vehicle traffic except for emergency vehicles, but in order to protect likely burial features at 1152, 1154, 1170 and 1176, limited sections of fencing may be installed. Road maintenance will be restricted to grading the existing corridor, and will be monitored.

Sites in the CPZ generally have high quality maps for inventory level reporting, but need to be upgraded for preservation functions in what is the most accessible heavily used portion of the coast. In addition to providing greater detail for a baseline used in condition monitoring, the maps will be expanded and integrated with one another and the local terrain. At the time of mapping, sites will also be evaluated in terms of stability, and both physical and vegetative stabilization will be employed as appropriate. (These methods have been described in detail in the **Preservation Actions** section above.)

The detailed maps will also be used in interpretive and educational aspects of the program, which will be described in a **Detailed Interpretive Plan.** This document will form a supplement to this plan, and will provide SHPD and interested parties with details regarding the specific interpretations tat will be made about this and other areas. Information compiled during the Supplemental Data Collection phase, site stability evaluations, and consultation with knowledgeable kūpuna will form the foundation of these interpretive elements.

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Inventory Data for Preservation Sites

All sites recorded during inventory of TMK 5-1-03-030 are included in the following table. This is intended as a quick reference, and summarizes site-level information for readers. Individual feature descriptions and more detailed discussion of sites can be found in the inventory report (Dixon and Major 1993).

Table 12. Archaeological Inventory Site Data

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
48	B6-61	Enclosure	Habitation	15 x 15	20	D,E
49	B6-62	Platform	Religious	5 x 5	20	D,E
50	B6-63	Platform	Habitation, Religious	15 x 10	20	C,D,E
50	B6-64	6 Alignment 4 C-shape 3 Enclosure Pavement Mound	Habitation, Religious	20 x 20	20	C,D,E
51	B6-65	Enclosure	Religious	20 x20	20	D,E
52	B6-66	Platform Wall	Religious, Lithic work	10 x 10	30	D,E
53	B6-68	Remnant Platform Lithic debitage	Lithic work, Religious, Trail	20 x 15	20	C,D,E
54	B6-69 to -73	9 Terrace 9 Enclosure 6 Mound 5 Terrace 5 Platform 4 C-shape 4 Wall 3 Remnant Cairn	Habitation, Trail, Burial, Men's House Poss. burial	275 x 150	45	C,D,E
56	B6-76 and -77	6 Enclosure 6 Cairn 6 Mound 4 C-shape 3 Wall 2 Platform 2 Cupboard	Habitation, Religious, Poss. Burial	120 x 75	20	C,D,E
57	B6-78	Platform	Religious	3 x 3	20	D,E
639	B6-67	6 Enclosure 6 C-shape 3 Platform 2 Wall remnant Mound	Habitation, Religious, Canoe Shed	90 x 60	20	C,D,E
640	B6-74	Mound	Undetermined	1 x 1	35	D
641	B6-83	2 Enclosure	Religious,	100 x 50	20	D,E

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
			Habitation, Lithic work			
642	B6-84	Enclosure	Habitation	10 x 5	15	D
643	B6-85	Lithic debitage	Lithic work	5 x 5	15	D
644	B6-86	2 C-shape	Habitation	10 x 10	25	D
645	B6-87	4 C-shape 3 Enclosure Cairn	Habitation, Canoe shed, Trail	20 x 10	20	C,D
646	B6-88	Lithic debitage	Lithic work, Midden	5 x 5	15	D
647	B6-89		Habitation, Agricultural	40 x 20	40	D
648	B6-90		Habitation, Religious, Poss. burial	50 x 30	30	D,E
649	B6-91	2 Mound C-shape Platform Enclosure	Habitation, Religious, Poss. burial	20 X 15	35	D,E
650	B6-92		Agricultural, Temp. Hab.	100 x 40	60	D
651	B6-93	9 Enclosure 6 C-shape 2 Mound Platform	Agricultural, Temp. Hab., Religious	80 x 60	60	D,E
652	B6-94	4 C-shape Anclosure Alignment	Agricultural, Habitation	30x20	60	D
654	B6-96	Midden deposit	Habitation	7 x 3	8	D
655 (aka 53)	B6-97	4 C-shape Enclosure	Habitation	20 x 15	40	D
656	B6-98	4 C-shape	Lithic quarry	80 x 50	240	D
657	B6-107	4 Alignment 3 Mod. Outcrop 3 Terrace	Agricultural, Temp. Hab.	75 x 25	20	D
658	B6-108	Mound	Agricultural	2 x 2	60	D
659	B6-109	Terrace	Undetermined	10 x 3	90	D
660	B6-110	C-shape Mound	Temp. Hab.	8 x 5	110	D
662	B6-112	Enclosure Bait mortar	Temp. Hab.	30 x 15	10	D
663	B6-113	Enclosure	Temp. Hab.	30 x 15	10	D
664	B6-114	5 Mound	Agricultural	10 x 10	60	D
665	B6-115	Lithic debitage	Lithic work	4 x 4	160	D
666	B6-116	C-shape	Temp. Hab.	4 x 3	60	D
667	B6-117	Enclosure	Habitation	5 x 5	50	D
668	B6-118	7 Enclosure 2 C-shape Pavement	Agricultural, Temp. Hab.	180 x 75	100	D
669	B6-119	C-shape	Agricultural,	60 x 40	120	D

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
		Enclosure Mound Terrace Alignment	Temp. Hab.			
670	B6-120	3 Mound 2 C-shape Cupboard Remnant	Religious, Temp. Hab.	60 x 25	130	D,E
671	B6-121	2 Mound	Burial	10 x 5	50	D,E
672	B6-122	4 Terrace	Soil retention	50 x 30	150	D
673	B6-123	Terrace	Soil retention	5 x 2	180	D
674	B6-124	Mound	Burial	1 x 1	80	D,E
675	B6-125	5 Enclosure	Temp. Hab., Agricultural	40 x 25	70	D
676	B6-126	Platform	Religious	35 x 15	40	D,E
678	B6-128	Enclosure	Planting circle	2 x 2	245	D
679	B6-129	4 Enclosure 3 C-shape Cairn	Temp. Hab., Agricultural, Poss. Trail	25 x 10	215	D
680	B6-130	2 Enclosure C-shape Wall remnant	Lithic quarry, Lithic work	60 x 40	165	D
681	B6-131	Mound	Poss. burial	3 x 2	130	D,E
682	B6-132	Mound	Poss. burial	2 x 2	130	D,E
683	B6-133	Terrace	Temp. Hab.	10 x 5	140	D
684	B6-134	C-shape	Temp. Hab.	3 x 3	155	D
685	B6-135	Enclosure	Temp. Hab.	3 x 3	80	D
686	B6-136	C-shape Cairn	Temp. Hab., Trail	5 x 4	150	D
687	B6-137	2 C-shape Enclosaure Terrace Mound	Habitation	20 x 10	50	D
688	B6-138	Lithic debitage	Lithic work	N/A	165	D
689	B6-139	L-shape	Temp. Hab.	5 x 5	60	D
690	B6-140	4 Mound 3 Mod. Outcrop Enclosure Platform Alignment	Religious, Habitation, Agrulcultural?	35 x 20	80	D,E
691	B6-141	C-shape	Temp. Hab.	4 x 3	120	D
692	B6-142	Alignment	Lithic work	30 x 10	120	D
693	B6-143	Lithic debitage	Lithc work	2 x 1	140	D
694	B6-144	2 Terrace	Agricultural	20 x 5	40	D
695	B6-145	Lithic debitage	Lithic work	5 x 5	40	D
696	B6-146	Lithic debitage	Lithic work	20 x 10	60	D
699	B6-149	Enclosure Faced pit Alignment	Habitation, Well, Trail?	70 x 30	30	D
736	B6-150	10 Mod. Outcrop	Agricultural	40 x 30	40	D

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
737	B6-151	6 Mound C-shape Alignment Cairn	Agricultural, Temp. Hab., Poss. trail	80 x 40	50	D
739	B6-153	Pavement	Poss. burial	4 x 3	15	D,E
741	B6-155	2 Mound Enclosure Cairn	Habitation, Trail, Burial	50 x 20	35	D,E
742	B6-156	Lithic debitage	Lithic work	50 x 15	60	D
744	B6-158	2 Cairn	Trail marker	8 x 3	60	D
747	B6-161	2 Wall Enclosure	Lithic quarry, Lithic work	50 x 20	160	D
748	B6-162	Enclosure C-shape	Military, Lithic work	20 x 10	160	D
750	B6-164	Cairn	Trail marker	1 x 1	70	D
751	B6-165	Cupboard	Storage	2 x 1	80	D
752	B6-166	Cairn	Trail marker	2 x 1	80	D
753	B6-167	Enclosure	Temp. Hab.	5 x 4	40	D
754	B6-168	Cupboard Mod. Outcrop	Temp. Hab.	5 x 3	40	D
761	*B6-175*	*Enclosure*	*Temp. Hab.*	*10 x 10*	*50*	*D*
763	B6-177	C-shape	Temp. Hab.	2 x 2	25	D
764	B6-178	Enclosure Platform	Habitation, Poss. burial	30 x 15	30	D,E
765	B6-179	3 Enclosure 3 Cairn	Temp. Hab.	60 x 40	30	D
768	B6-182	Lithic debitage	Lithic work	5 x 5	280	D
769	B6-183	C-shape	Temp. Hab.	4 x 4	330	D
770	B6-184	C-shape	Temp. Hab.	4 x 4	160	D
771	B6-185	12 Enclosure 5 Pit Terrace	Habitation	30 x 20	90	C,D
772	B6-186	5 Enclosure 2 Pit	Habitation	20 x 10	110	C,D
773	B6-187	Enclosure Cairn	Habitation	25 x 10	105	C,D
774	B6-188	Lithic debitage	Lithic work	20 x 20	180	D
775	B6-189	6 Enclosure C-shape	Habitation	50 x 25	210	C,D
776	B6-190	Lithic debitage	Lithic work	10 x 5	80	D
777	B6-191	Lithic debitage	Lithic work	20 x 20	190	D
778	B6-192	Lithic debitage	Lithic work	10 x 5	80	D
779	B6-193	Lithic debitage	Lithic work	10 x 5	60	D
780	B6-194	Lithic debitage	Lithic work	10 x 5	50	D
781	B6-195	Lithic debitage	Lithic work	20 x 10	240	D
782	B6-196	Lithic debitage	Lithic work	10 x 5	60	D
1100	B5-59	Lithic debitage	Religious	80 x 20	20	D,E
1101	B5-60	Platform	Religious	15 x 10	70	D,E
1102	B5-62	Platform	Habitation, Poss. burial	9 x 8	30	D,E

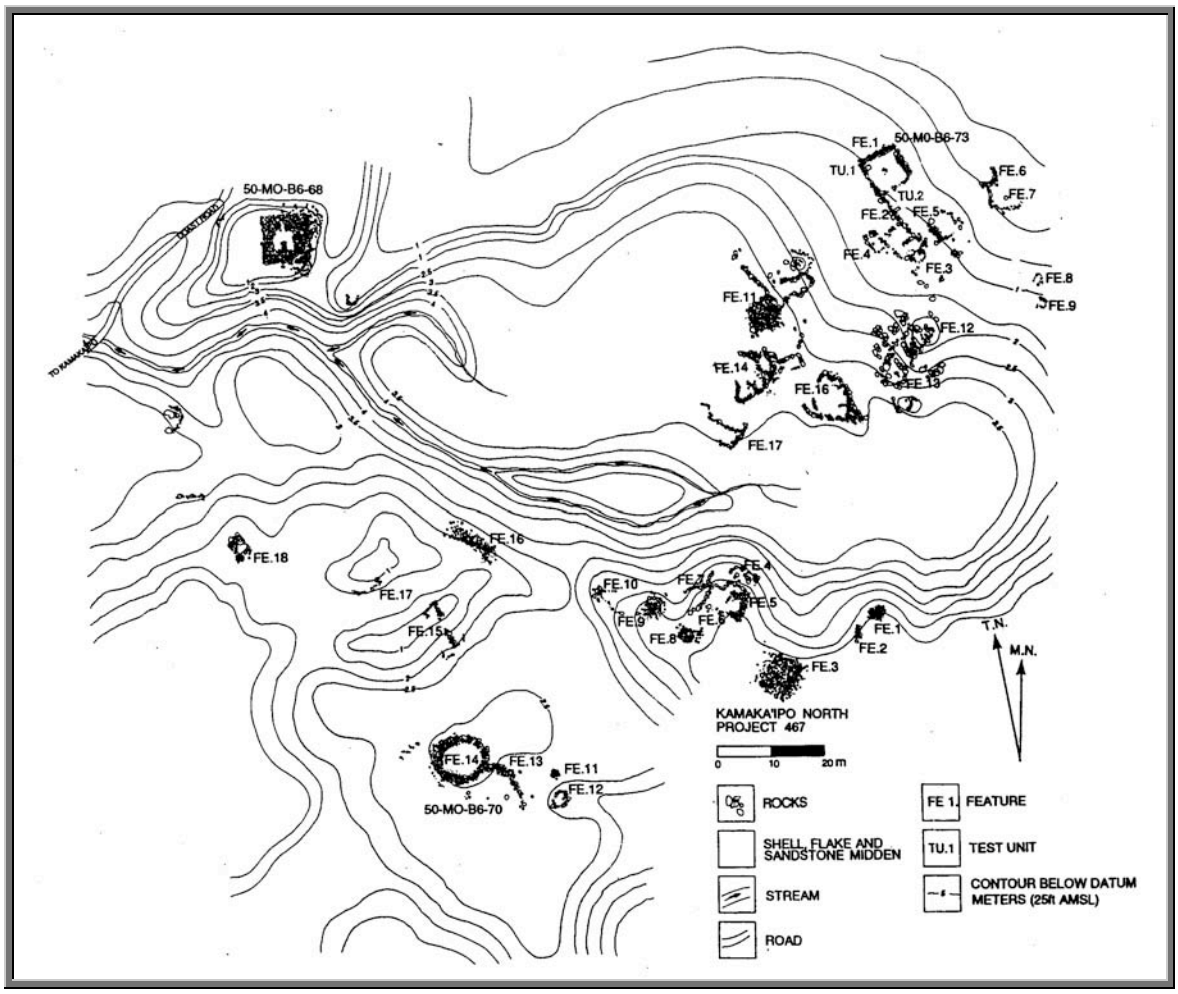
State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
1103	B5-63	Enclosure	Canoe shed	16 x 4	10	C,D
1104	B5-64	Platform 2 Alignments	Religious	10 x 5	10	C,D,E
1105	B5-65	C-shape	Habitation, Poss. religious	5 x 4	10	C,D,E
1106	B5-66	Enclosure 2 Cupboards	Religious	20 x 20	40	C,D,E
1107	B5-67	2 Platforms 3 Cupboards 3 Enclosures Mound Bi-level platform	Habitation, Burial, Poss. religious	250 x 50	45	D,E
1109	B5-69	Wall	Lighthouse	10 x 5	110	D
1110	B5-70	Enclosure	Undetermined	7 x 6	85	D
1111	B5-71	Enclosure Wood railroad	Lighthouse, Ranching	100 x 70	110	D
1112	B5-72	Overhang 4 Terraces	Agricultural, Habitation	50 x 45	90	D
1113	B5-73	4 Mod. Overhang, 2 Overhang 2 Enclosure	Temp. Hab.	45 x 30	40	D
1114	B5-74	Enclosure	Temp. Hab., Lithic work	30 x 30	30	D
1115	B5-75	2 Enclosure	Temp. Hab., Military	35 x 20	30	D
1116	B5-76	Cairn	Trail marker	2 x 2	50	D
1117	B5-77	Overhang	Temp. Hab.	5 x 5	30	D
1118	B5-78	3 Overhang	Habitation	45 x 30	40	D
1119	B5-79	Wall 2 Cairn 2 C-shape Overhang Mound	Religious, Temp. Hab.	25 x 20	50	D,E
1120	B5-80	2 Overhang Mound	Religious, Temp. Hab.	20 x 10	80	D,E
1122	B5-82	Mod. Outcrop	Temp. Hab.	8 x 5	40	D
1123	B5-83	5 Pits	Undteremined	60 x 20	35	D
1125	*B5-85*	*Overhang*	*Temp. Hab.*	*4 x 3*	*60*	*D*
1126	B5-86	3 Overhang	Temp. Hab.	16 x 12	60	D
1127	B5-87	C-shape Cairn Alignment Mound	Poss. boundary	40 x 30	240	D
1128	B5-88	Natural cupboard	Piko stone	4 x 4	240	A,C,D,E
1136	*B5-95*	*Overhang* *Cairn*	*Temp. Hab.*	*25 x 4*	*30*	*D*
1139	B5-98	Lithic debitage	Lithic quarry	2 x 2	250	D
1142	B5-101	2 Platforms Natural cupboard Overhang	Religious	15 x 15	70	D,E

State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
		Lithic debitage				
1143	B5-102	Mound	Poss. burial	3 x 3	120	D,E
1144	B5-103	2 Mound	Poss. burial	25 x 5	60	D,E
1146	B5-105	Natural Wetland	Fishpond	75 x 40	5	D
1147	B5-106	Enclosure 2 Terrace 2 Mound	Temp. Hab., Burial	N/A	45	D,E
1148	B5-107	Terrace Wall	Agricultural	10 x 8	30	D
1149	B5-108	2 Platform Terrace	Religious	15 x 10	40	D,E
1150	B5-109	C-shape 6 Cairn 2 Mound	Burial, Religious	60x 50	45	D,E
1151	B5-110	7 C-shape Alignment Wall	Lithic work	20 x 20	40	D
1152	B5-111	2 Mound 2 Platform	Burial, Religious	20 x 20	60	D,E
1153	B5-112	Enclosure Mound	Temp. Hab., Road	30 x 5	70	D
1154	B5-113	2 Mound	Burial Lithic work	60 x 60	80	D,E
1155	B5-114	C-shape 2 Mound	Burial, Lithic work	20 x 10	80	D,E
1156	B5-115	5 C-shape Lithic debitage	Lithic work Lithic quarry	50 x 30	400	D
1157	B5-116	Alignment	Temp. Hab.	3 x 3	390	D
1158	B5-117	Lithic debitage	Lithic work	5 x 3	350	D
1160	B5-119	Cement foundation Pavement	Ranching Poss. burial	20 x 20	12	D
1161	B5-120	2 Mound	Lithic quarry	5 x 3	50	D
1162	B5-121	Lithic debitage	Lithic work	1 x 1	150	D
1163	B5-122	Lithic debitage	Lithic work	2 x 1	130	D
1164	B5-123	Cairn	Lithic work	1 x 1	160	D
1166	B5-125	Enclosure Wall	Lithic work	40 x 30	310	D
1167	B5-126	2 Platform	Burial	25 x 10	300	D,E
1168	B5-127	L-shape 2 Mound	Lithic quarry	30 x 15	25	D
1169	B5-128	4 Mound Enclosure	Burial, Lithic work	45 x 25	90	D,E
1170	B5-129	Mound	Burial, Lithic work	5 x 5	35	D,E
1171	B5-130	Mound	Poss. burial	3 x 3	210	D,E
1172	B5-131	2 Terrace	Undetermined	25 x 20	350	D
1173	B5-132	Cairn	Trail marker?	3 x 2	270	D
1174	B5-133	5 Terrace 4 Mound 3 Platform	Religious, Burial, Habitation	75 x 50	35	C,D,E

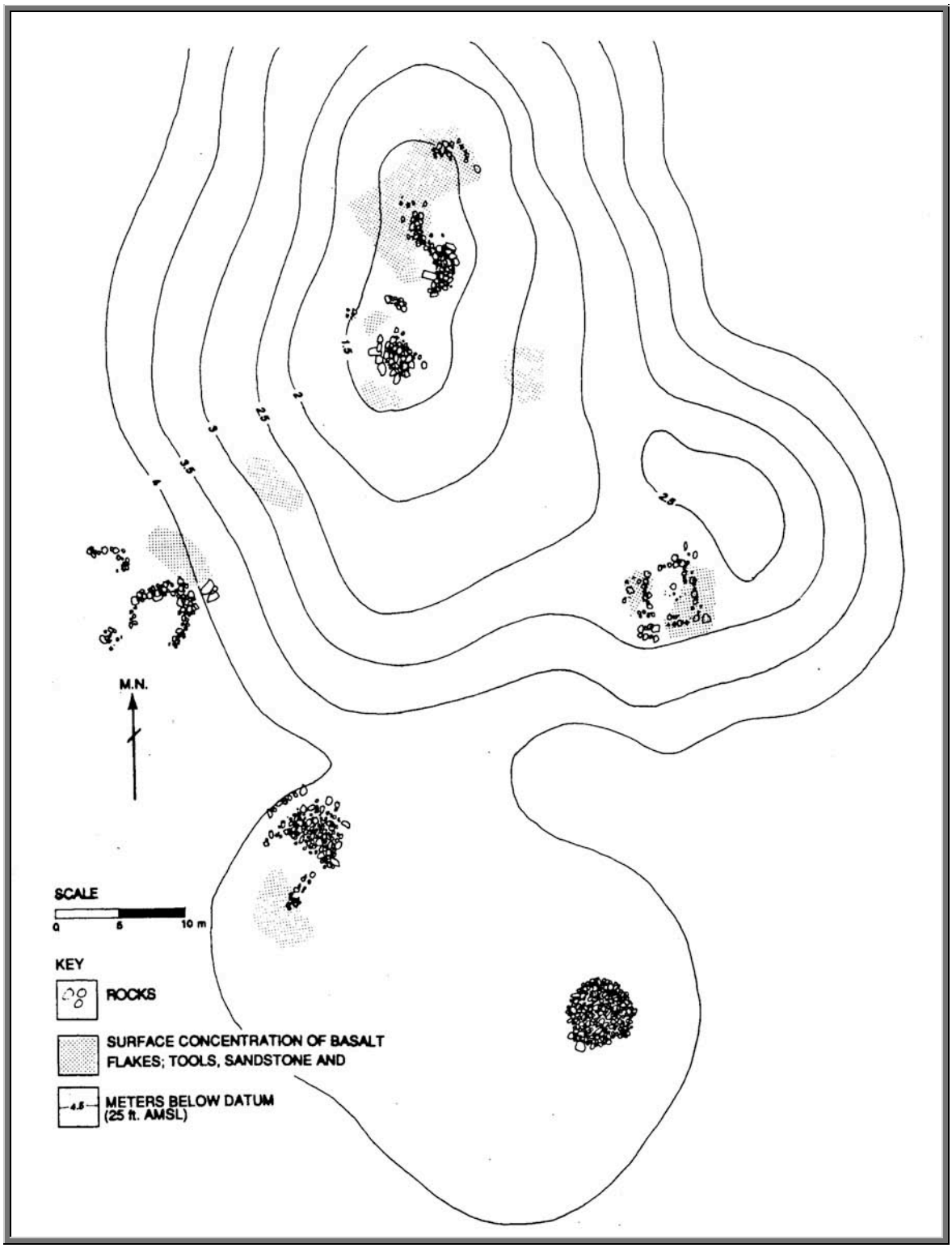
State Number (50-60-01-)	Bishop Museum Number (50-Mo-)	Feature Types	Site Function	Site Area (m^2)	Altitude	Significance
		C-shape Lithic debitage Enclosure				
1175	B5-134	Lithic debitage	Litchi work	5 x 5	200	D
1176	B5-135	5 Terrace 4 Mound 2 Enclosure Wall C-shape Lithic debitage	Temp. Hab.	5 x 3	70	D

Selected Site Maps

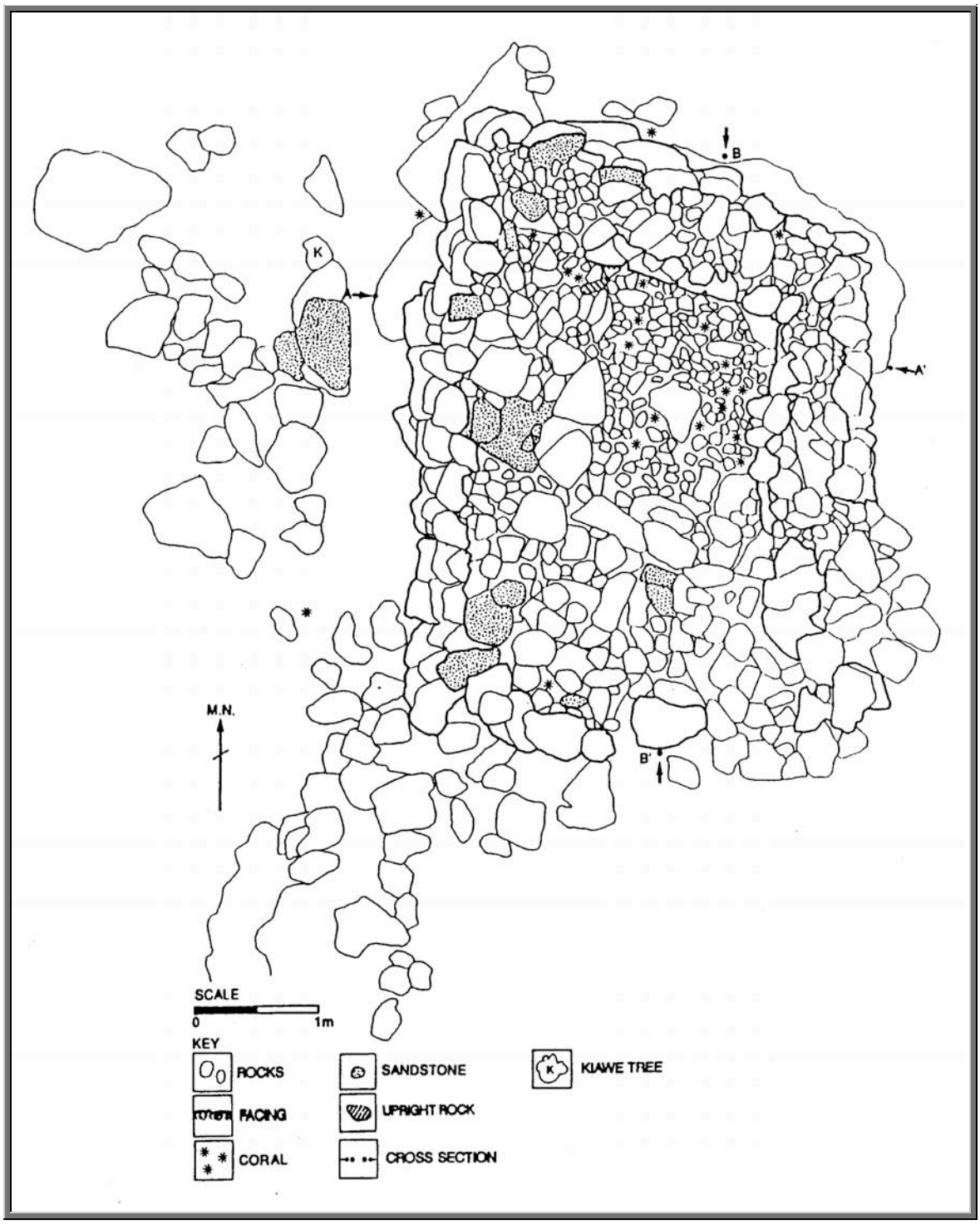
The following gallery of maps depicts sites in and near the Project Area, as well as some representative samples of other areas in TMK 5-1-02-030, and of the range of site types. Sites not included in this gallery are either well away from the areas of potential effects (such as the Kaunalu and Kaheu Cultural Protection Zones), or are extremely redundant. Dixon and Major (1993) and Weisler (1984) include additional inventory maps not shown here.



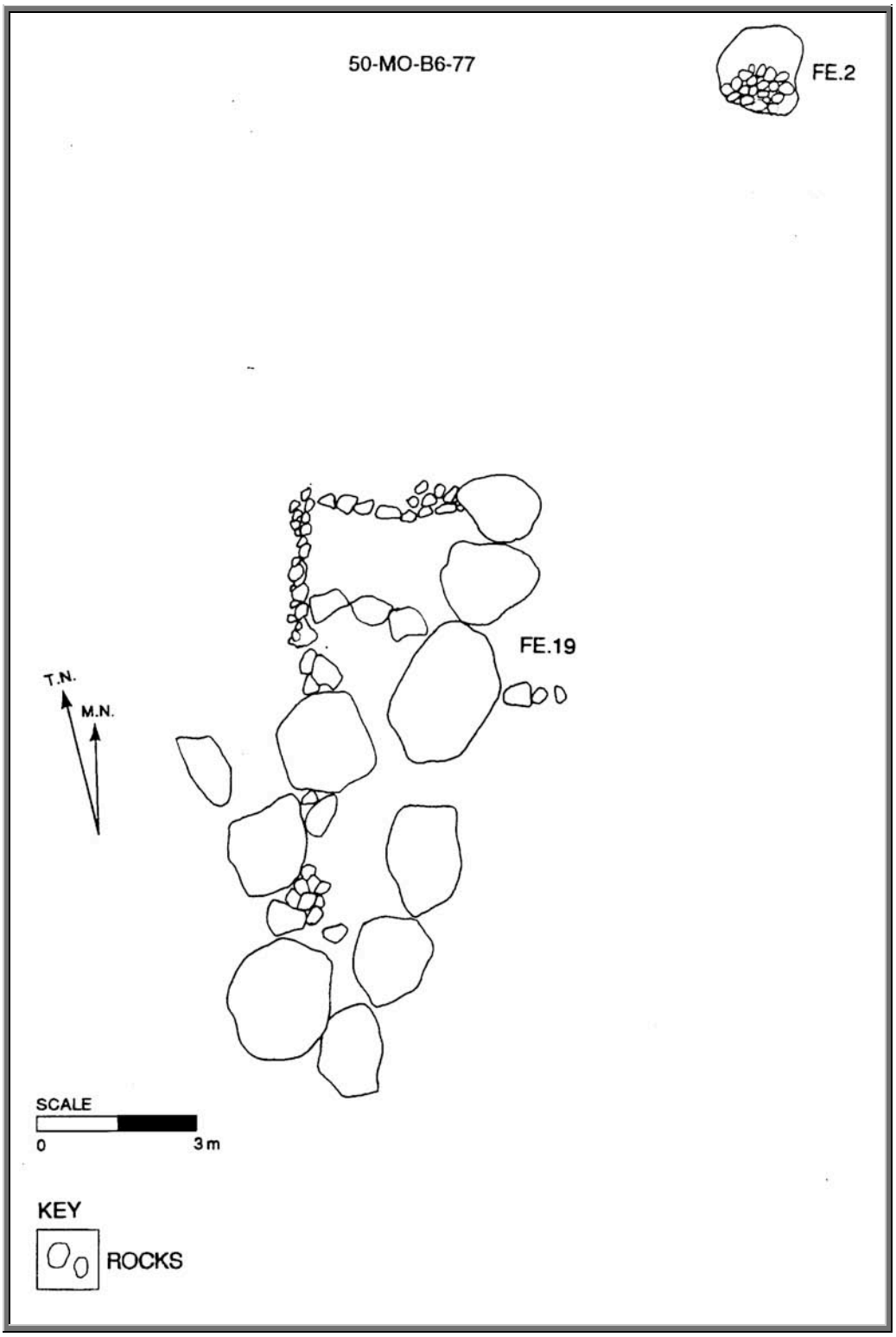
Site 54. North Kamaka'ipō Coastal Complex (B6-68, -70, -73). From Dixon and Major 1993.



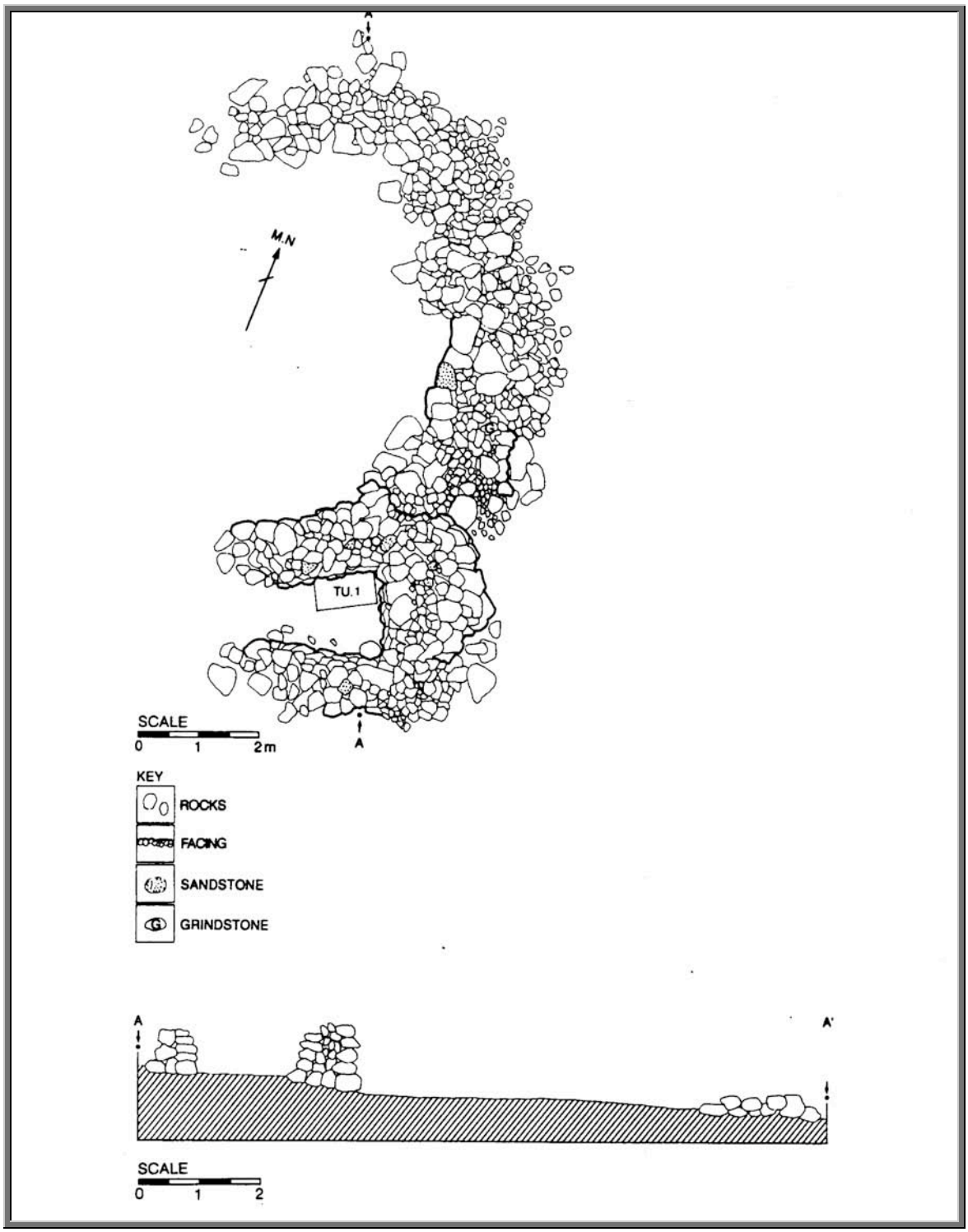
Site 54. North Kamaka'ipō Complex (B6-69). From Dixon and Major 1993.



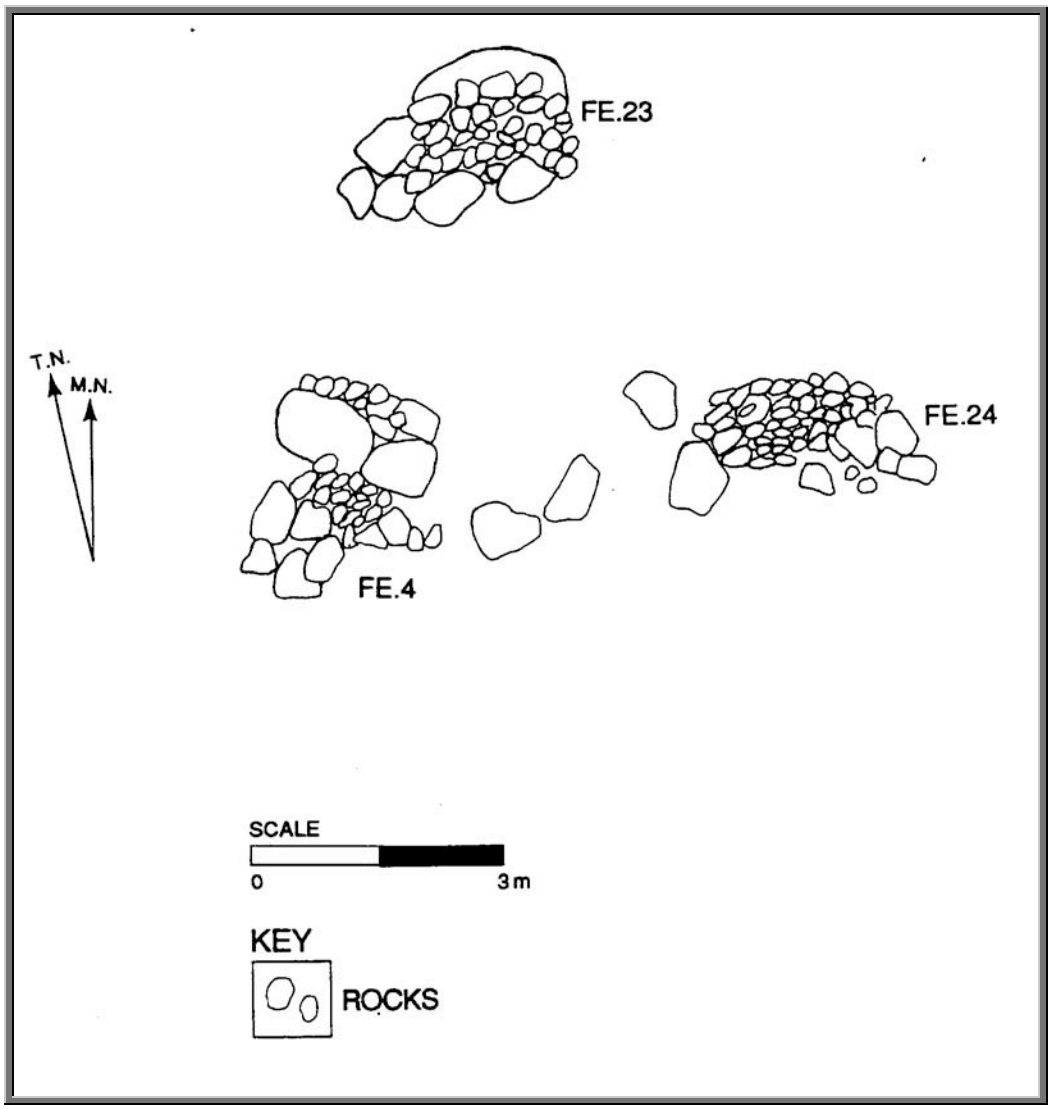
Site 56, Feature 1, Coastal Kamāka'ipō ko'a (fishing shrine). From Dixon and Major 1993.



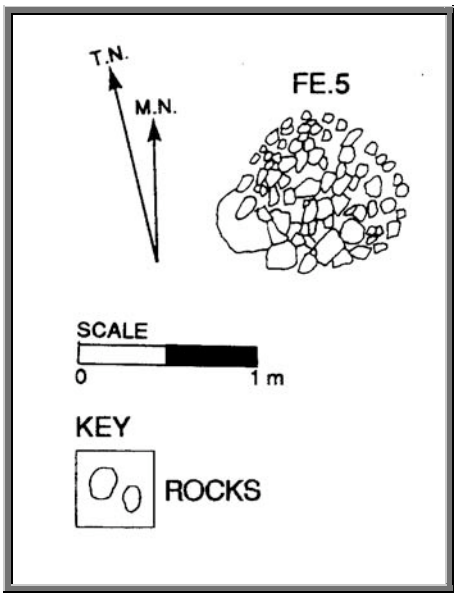
Site 56, Features 2 and 19, Coastal Kamāka'ipō. From Dixon and Major 1993.



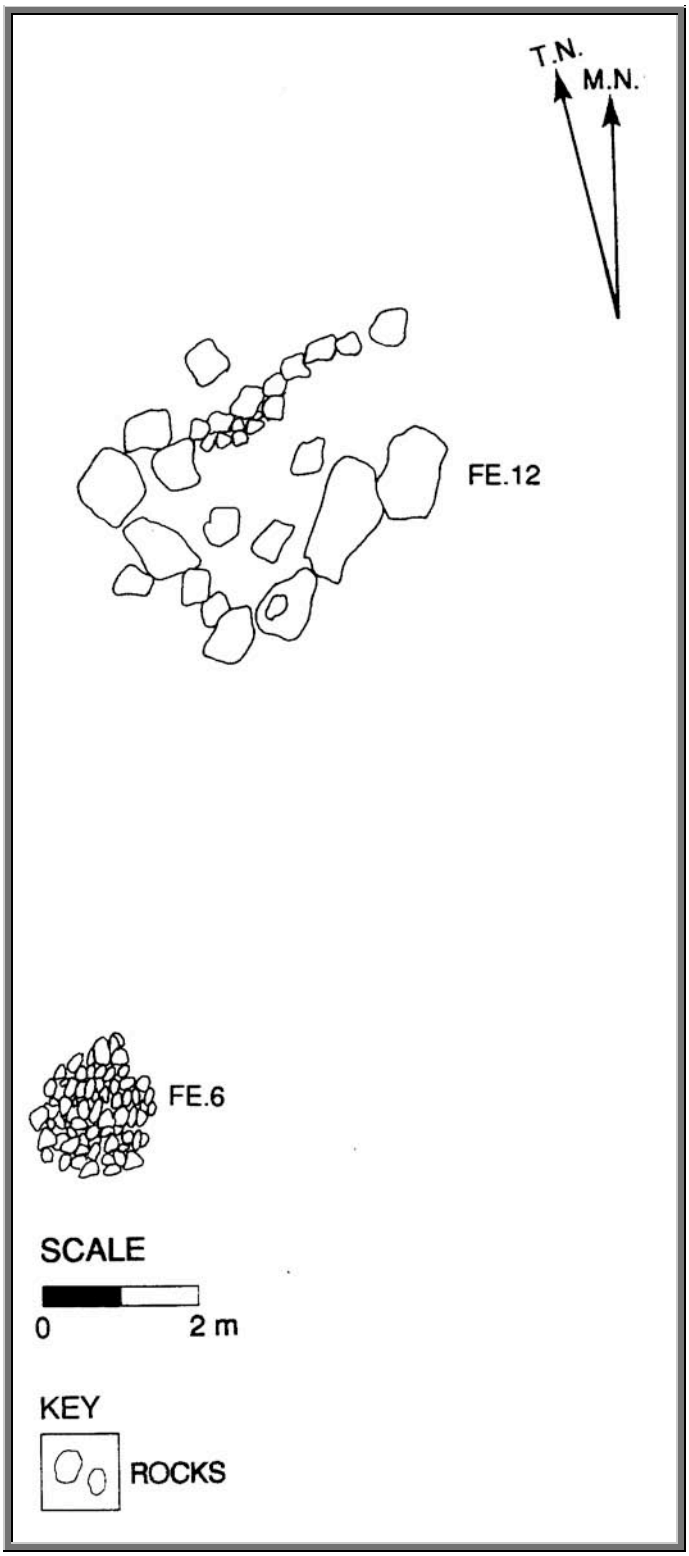
Site 56, Feature 3, Coastal Kamāka'ipō C-shape with tail. From Dixon and Major 1993.



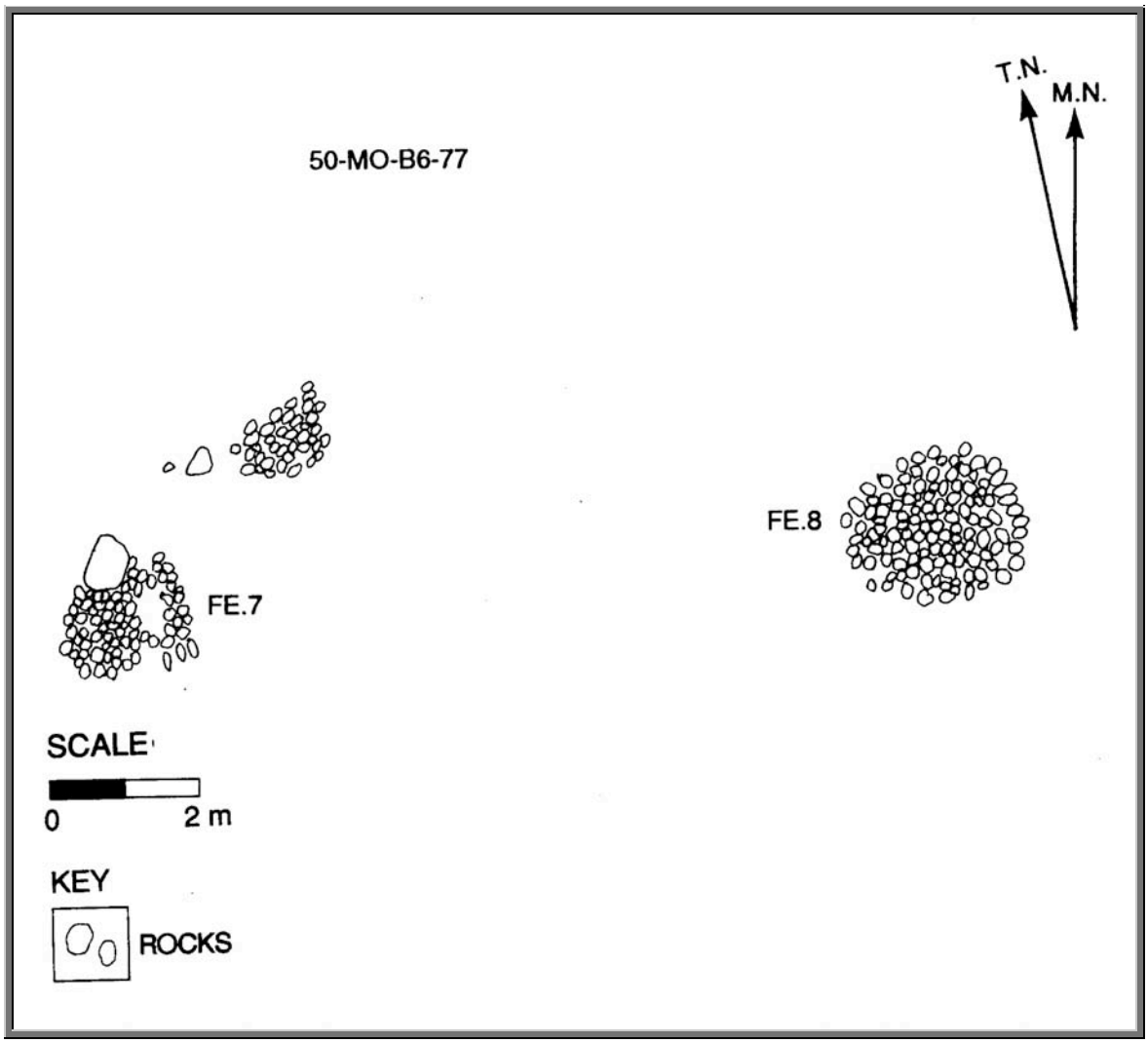
Site 56, Features 4, 24, and 25 Coastal Kamāka'ipō. From Dixon and Major 1993.



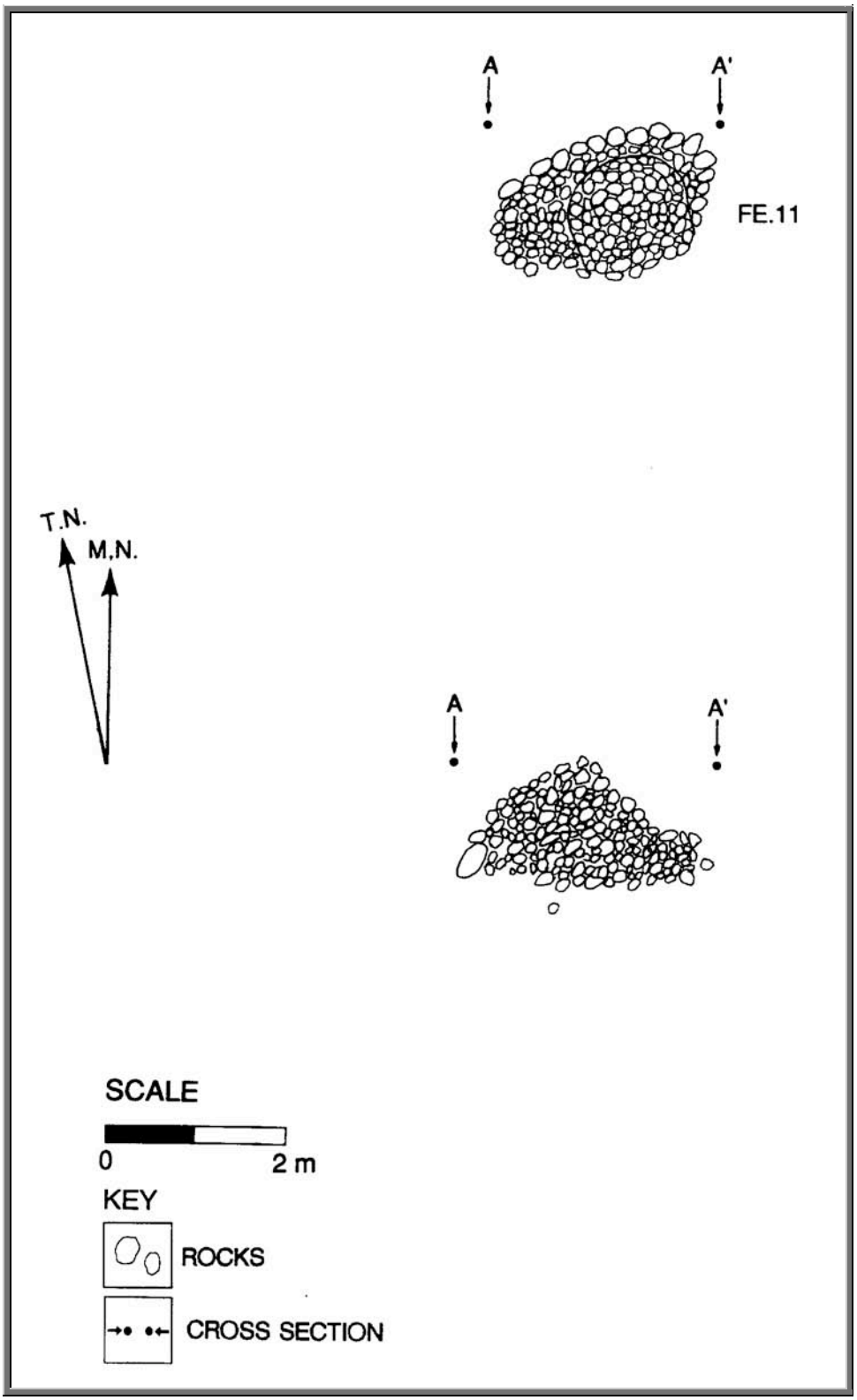
Site 56, Feature 5, Coastal Kamāka'ipō mound. From Dixon and Major 1993.



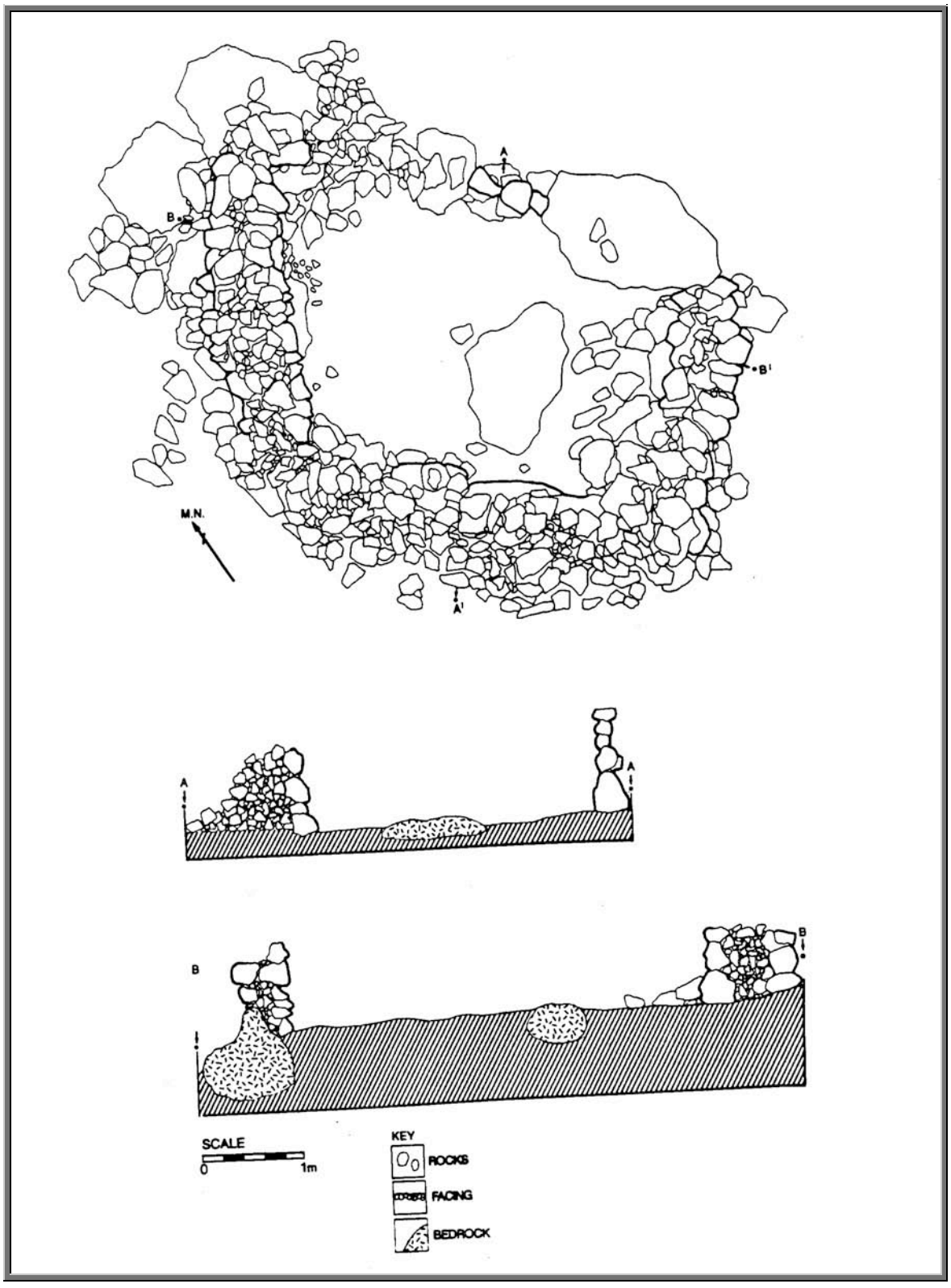
Site 56, Features 6 and 12 Coastal Kamāka'ipō. From Dixon and Major 1993.



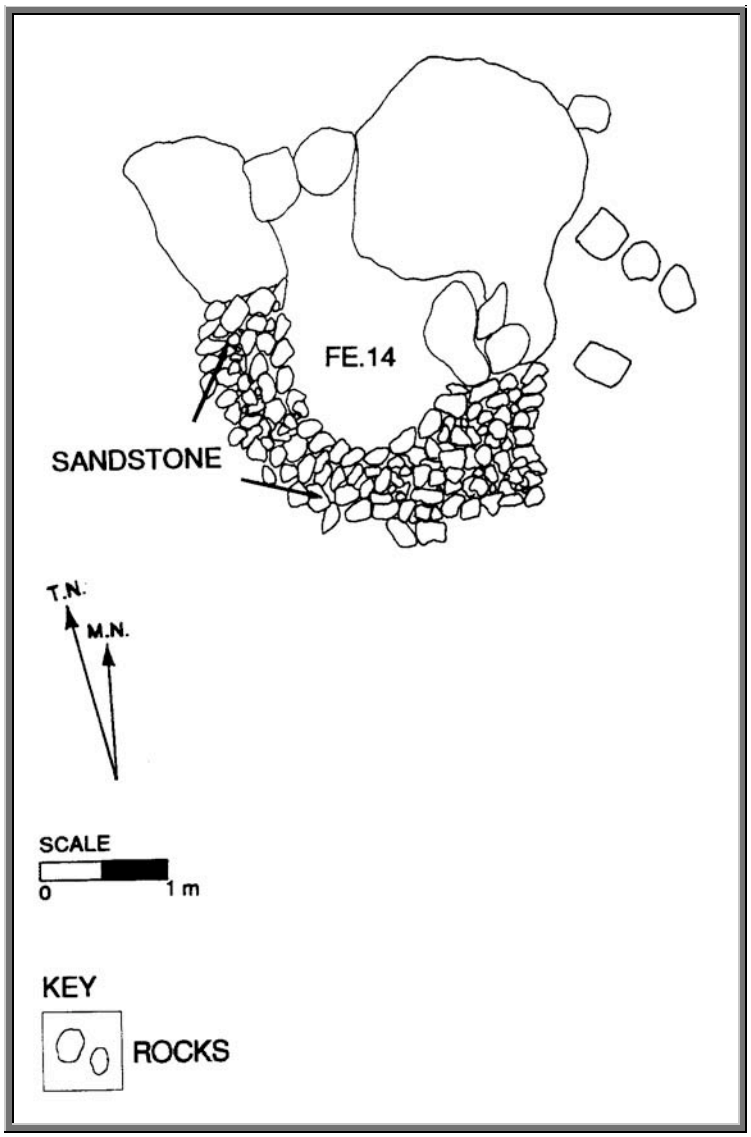
Site 56, Features 7 and 8 Coastal Kamāka'ipō. From Dixon and Major 1993.



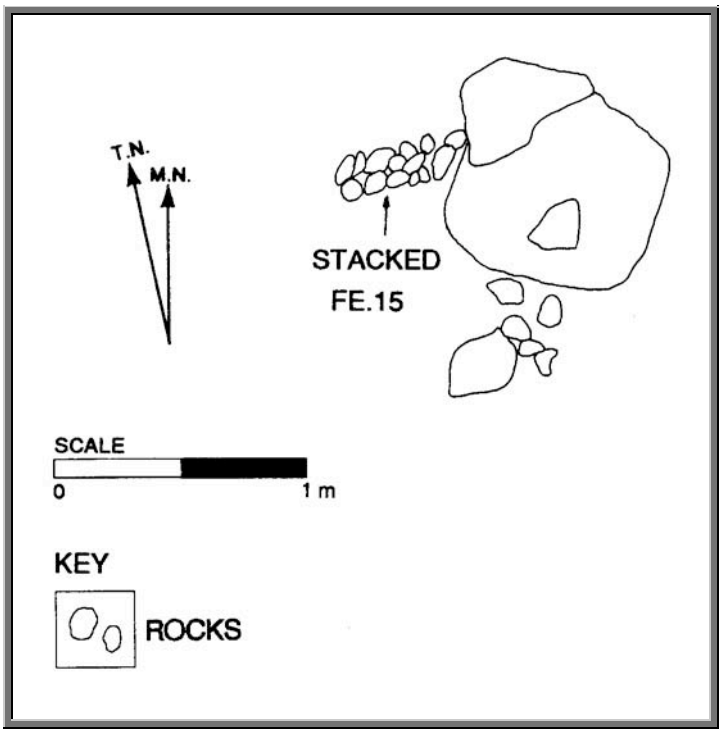
Site 56, Feature 12, Coastal Kamāka'ipō burial. From Dixon and Major 1993.



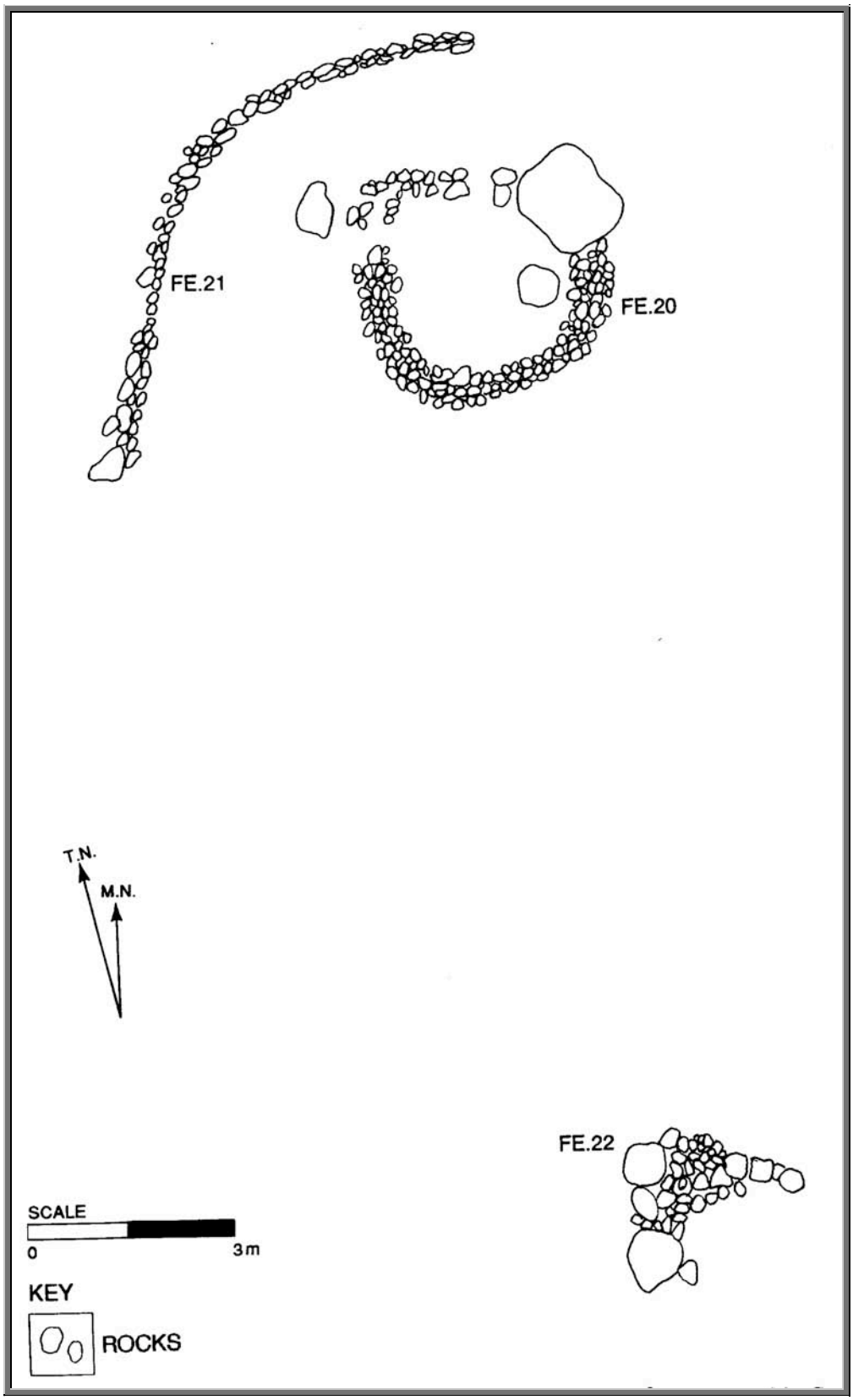
Site 56, Feature 13, Coastal Kamāka'ipō enclosure. From Dixon and Major 1993.



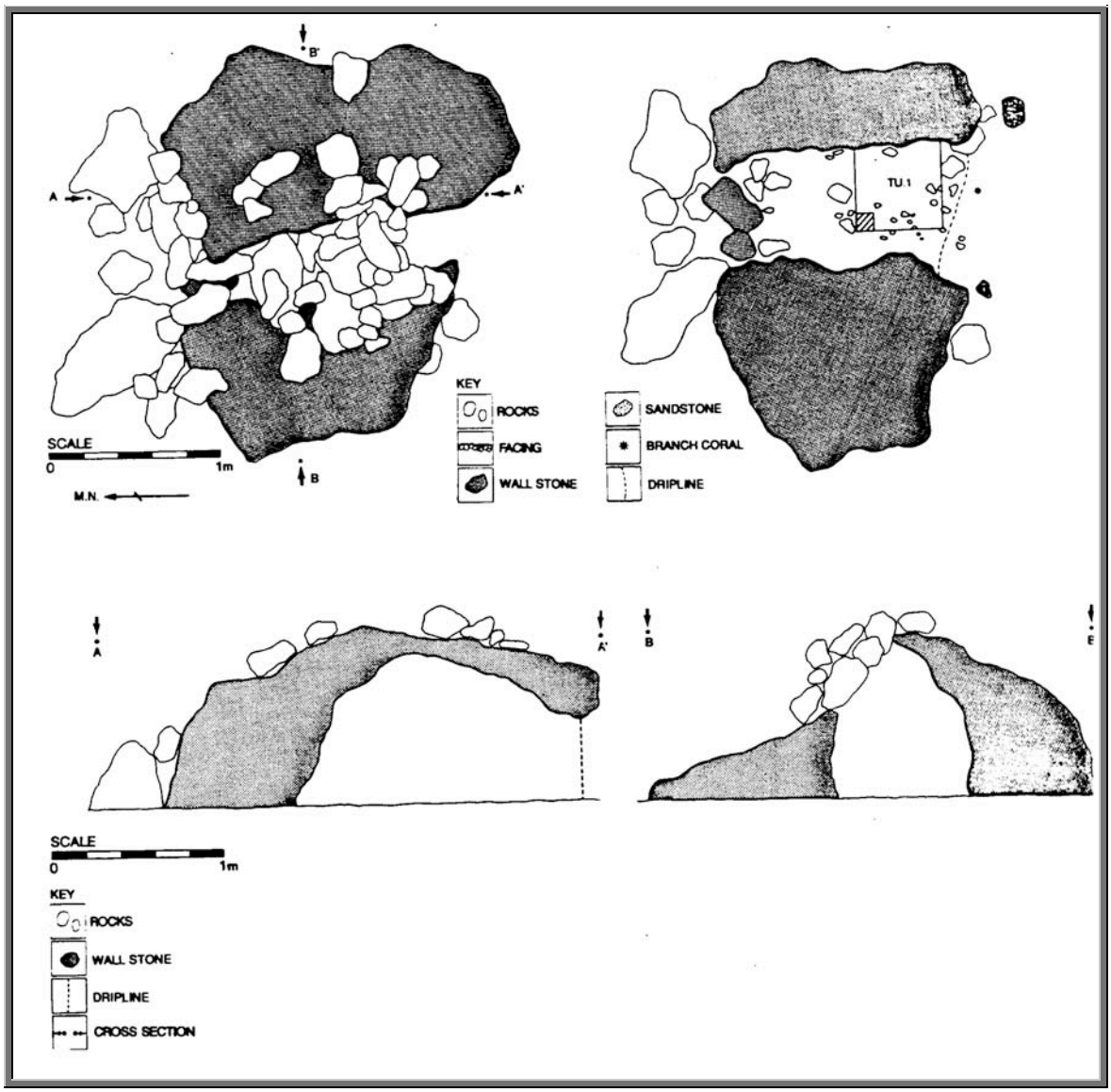
Site 56, Feature 14, Coastal Kamāka'ipō. From Dixon and Major 1993.



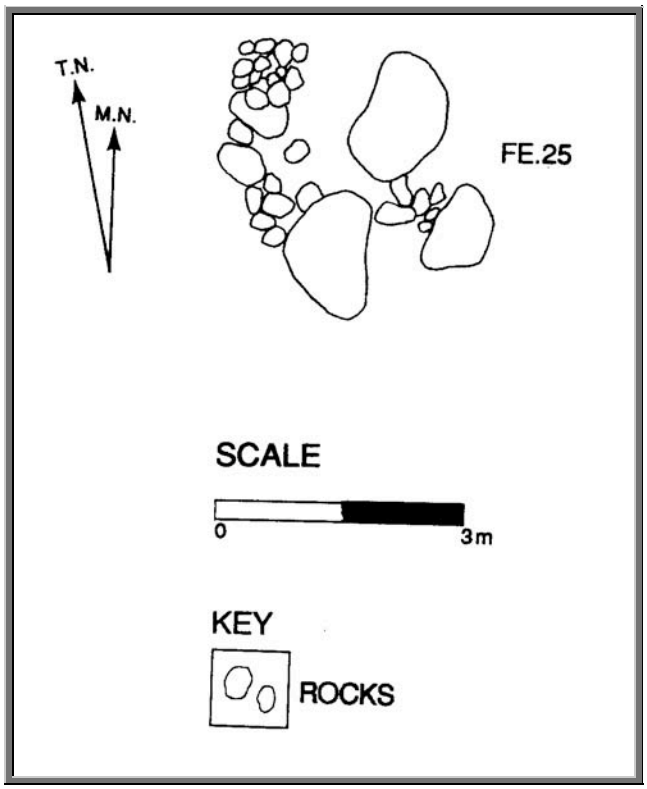
Site 56, Feature 15, Coastal Kamāka'ipō. From Dixon and Major 1993.



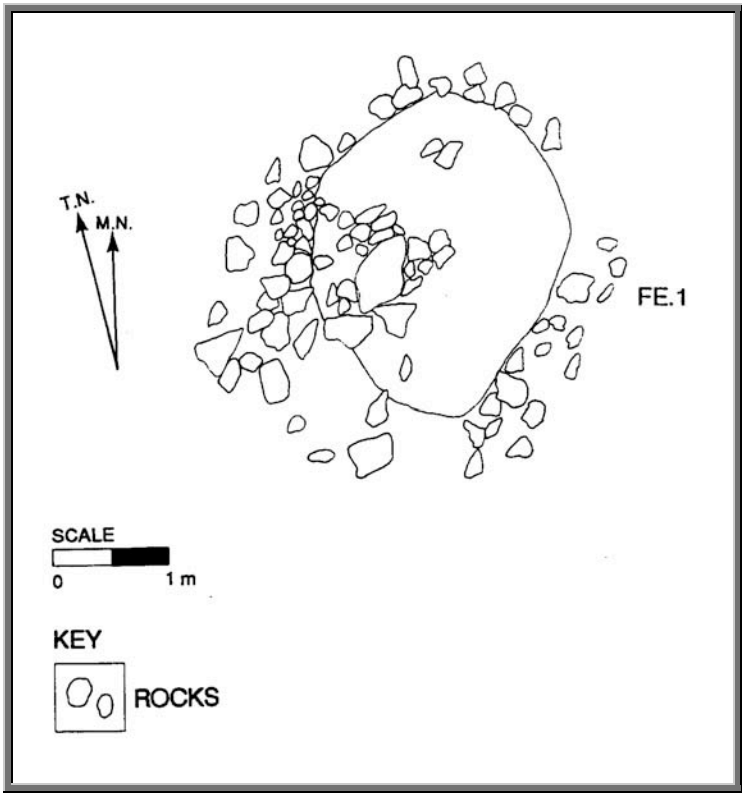
Site 56, Features 20-22, Coastal Kamāka'ipō. From Dixon and Major 1993.



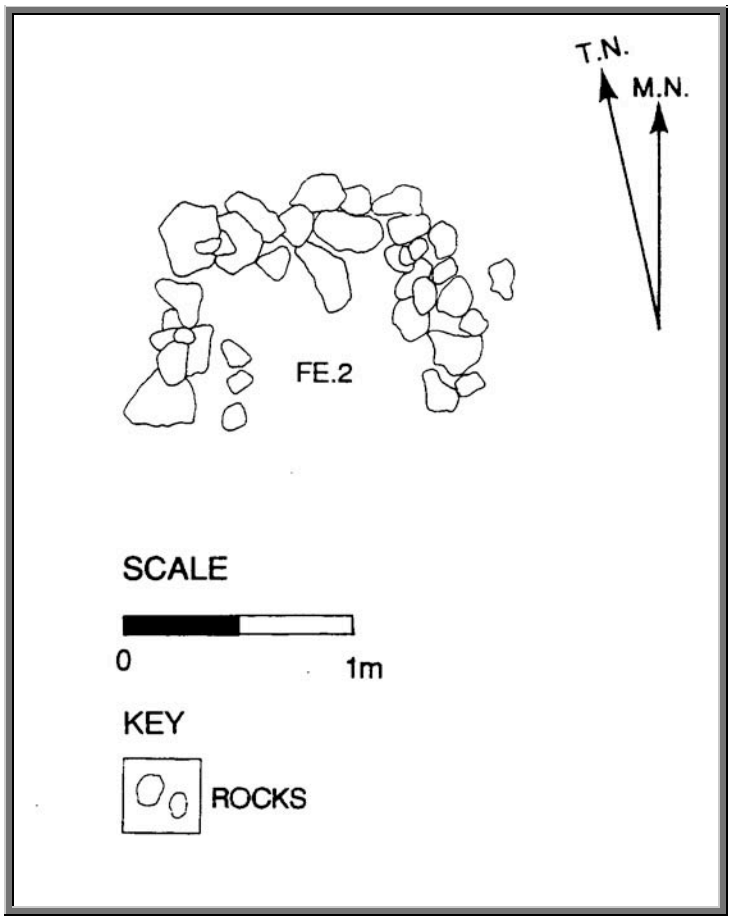
Site 56, Feature 24, Coastal Kamāka'ipō cupboard. From Dixon and Major 1993.



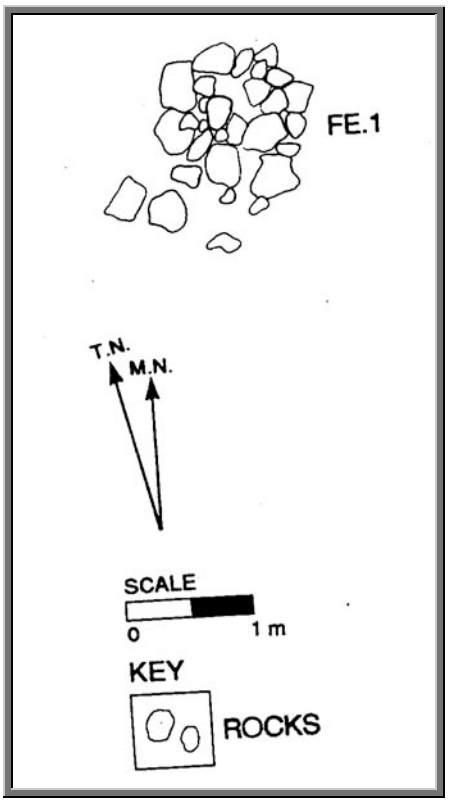
Site 56, Feature 25, Coastal Kamāka'ipō. From Dixon and Major 1993.



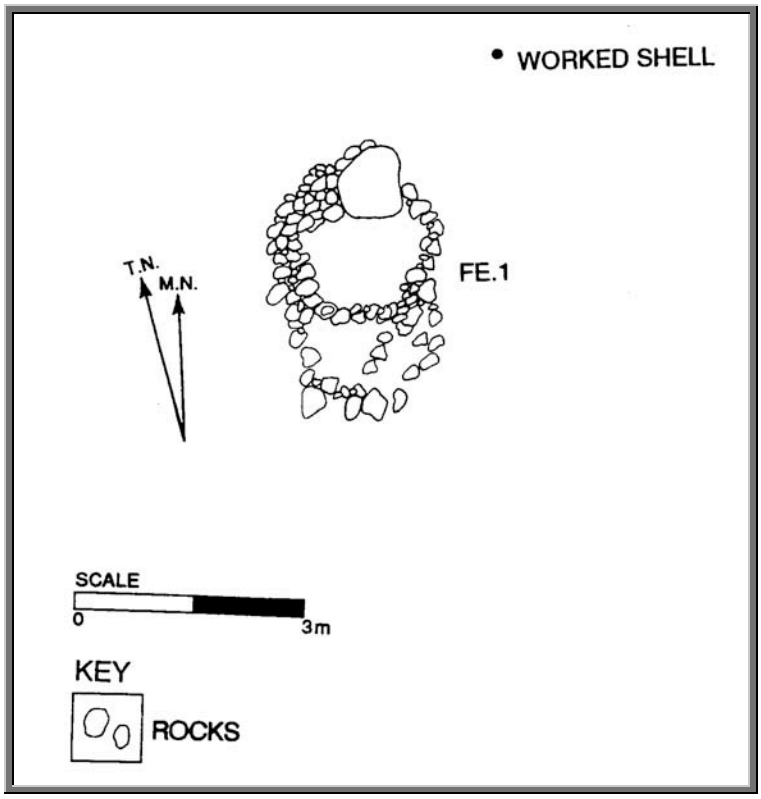
Site 679, Feature 1, Upper North Kamāka'ipō Gulch. From Dixon and Major 1993.



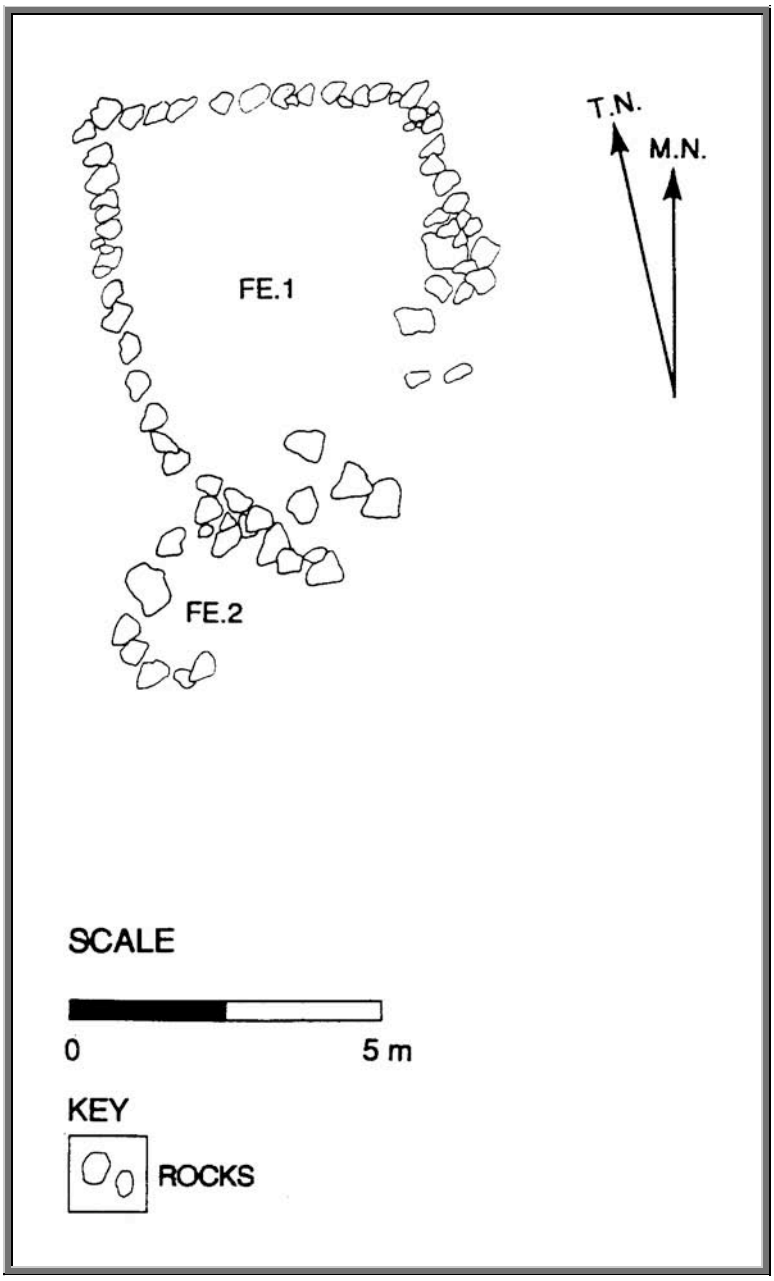
Site 679, Feature 2, Upper North Kamāka'ipō Gulch C-shape. From Dixon and Major 1993.



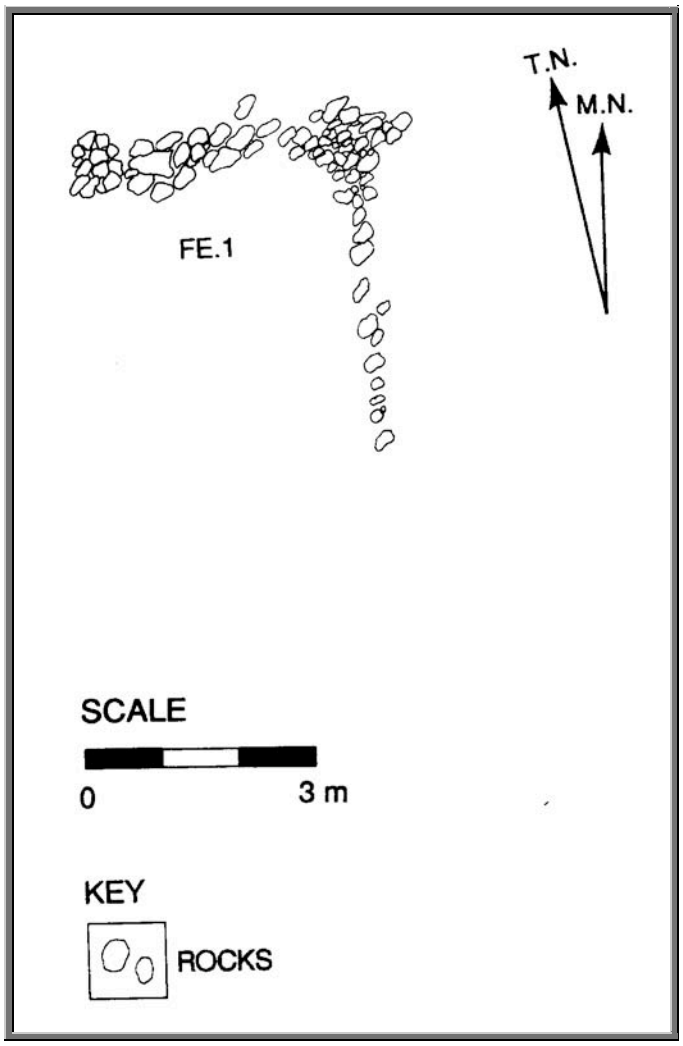
Site 682, Feature 1, Upper North Kamāka'ipō Gulch. From Dixon and Major 1993.



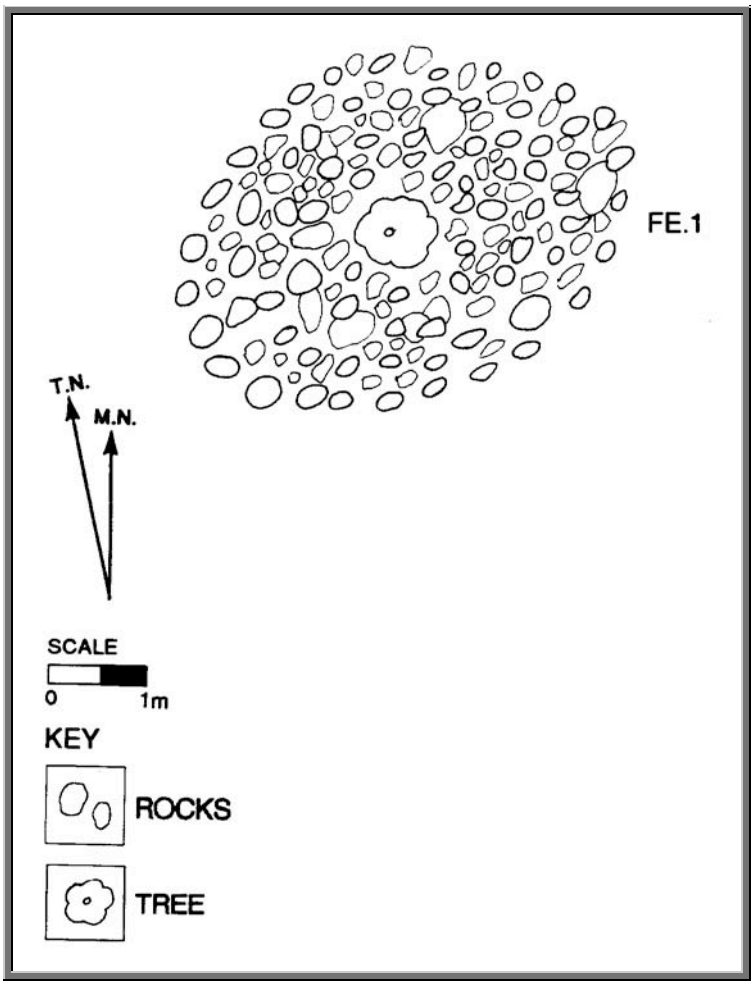
Site 685, Feature 1, Upper North Kamāka'ipō Gulch. From Dixon and Major 1993.



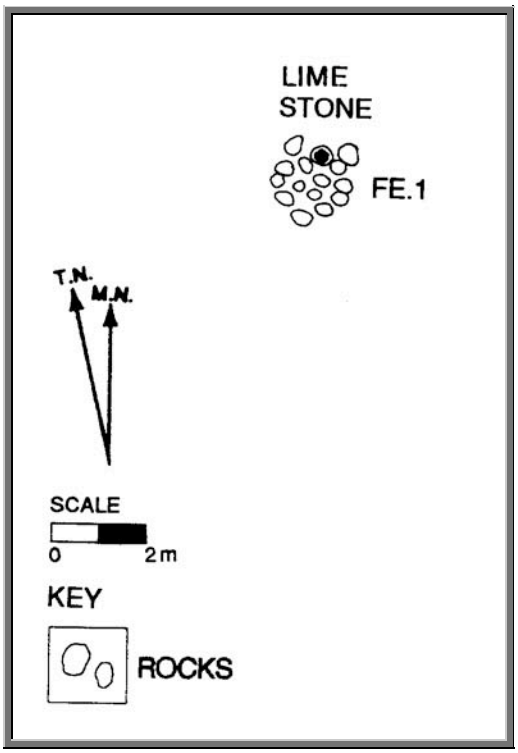
Site 687, Feature 1, North Kamāka'ipō Gulch. From Dixon and Major 1993.



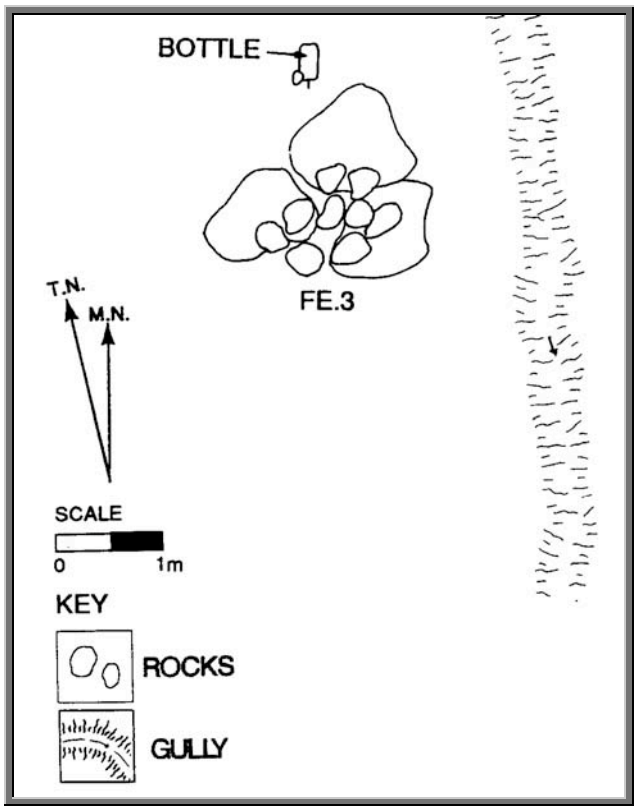
Site 689, Feature 1, North Kamāka'ipō Gulch. From Dixon and Major 1993.



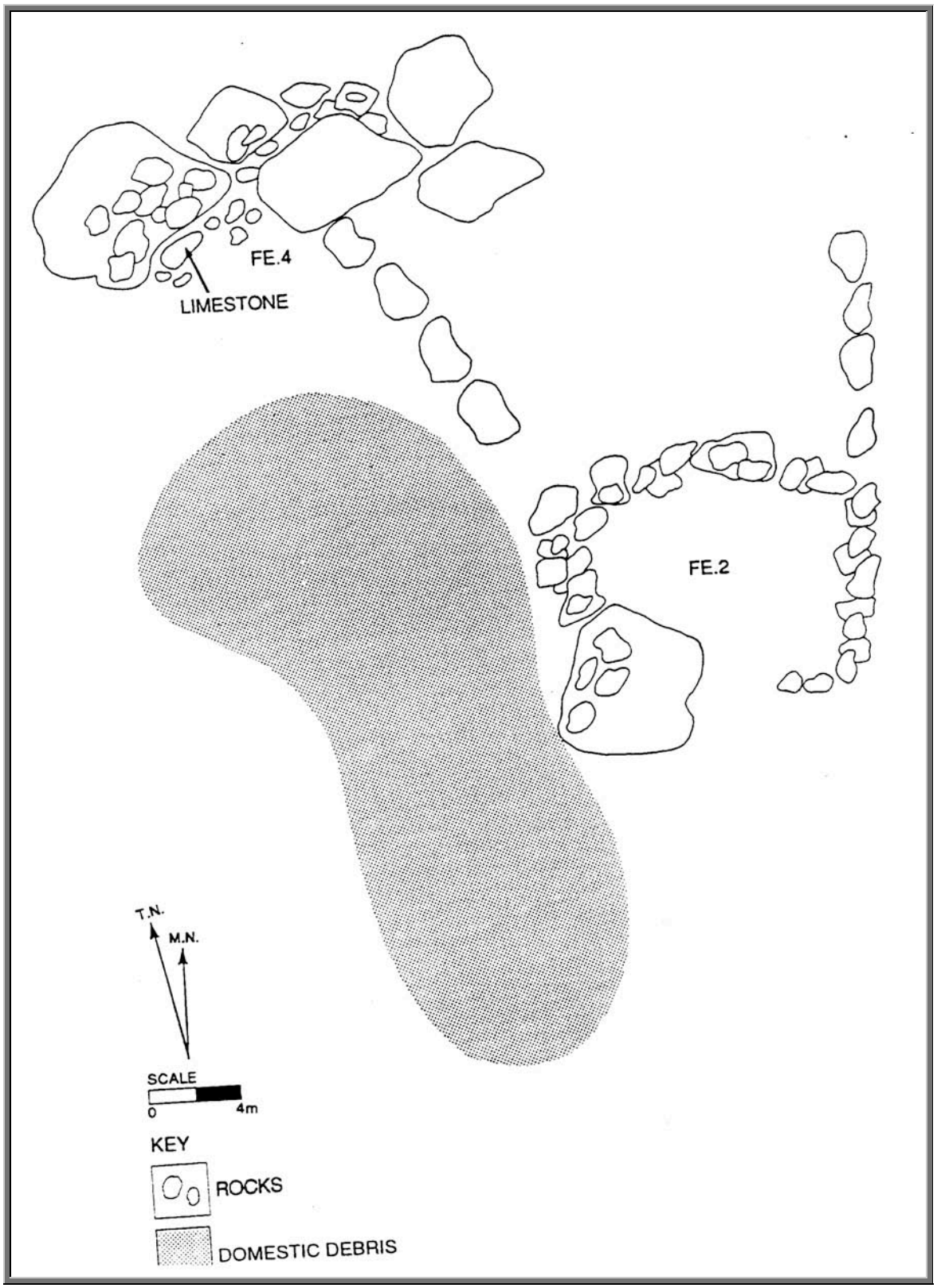
Site 739, Feature 1, Coastal Kamāka'ipō. From Dixon and Major 1993.



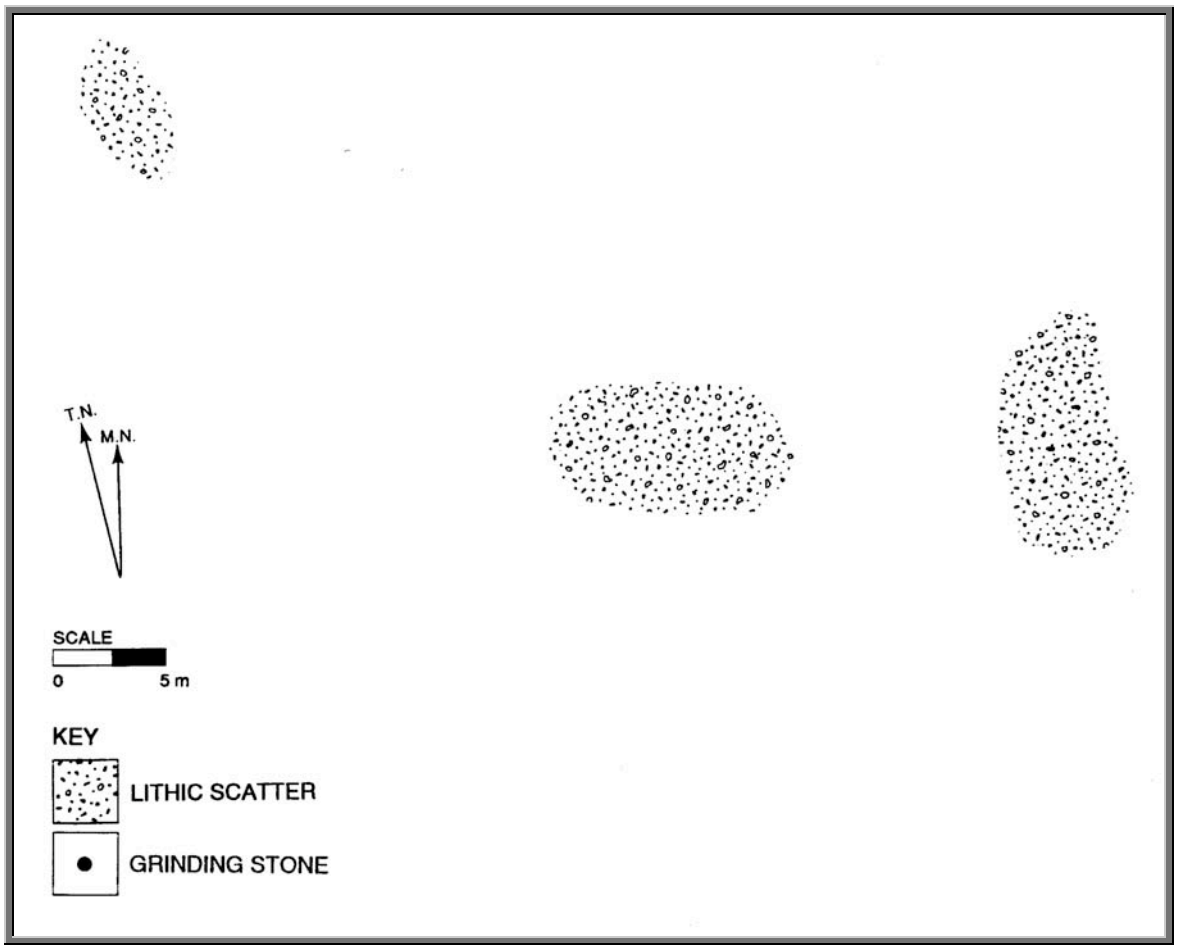
Site 741, Feature 1, Coastal Kamāka'ipō. From Dixon and Major 1993.



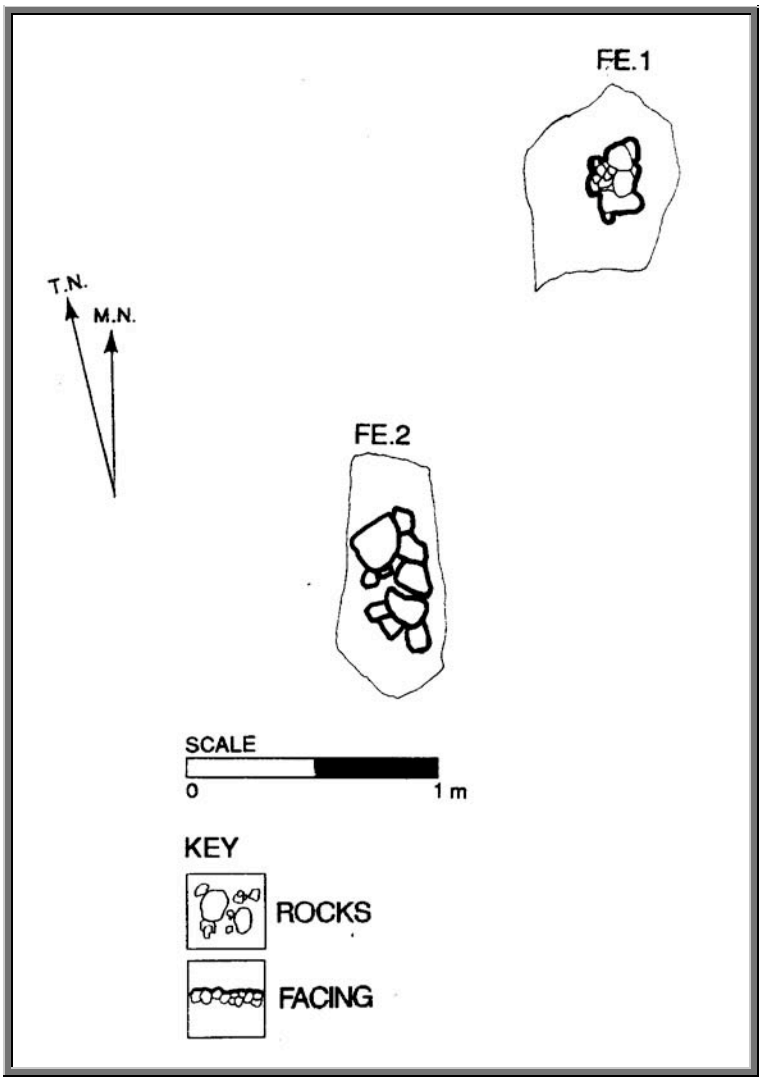
Site 741, Feature 3, Coastal Kamāka'ipō Trail Marker. From Dixon and Major 1993.



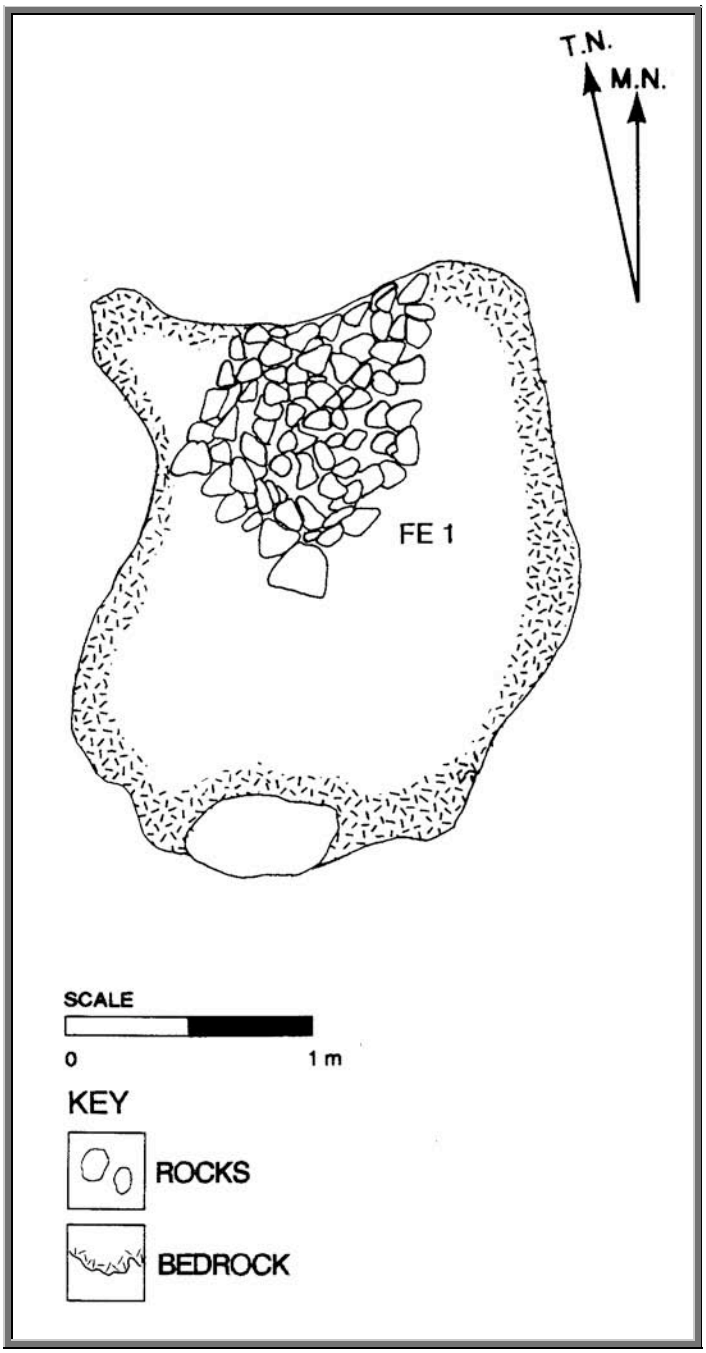
Site 741, Features 2 and 4 with midden, Coastal Kamāka'ipō. From Dixon and Major 1993.



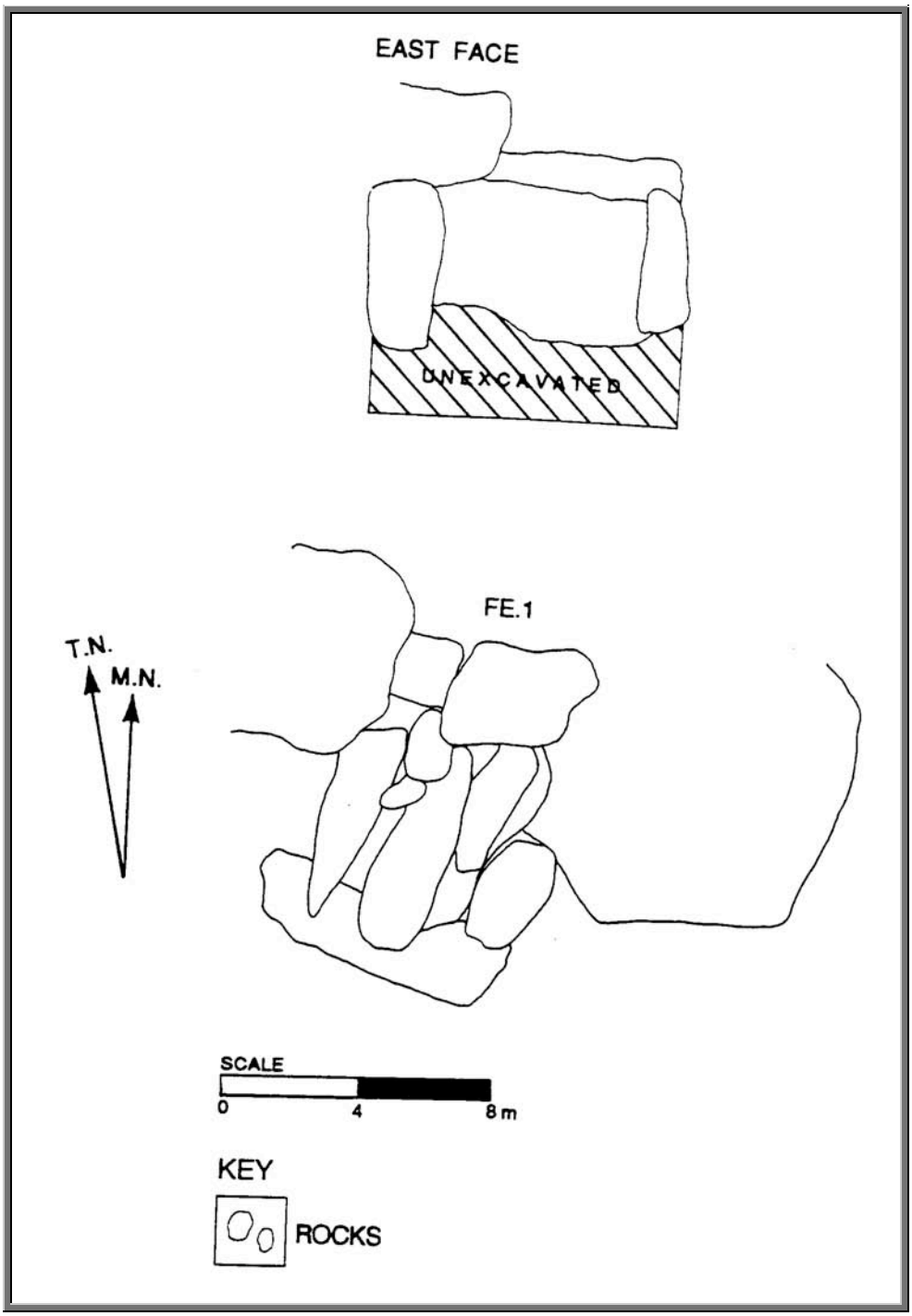
Site 742, Kamāka'ipō South ridge lithic work area. From Dixon and Major 1993.



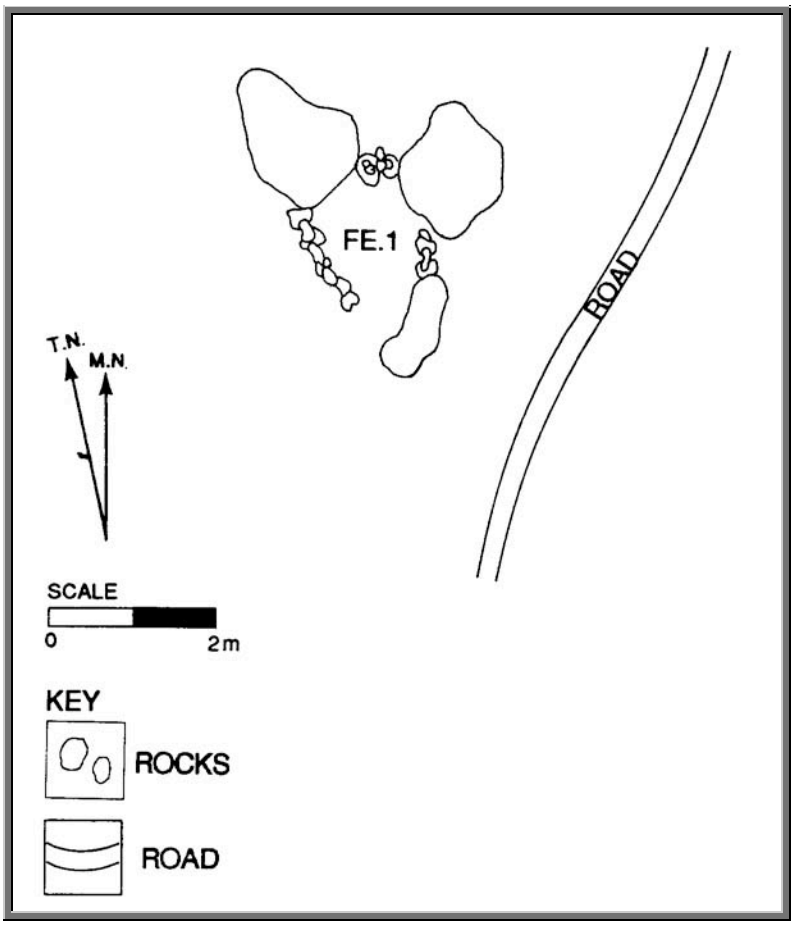
Site 744, Coastal Kamāka'ipō South. From Dixon and Major 1993.



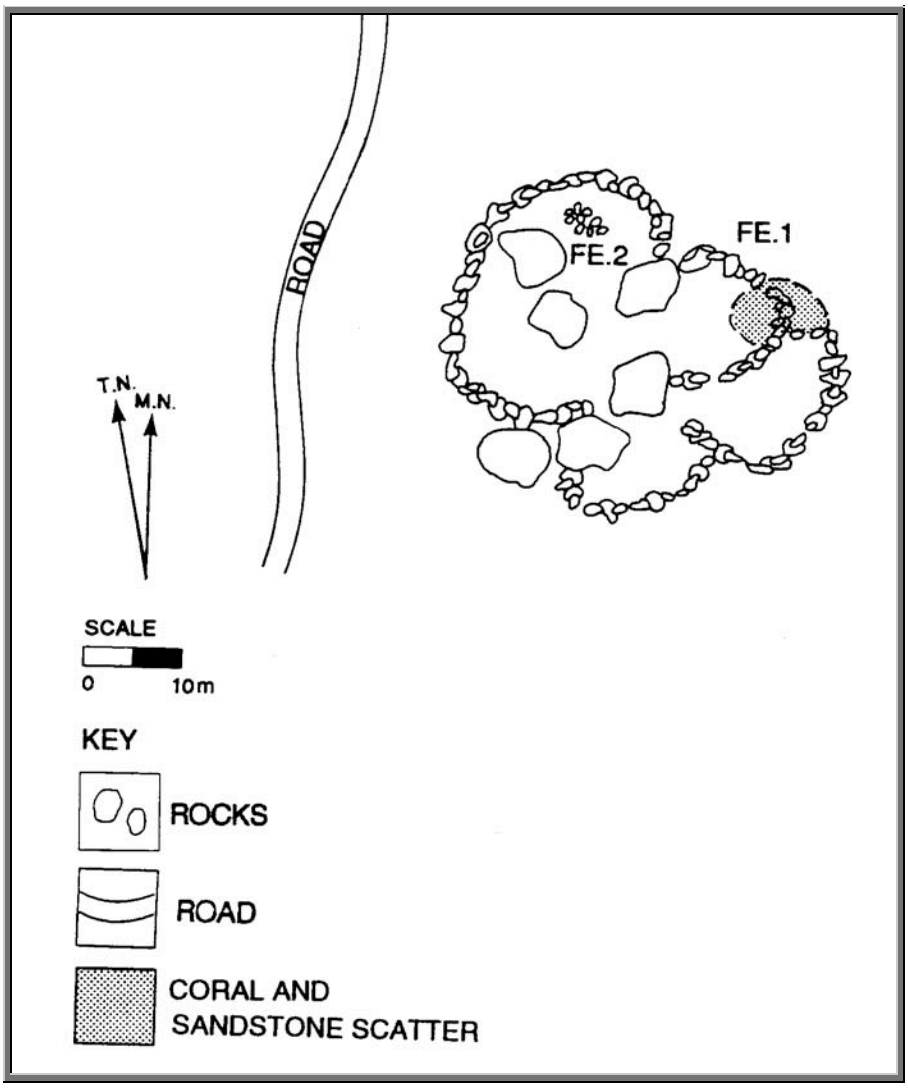
Site 750, Kamāka'ipō South trail marker. From Dixon and Major 1993.



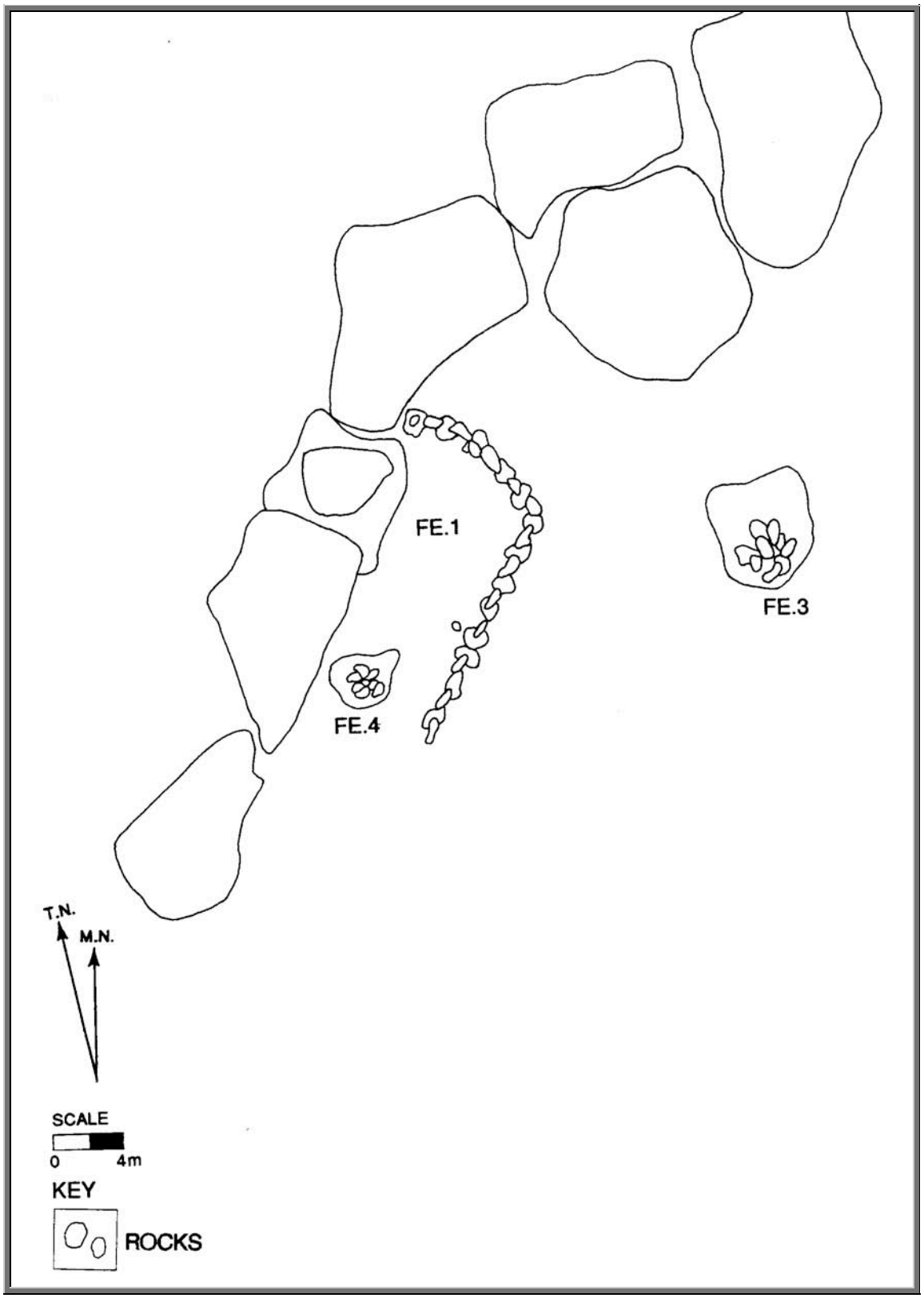
Site 751, Kamāka'ipō South cupboard. From Dixon and Major 1993.



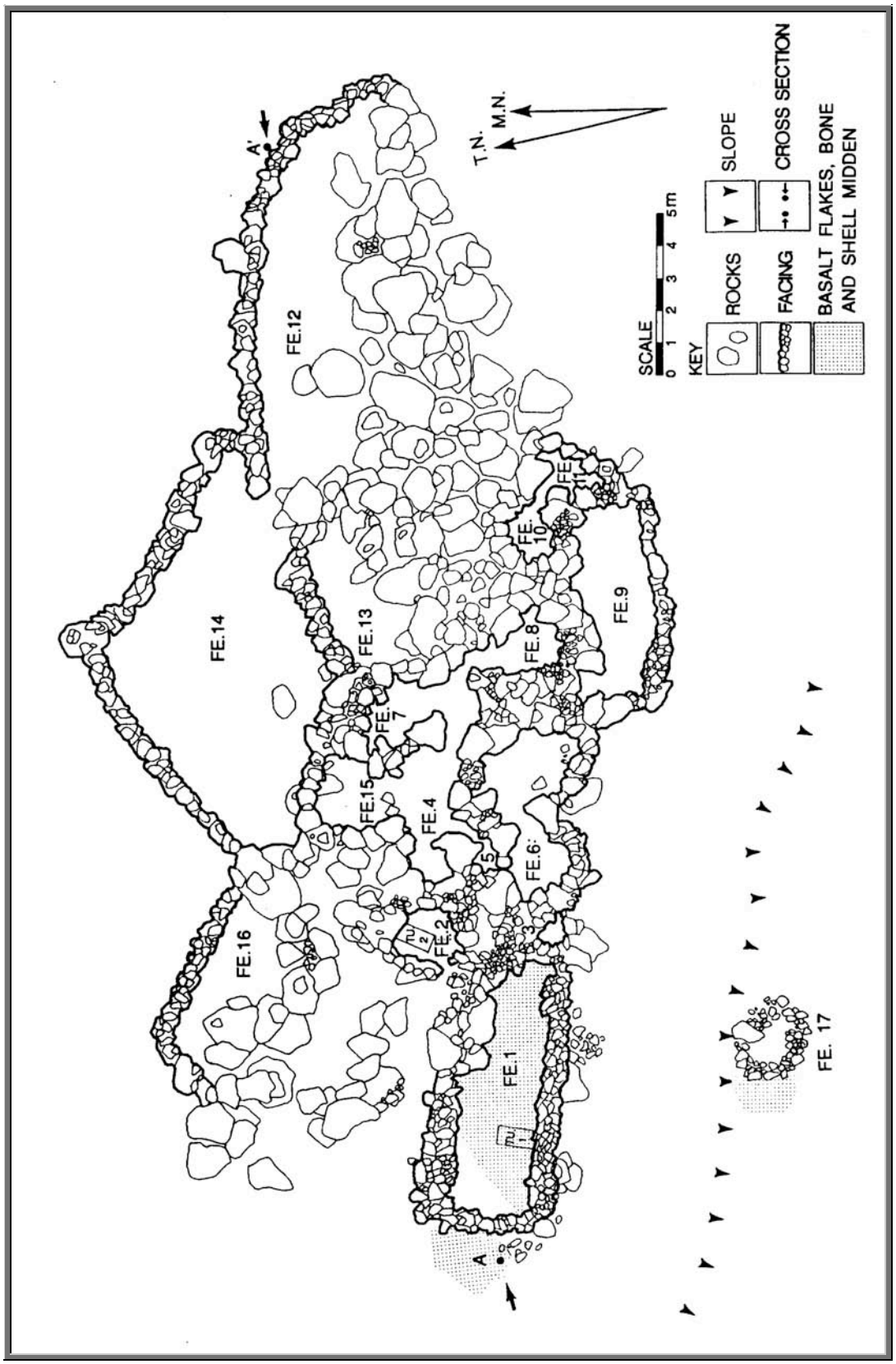
Site 763, Lā'au Point modified outcrop enclosure. From Dixon and Major 1993.



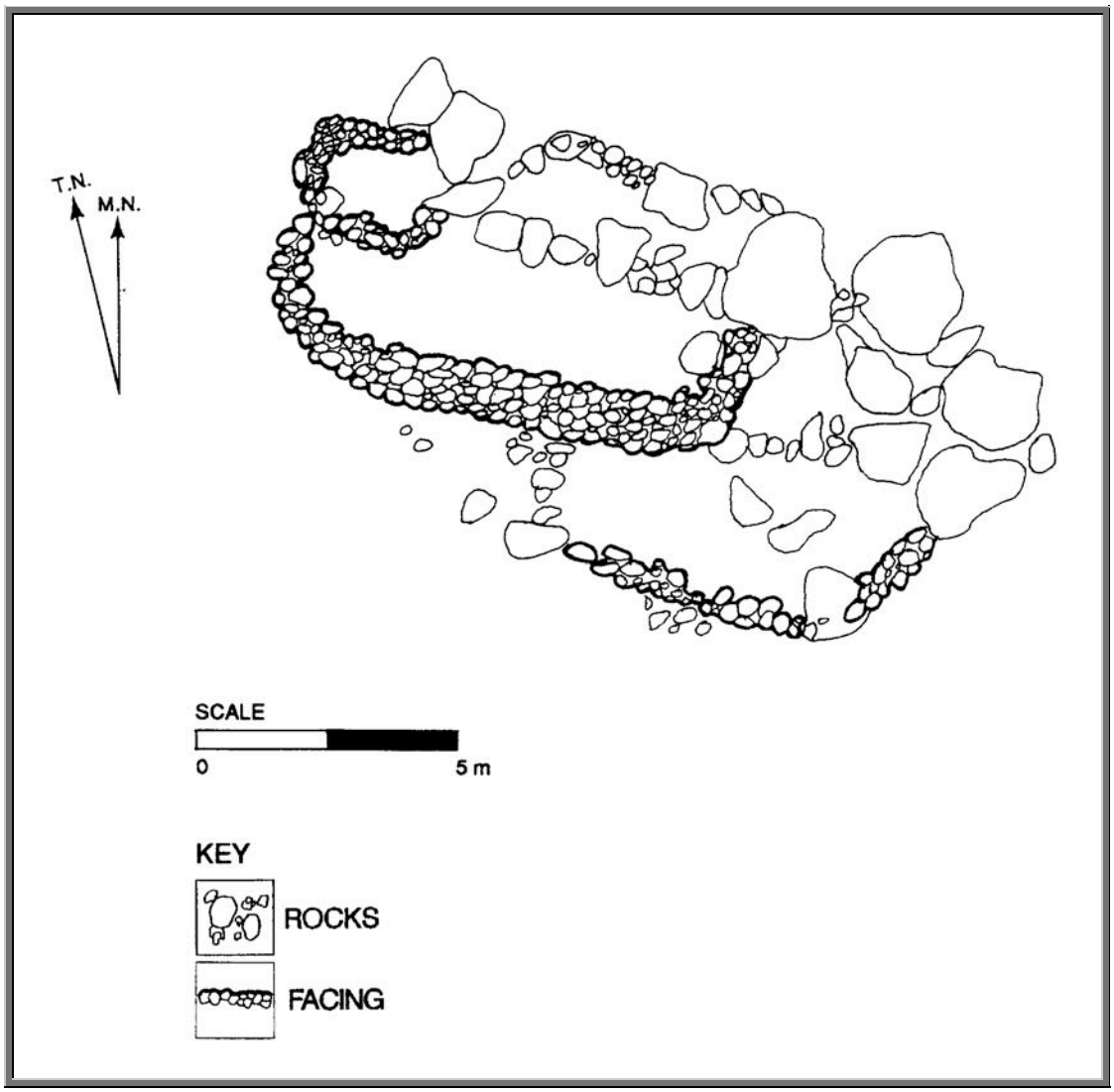
Site 764, Lā'au Point multi-room enclosure. From Dixon and Major 1993.



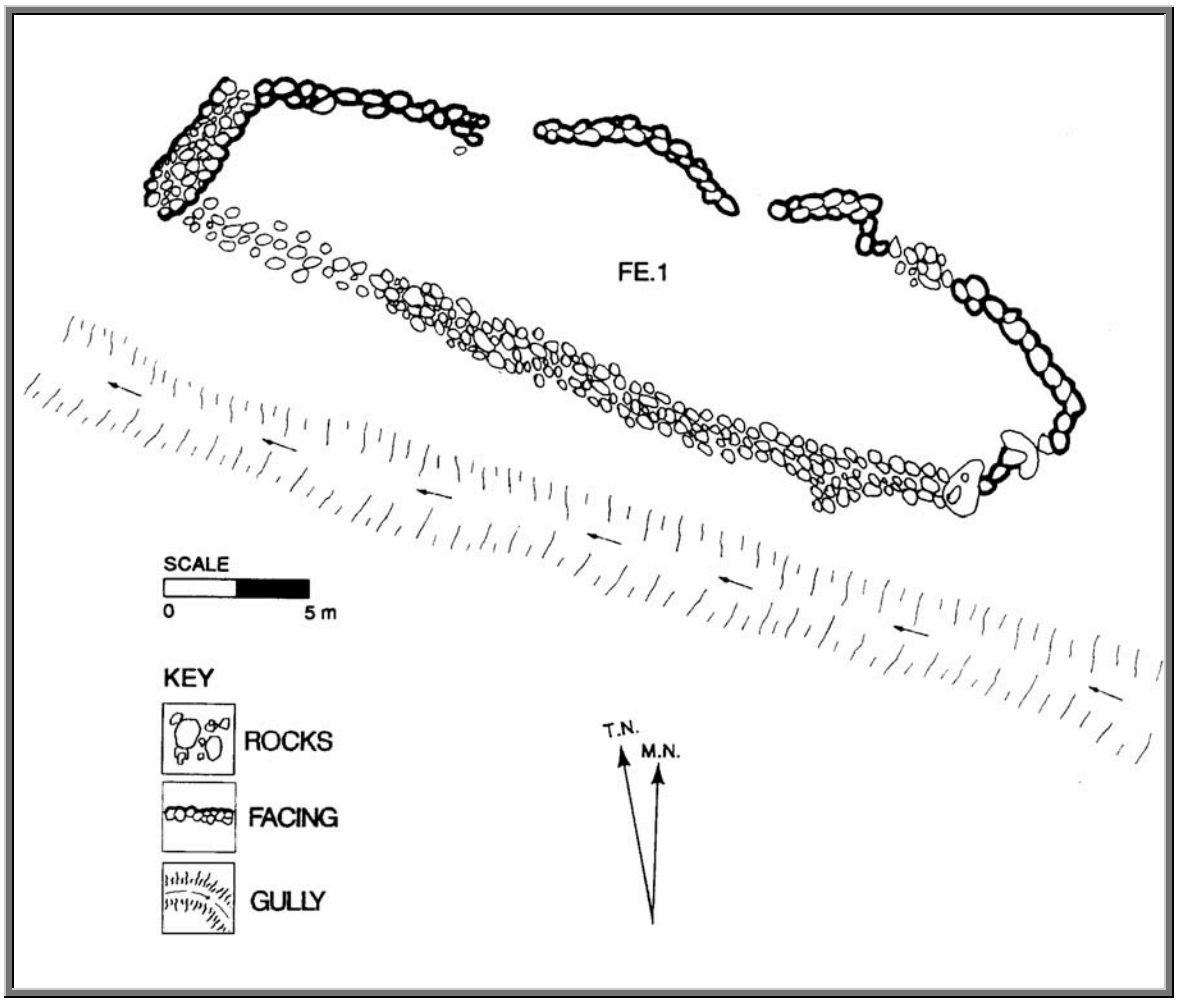
Site 765, Features 1, 3, and 4. Lā'au Point modified outcrop and markers. From Dixon and Major 1993.



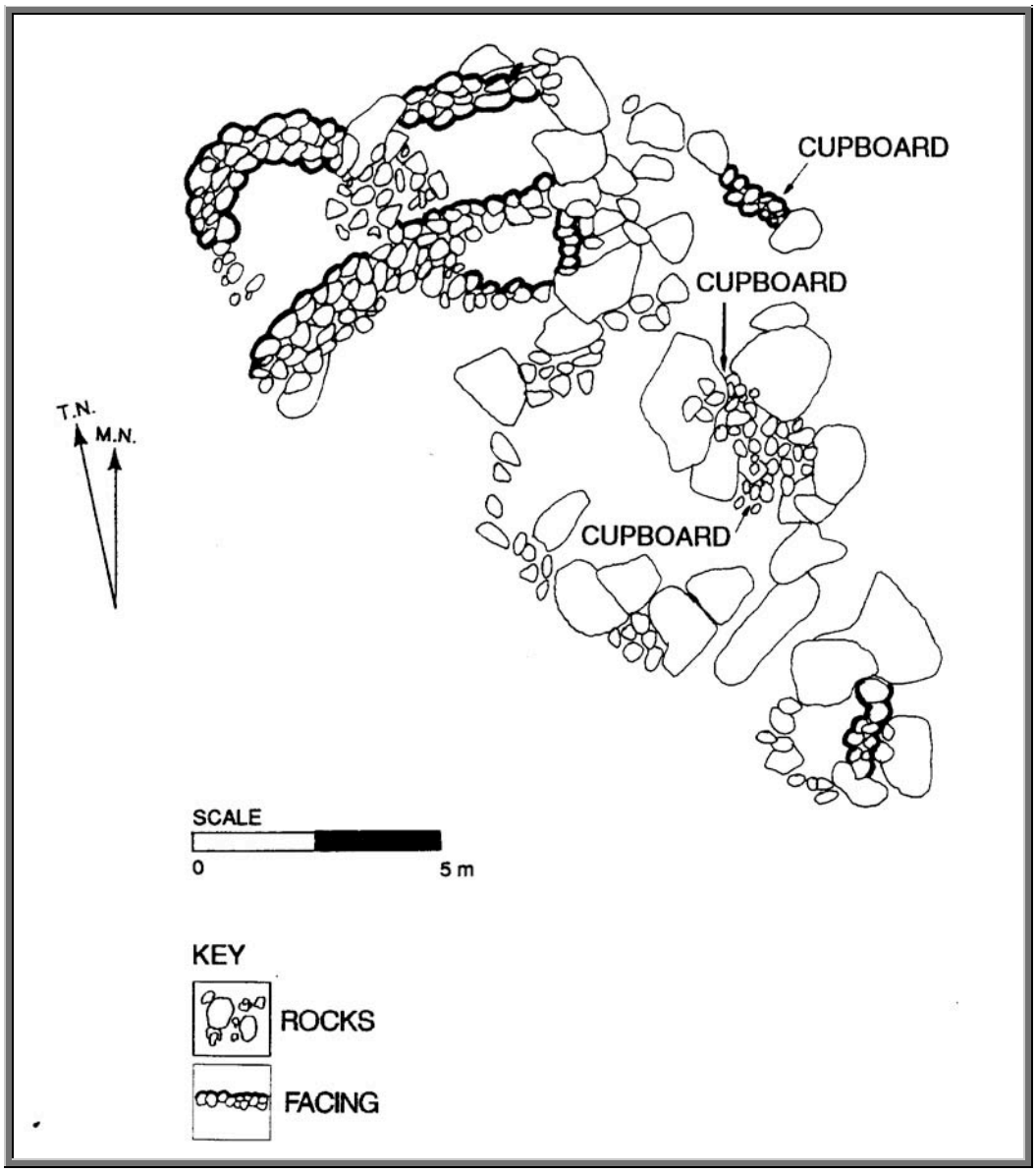
Site 771. Large multi-room enclosure. Upland Kamāka'ipō South. From Dixon and Major 1993.



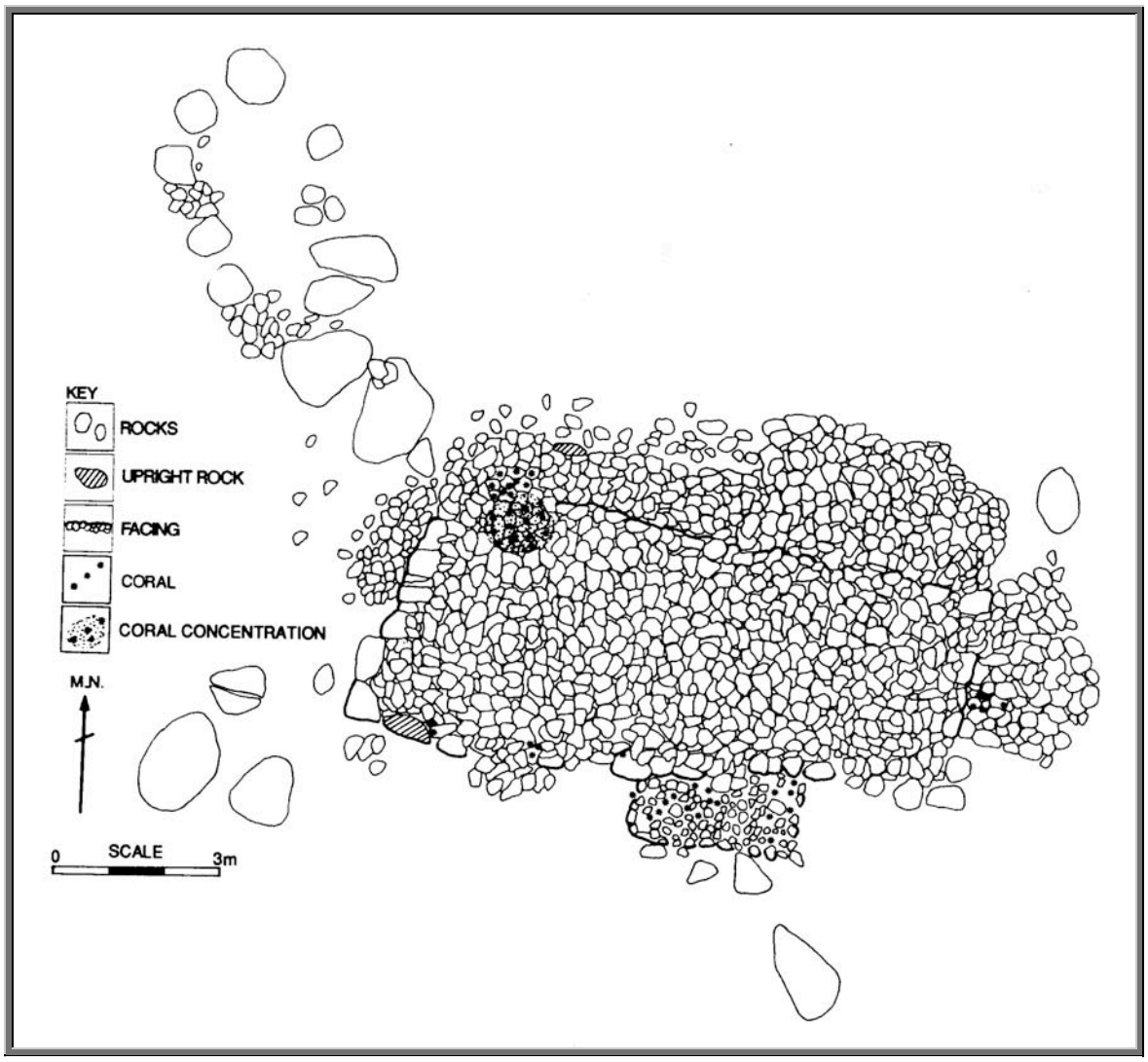
Site 772. Large multi-room enclosure. Upland Kamāka'ipō South. From Dixon and Major 1993.



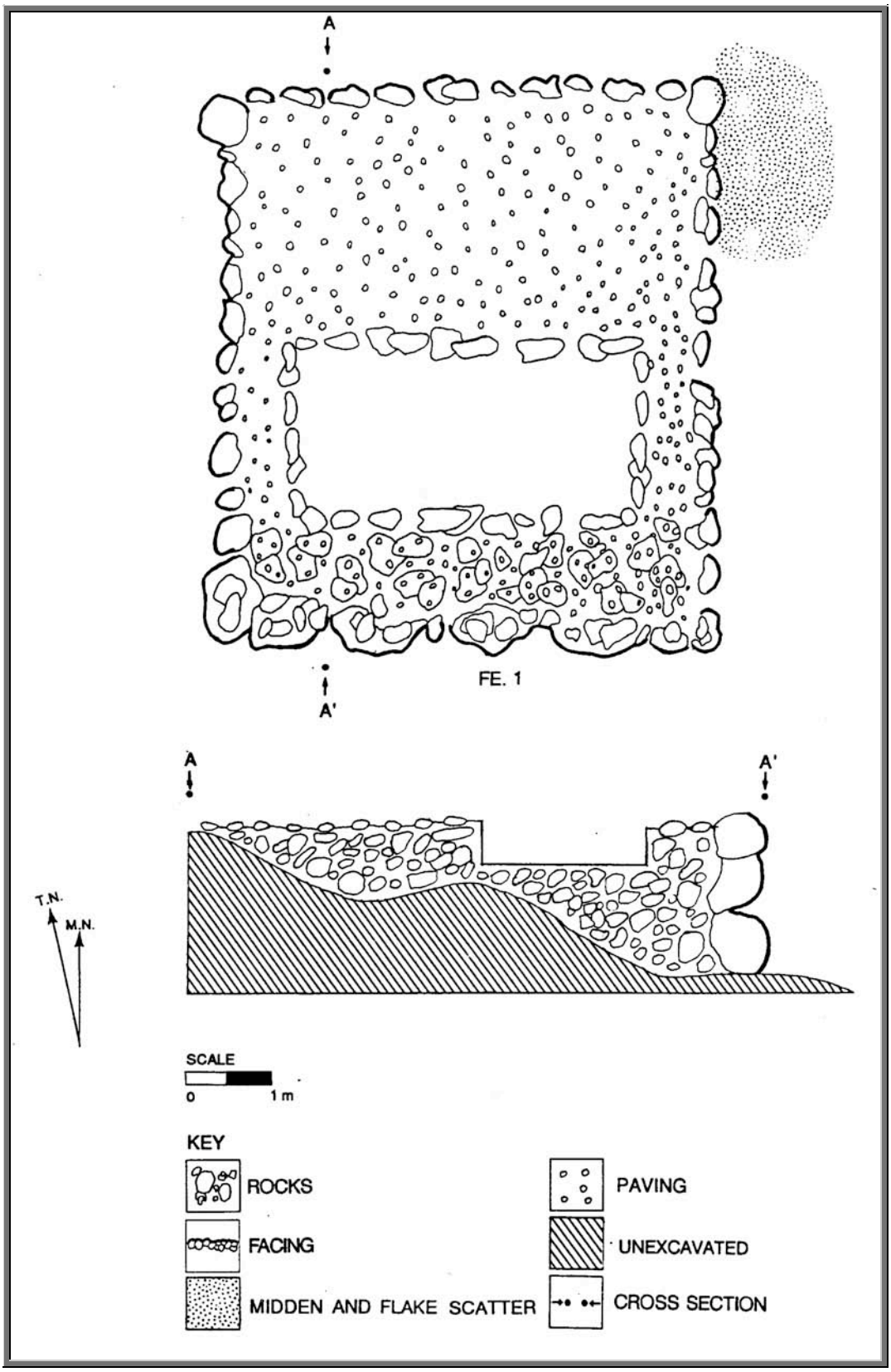
Site 773. Large single-room enclosure. Upland Kamāka'ipō South. From Dixon and Major 1993.



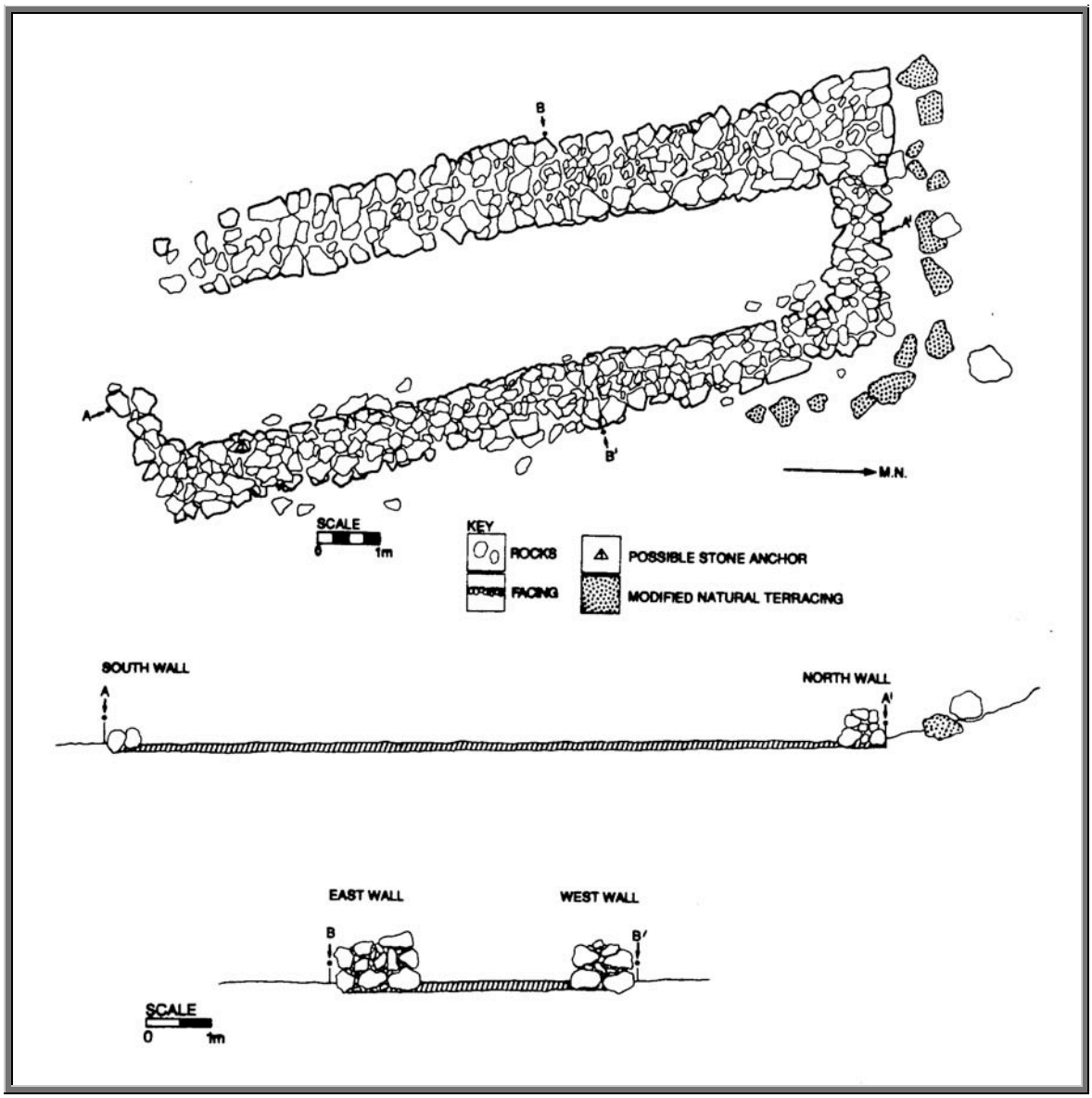
Site 775. Large multi-room enclosure. Upland Kamāka'ipō South. From Dixon and Major 1993.



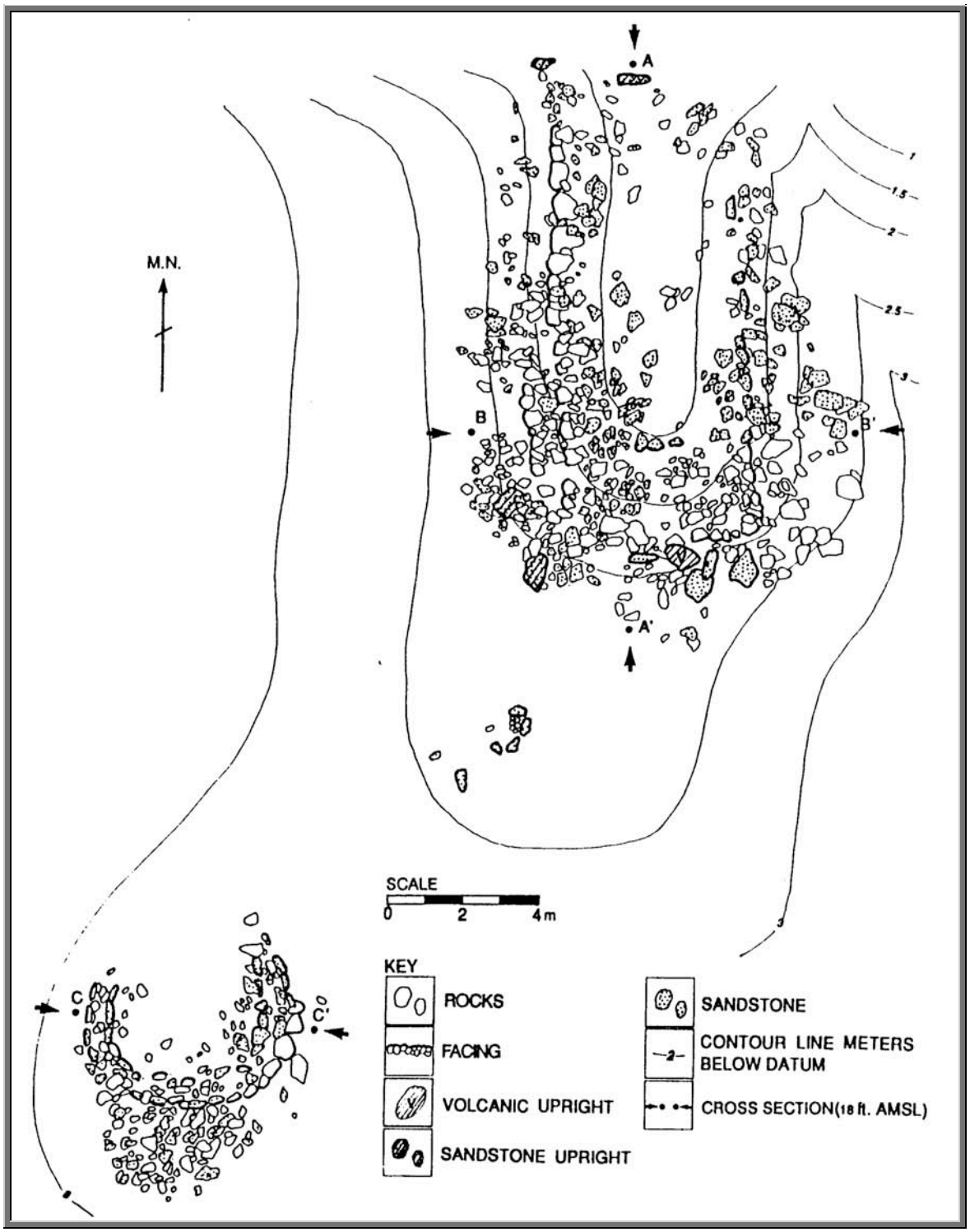
Site 1101. South shore platform koʻa. From Dixon and Major 1993.



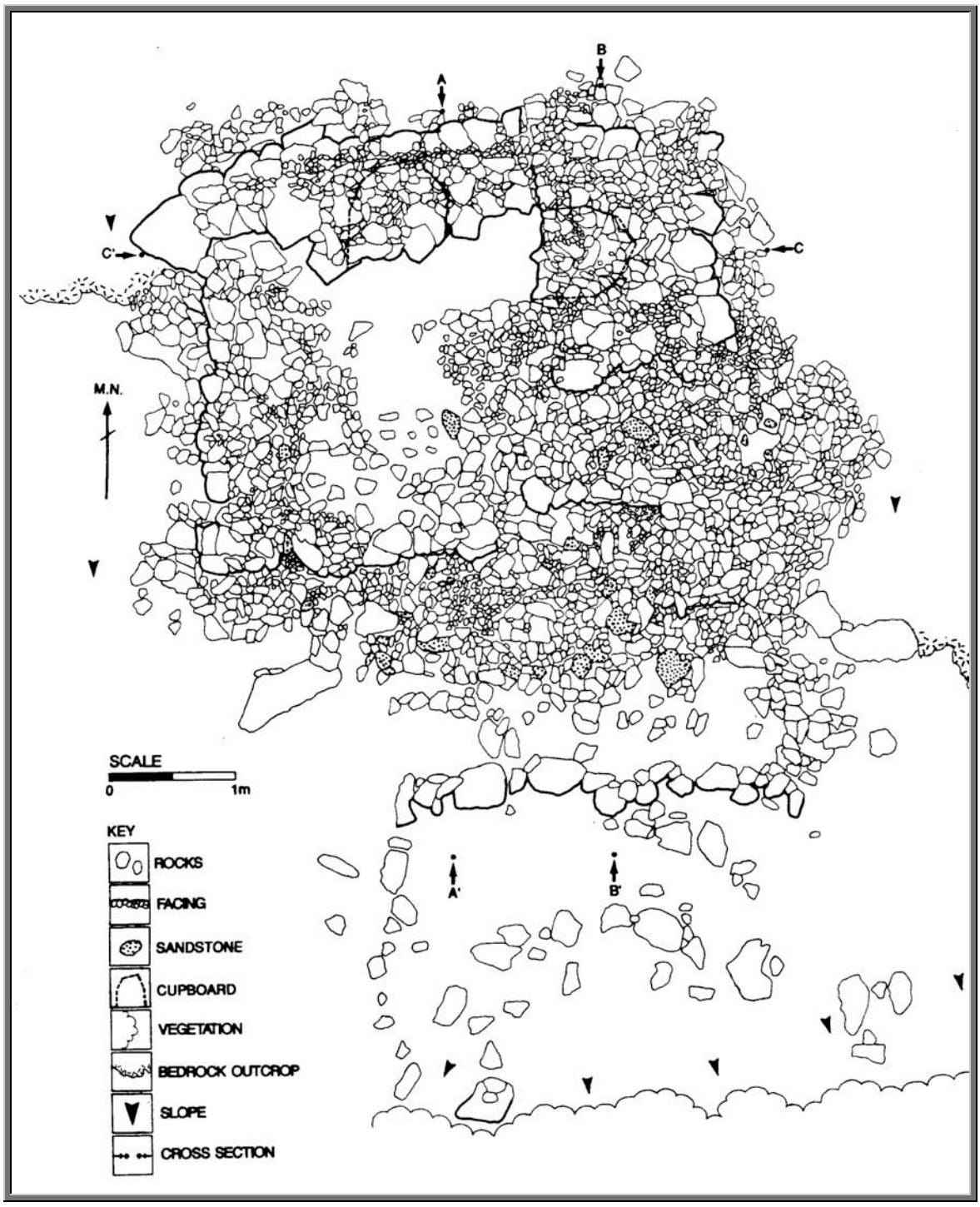
Site 1102. Coastal Pu'u Hakina platform with possible burial. From Dixon and Major 1993.



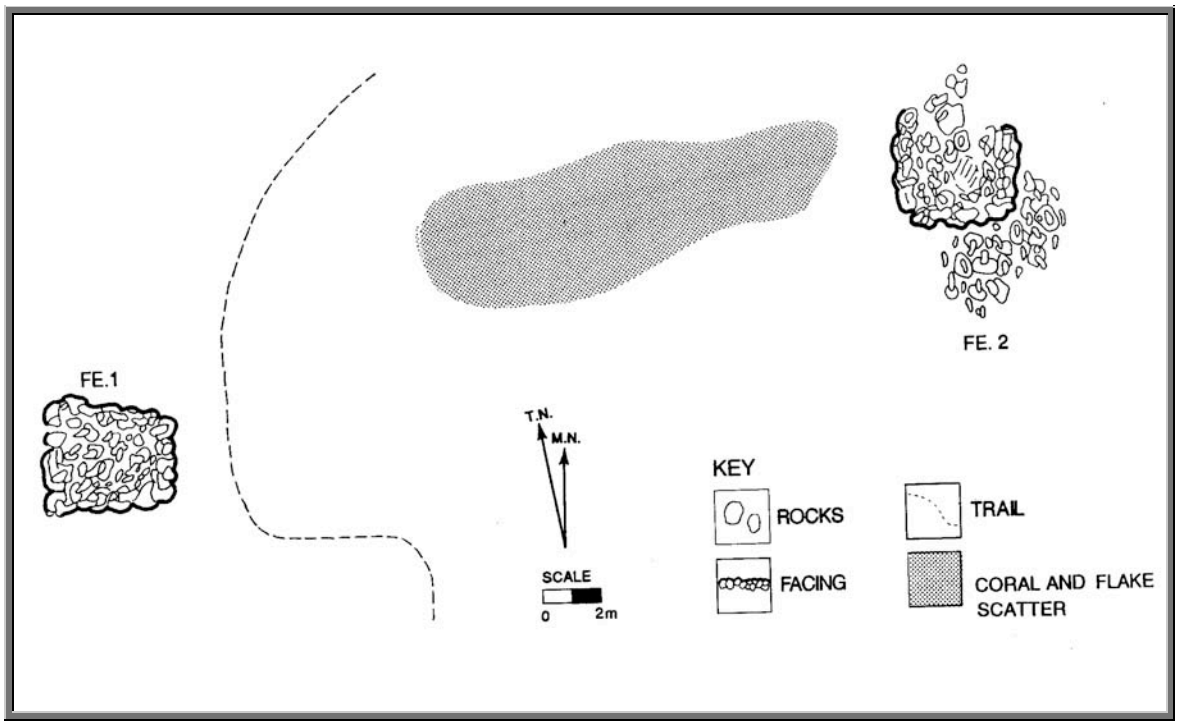
Site 1103. Coastal Pu'u Hakina canoe shed. From Dixon and Major 1993.



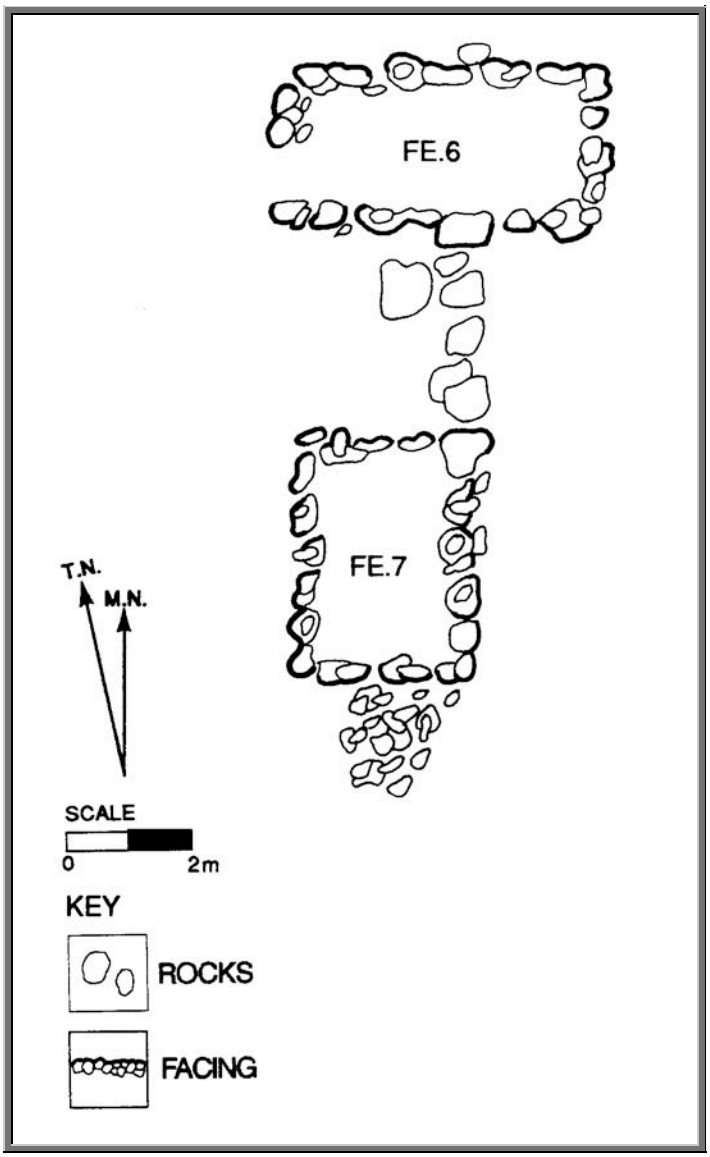
Site 1104. Kalalua Heiau at Coastal Pu'u Hakina. From Dixon and Major 1993.



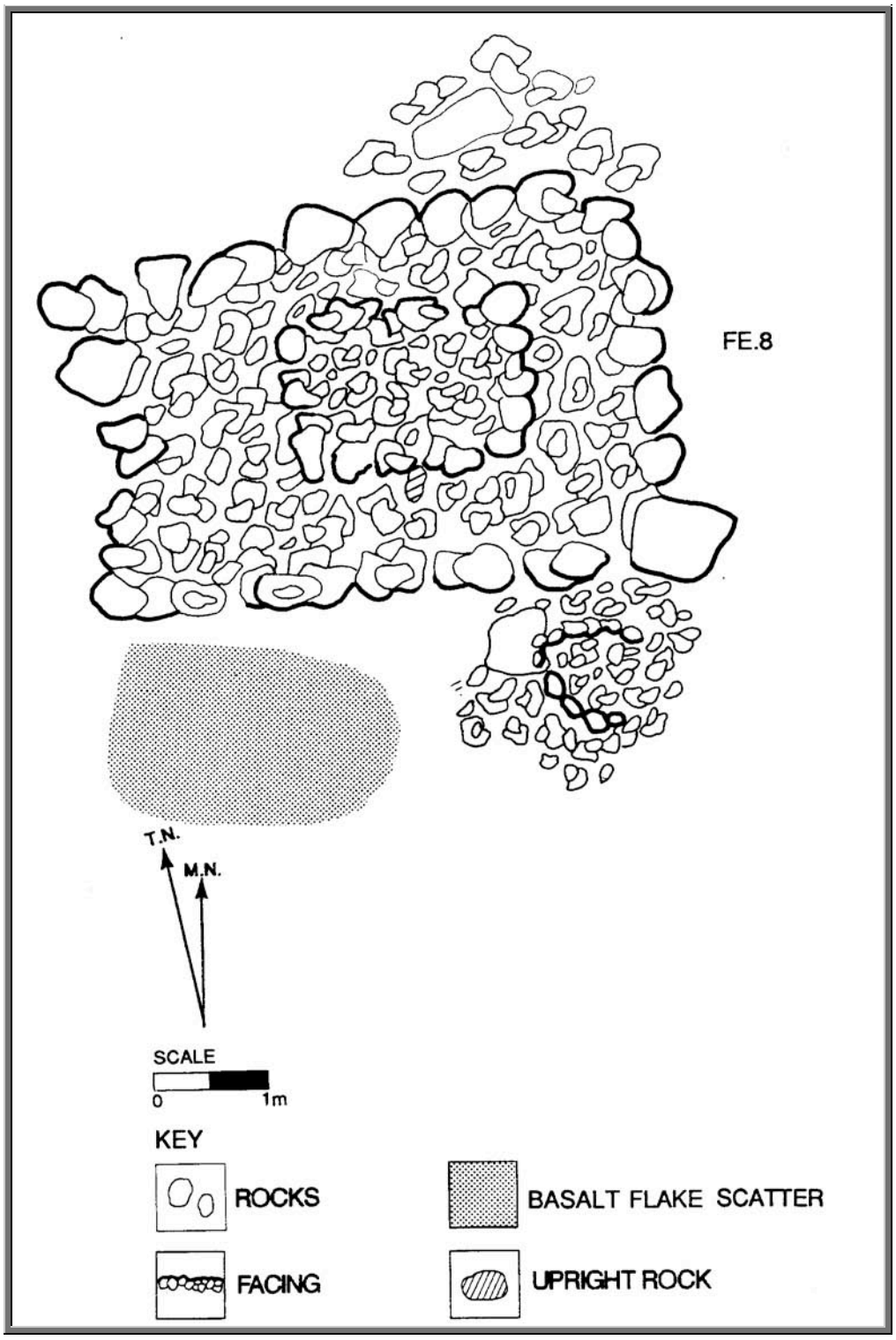
Site 1106. Coastal Pu'u Hakina heiau. From Dixon and Major 1993.



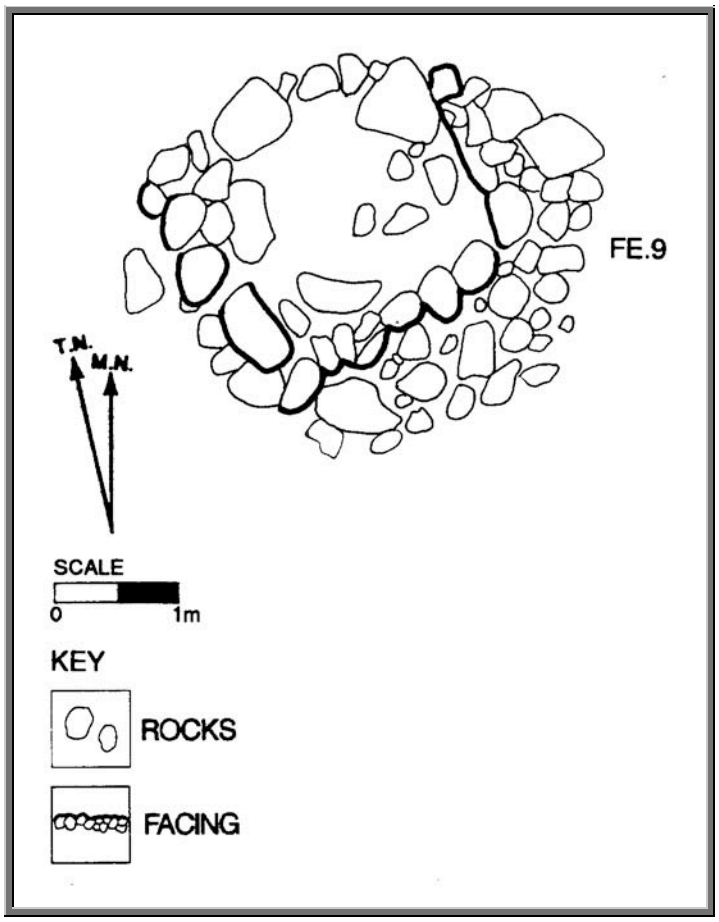
Site 1107, Features 1 and 2. Coastal Pu'u Hakina habitation complex. From Dixon and Major 1993.



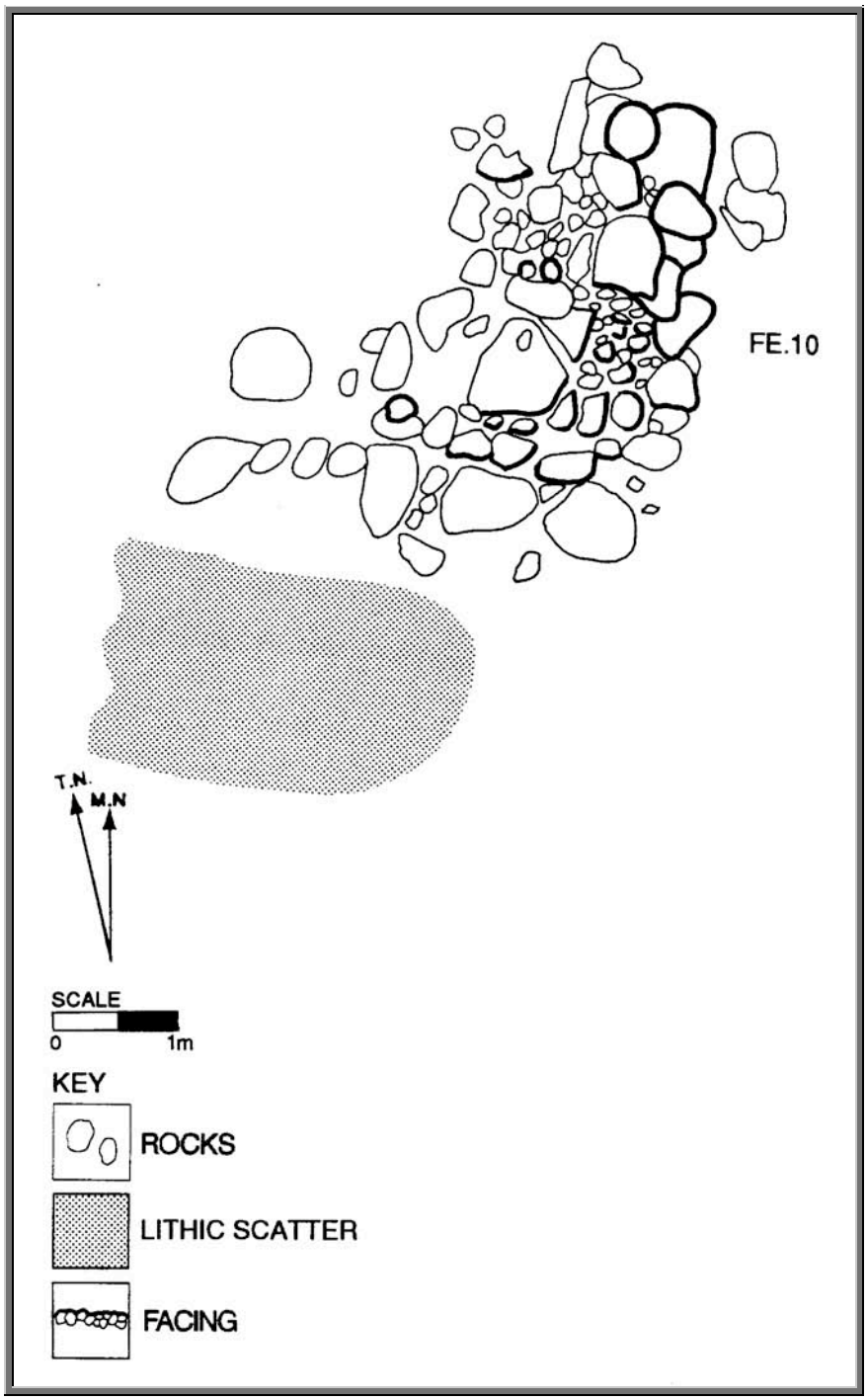
Site 1107, Feature 6 and 7 enclosures. Coastal Pu'u Hakina habitation complex. From Dixon and Major 1993.



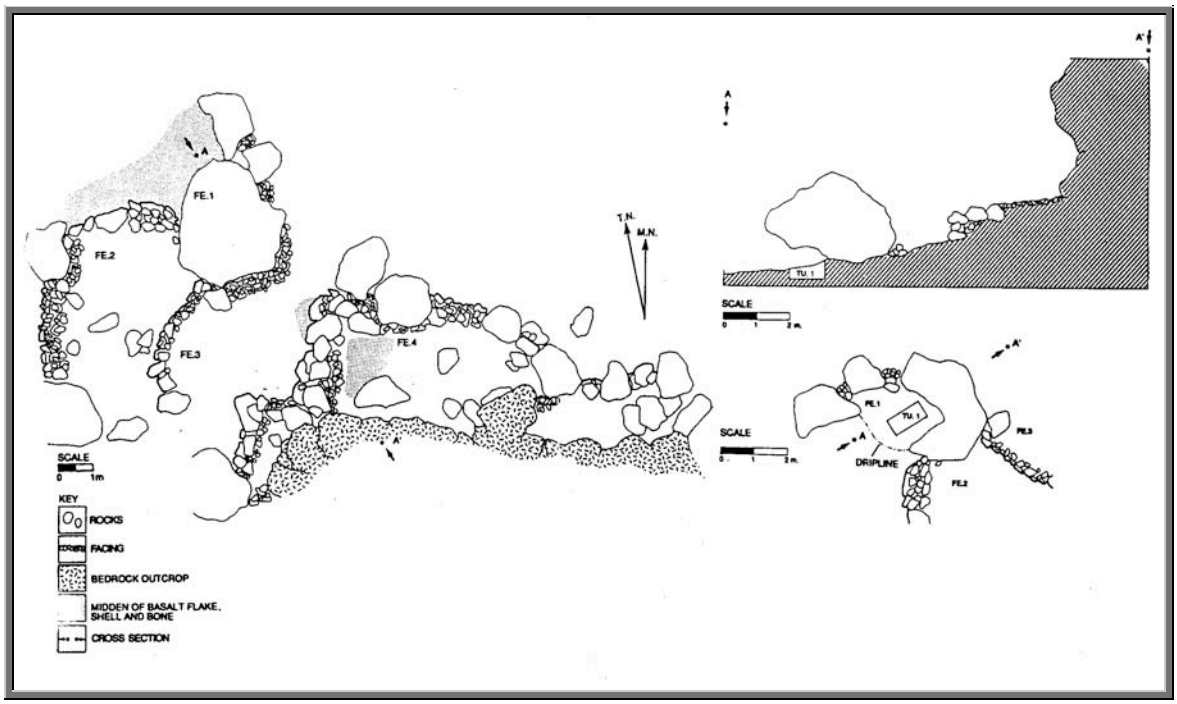
Site 1107, Feature 8 complex platform burial. Coastal Pu'u Hakina habitation complex. From Dixon and Major 1993.



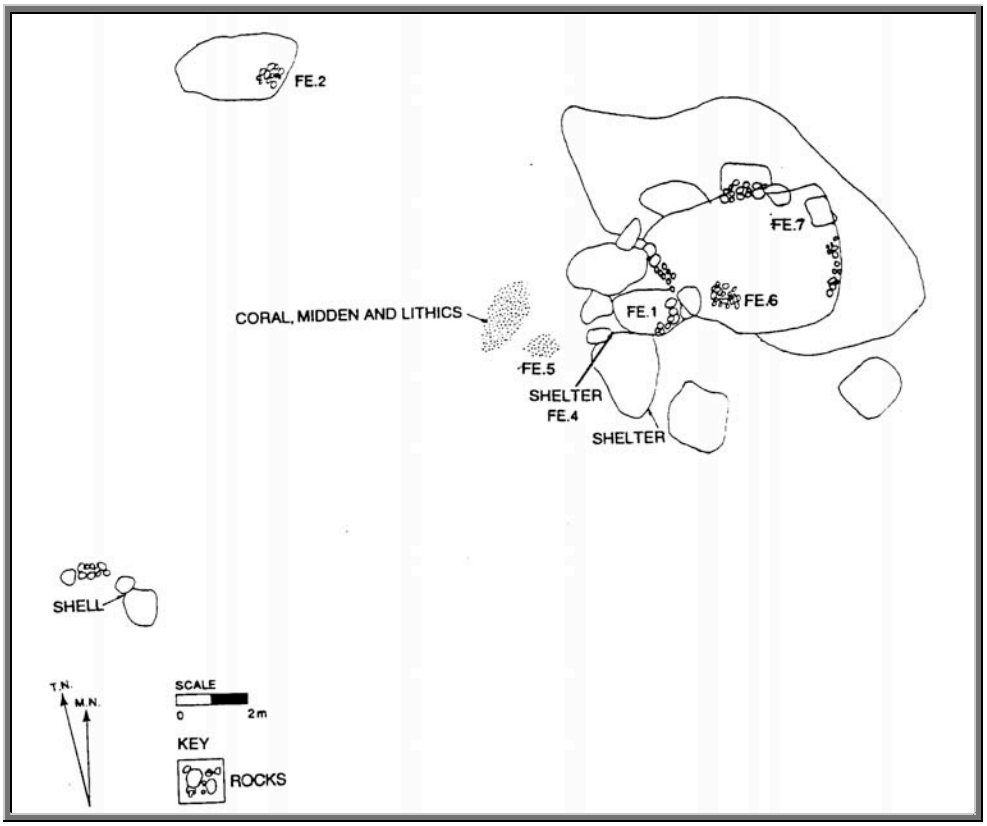
Site 1107, Feature 9 enclosure. Coastal Pu'u Hakina habitation complex. From Dixon and Major 1993.



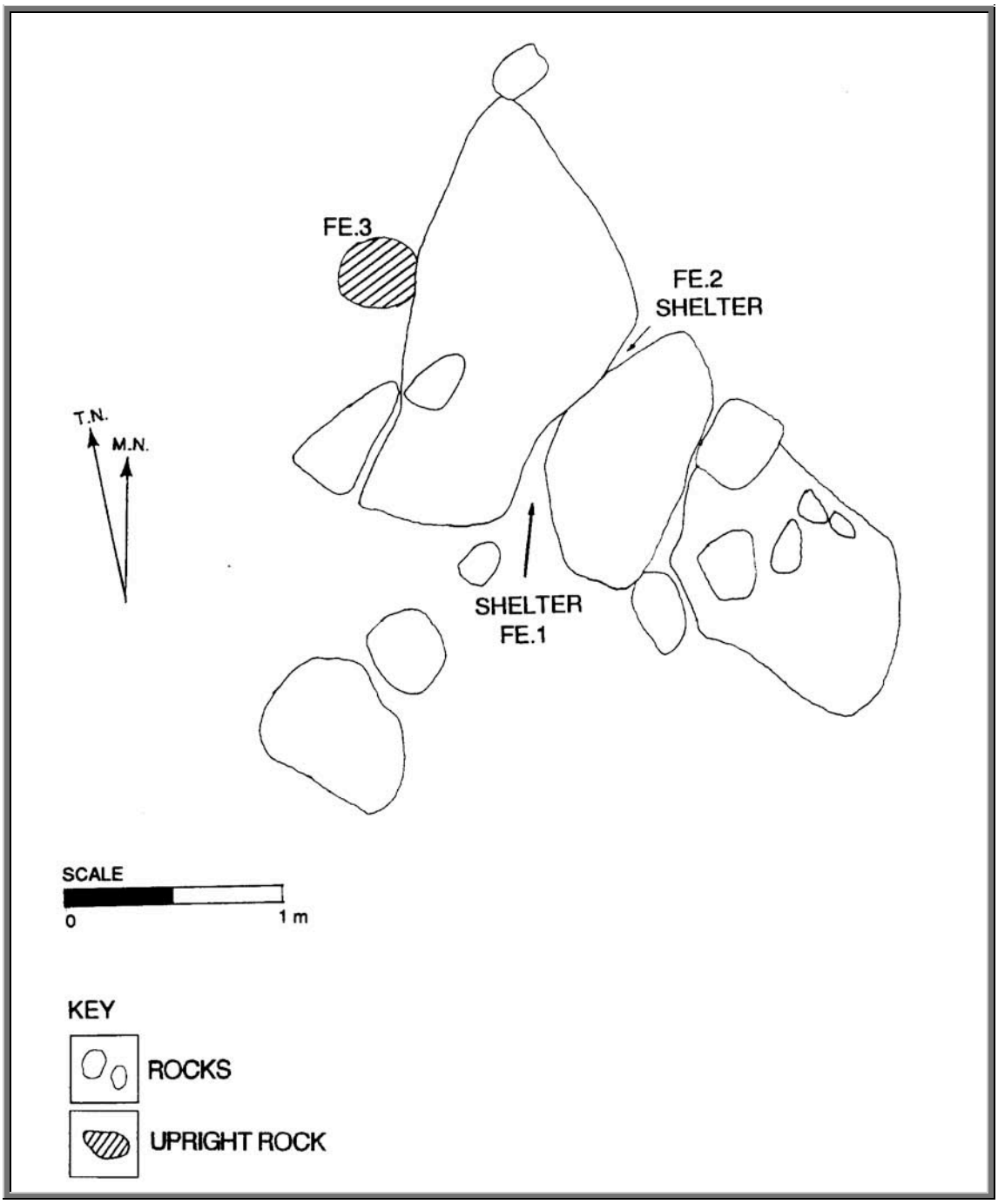
Site 1107, Feature 10 mound (possible burial. Coastal Pu'u Hakina habitation complex. From Dixon and Major 1993.



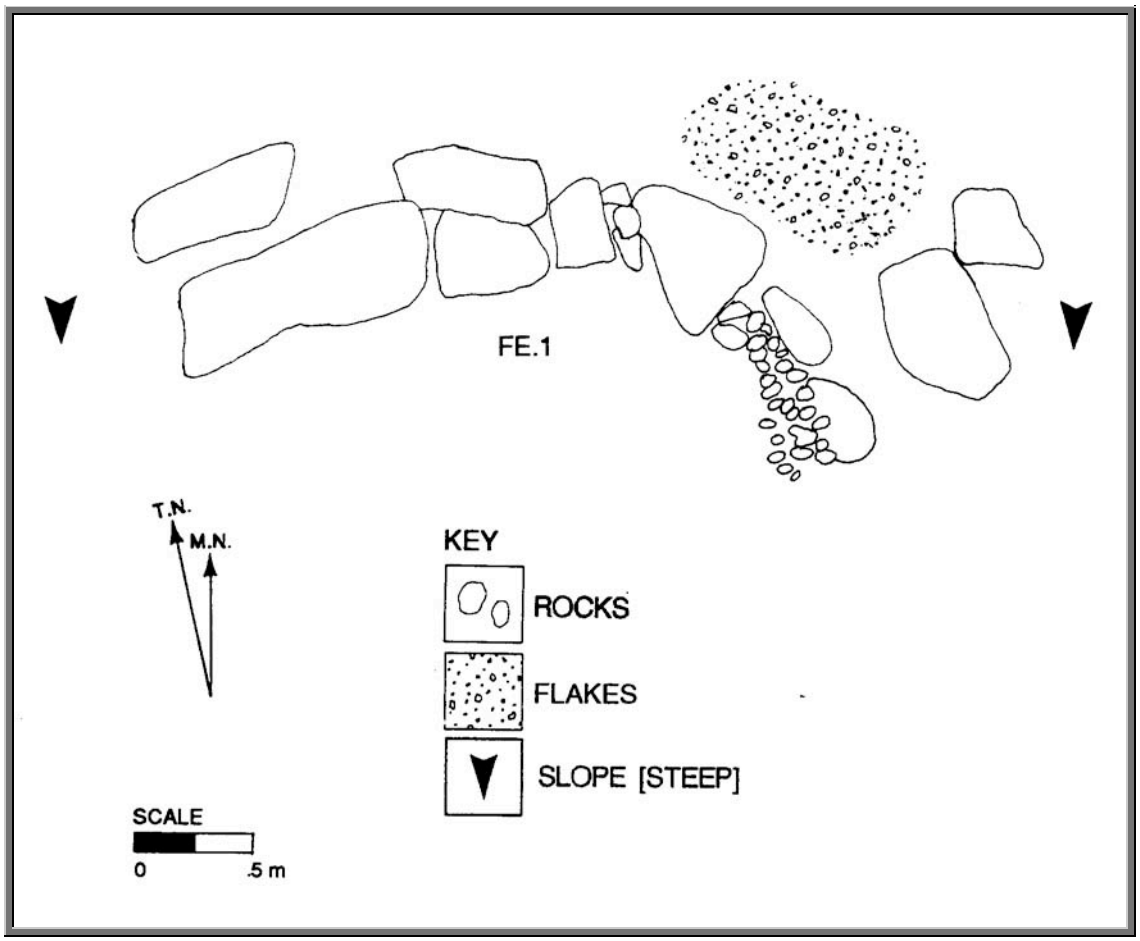
Site 1112. Lā'au Point Modified Outcrops and Overhang shelters. From Dixon and Major 1993.



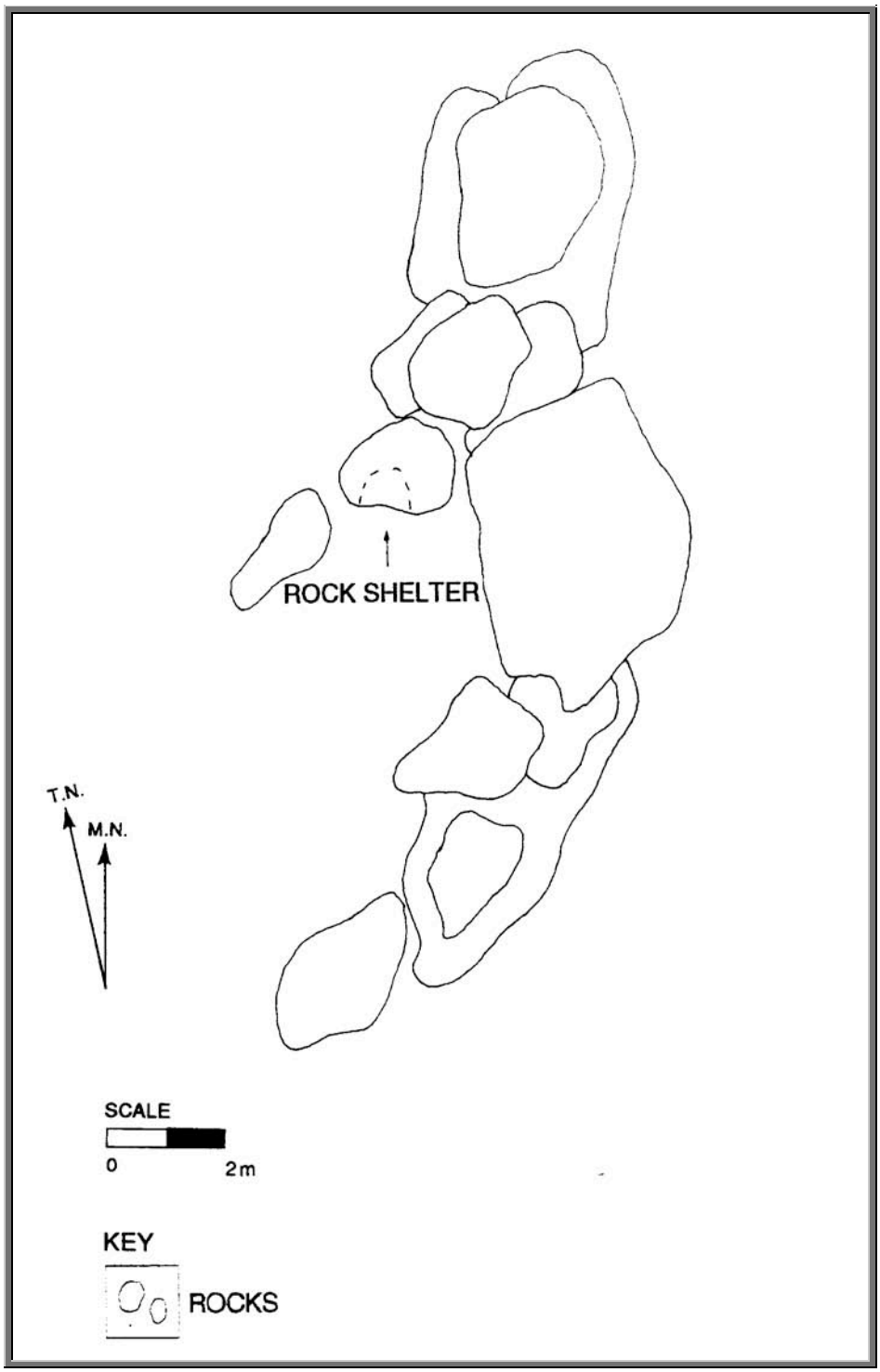
Site 1119. Lā'au Point Modified Outcrops and Overhang shelters. From Dixon and Major 1993.



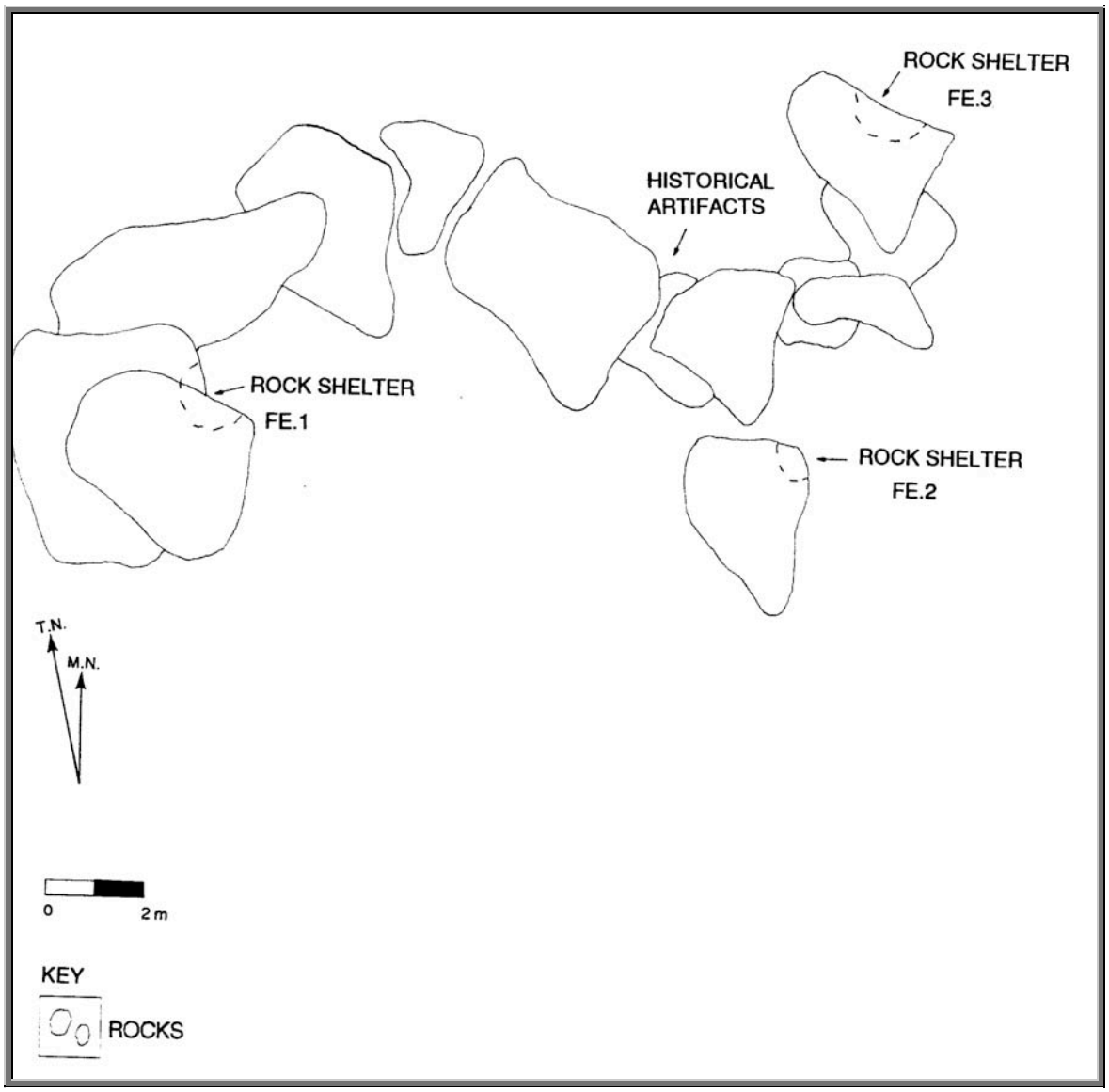
Site 1120. Lā'au Point Modified Outcrops and Overhang shelters. From Dixon and Major 1993.



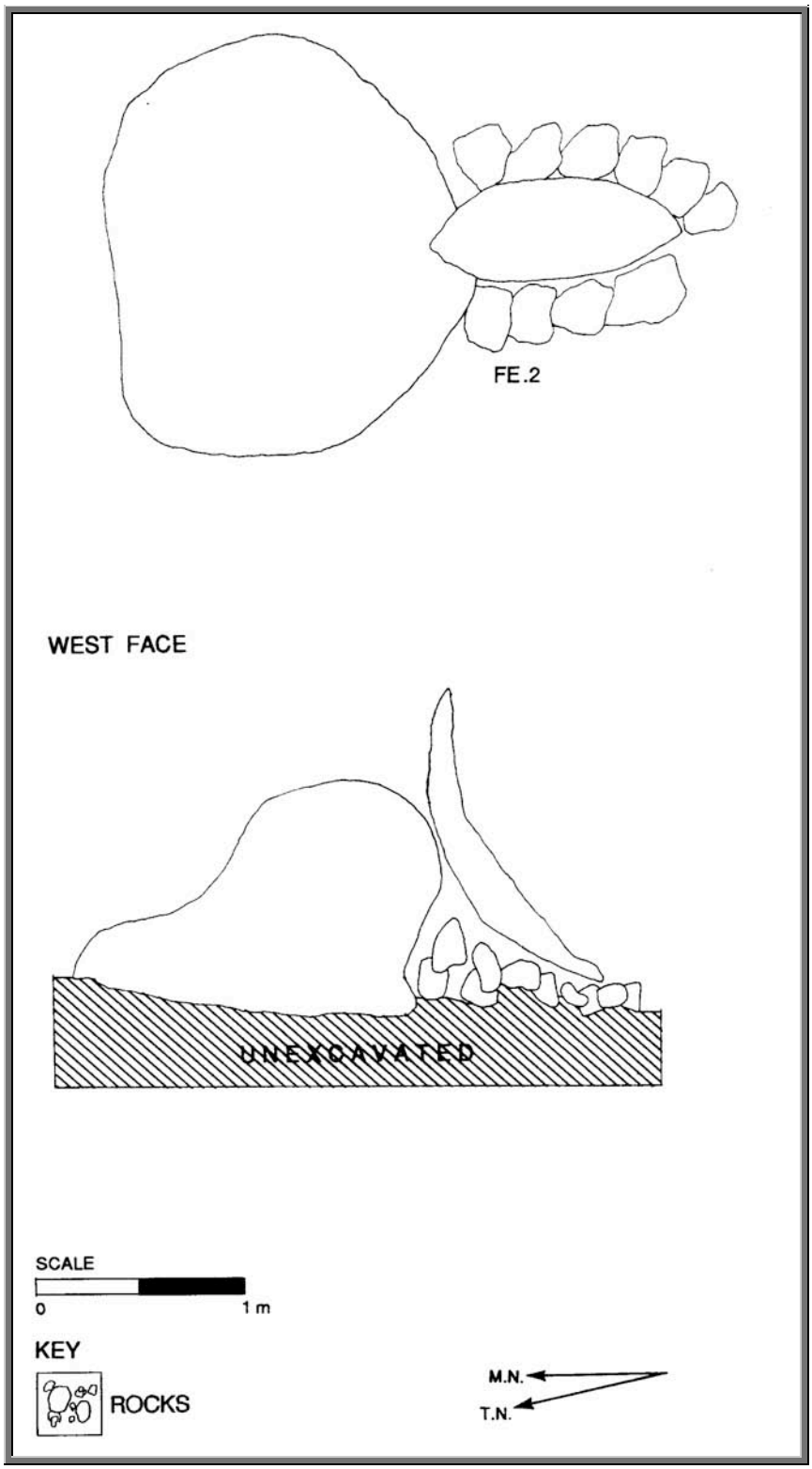
Site 1122. Coastal Keawakalani Lithic work area. From Dixon and Major 1993.



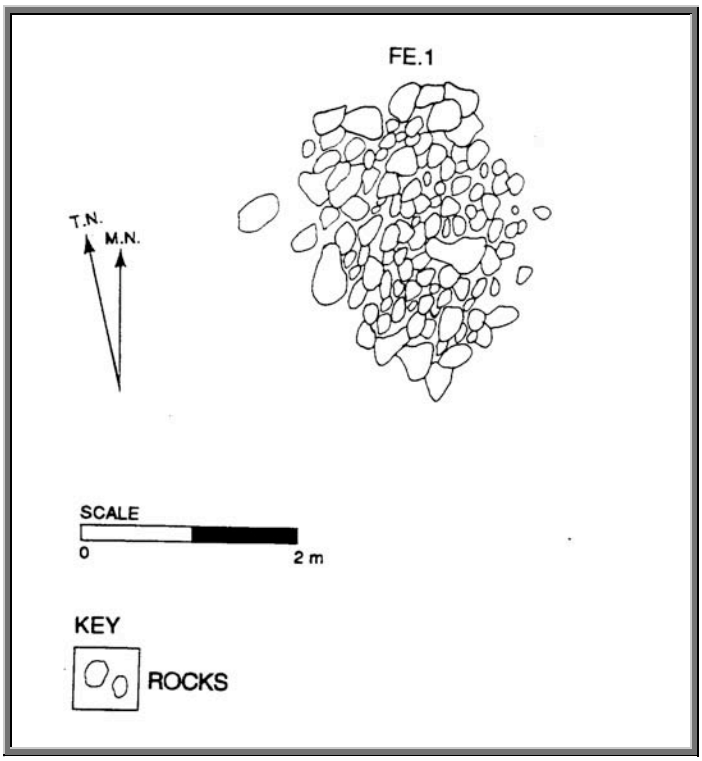
Site 1125. Coastal Keawakalani. Overhang shelter. From Dixon and Major 1993.



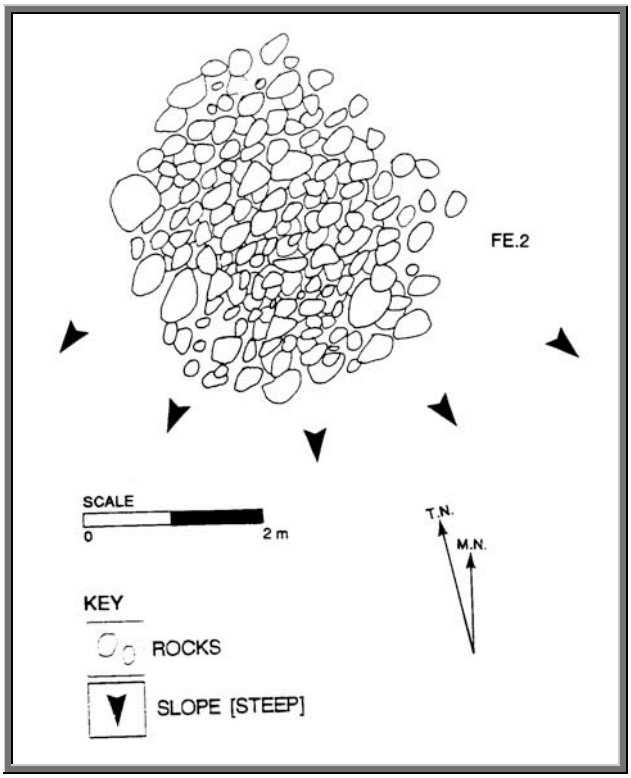
Site 1126. Coastal Keawakalani. Overhang shelters. From Dixon and Major 1993.



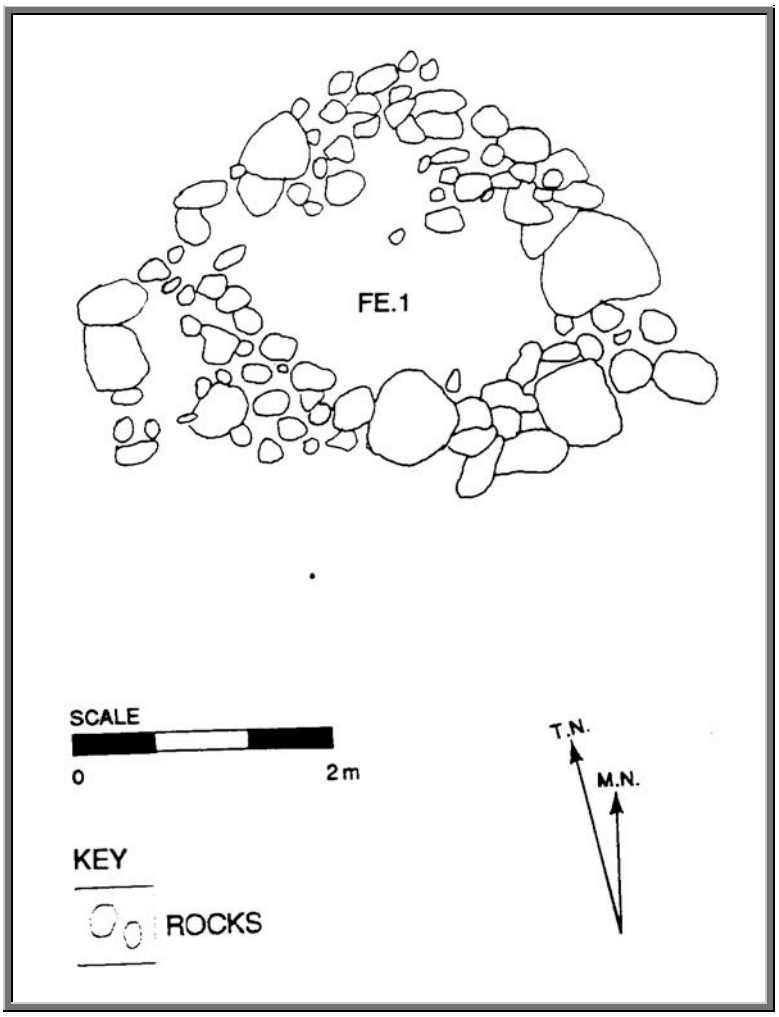
Site 1127, Feature 2. Mauka Pookohola. Possible birthing feature. From Dixon and Major 1993.



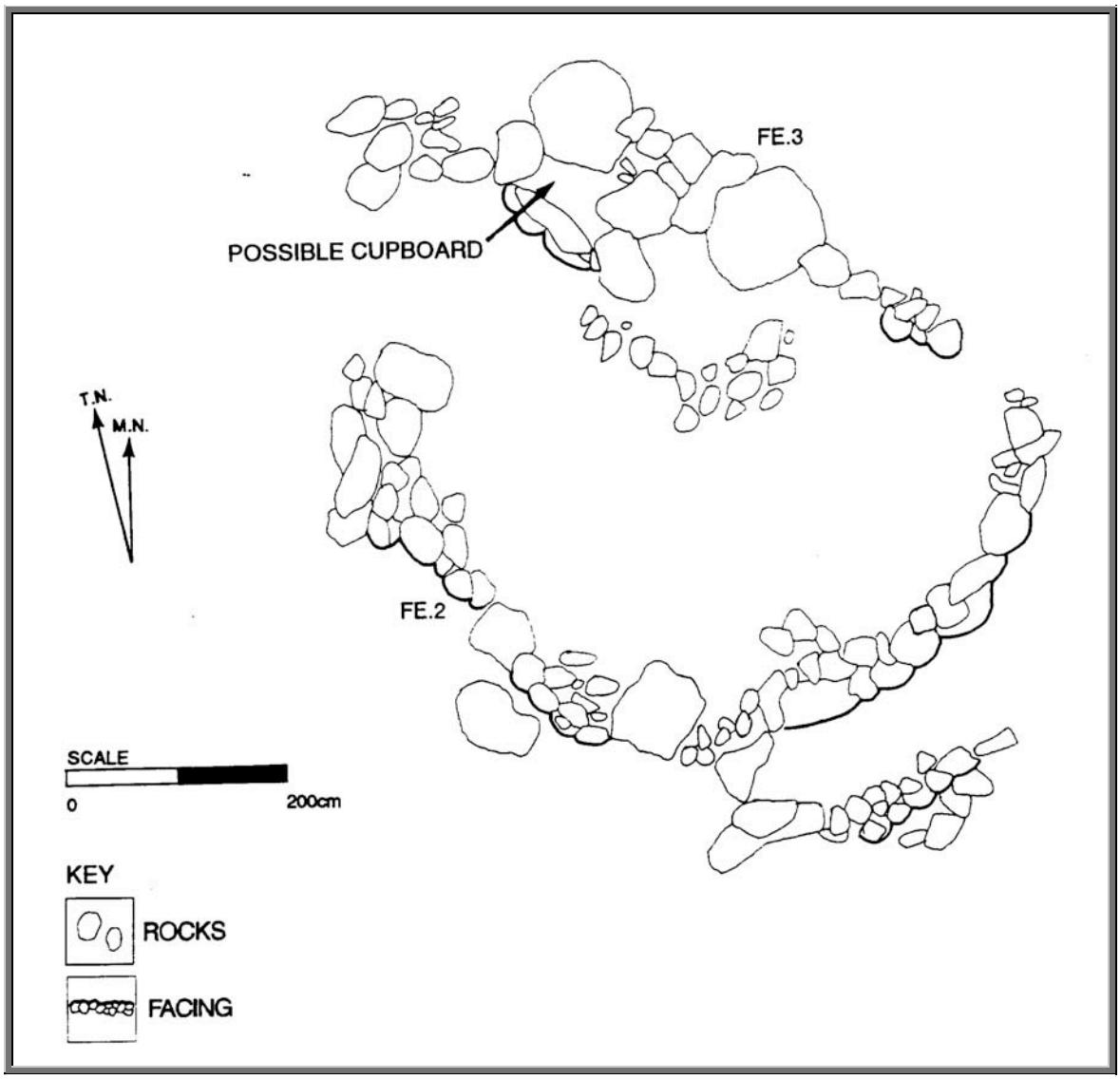
Site 1143. Possible burial mound. Pu'u Hakina. From Dixon and Major 1993.



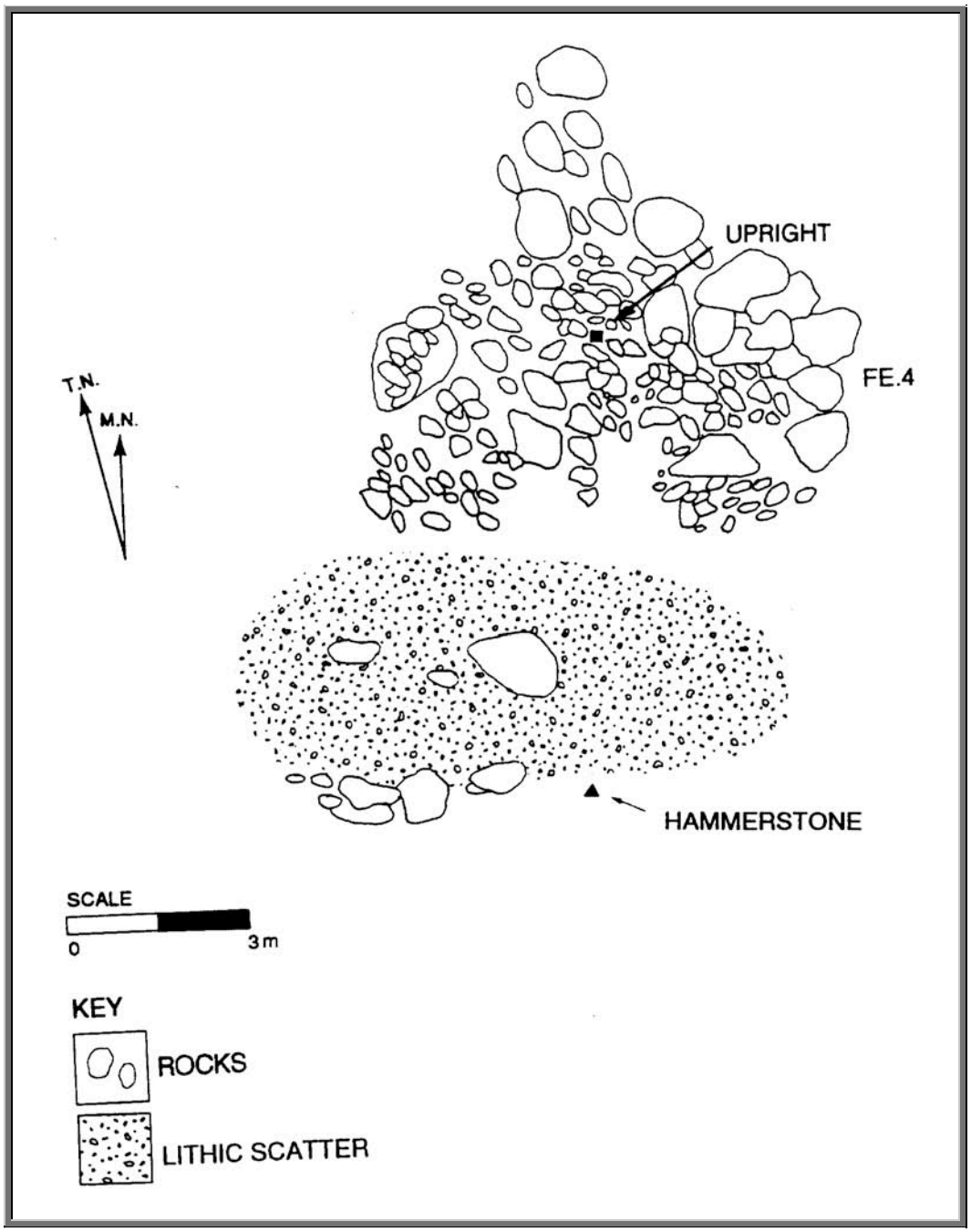
Site 1144. Possible burial mound. Pu'u Hakina. From Dixon and Major 1993.



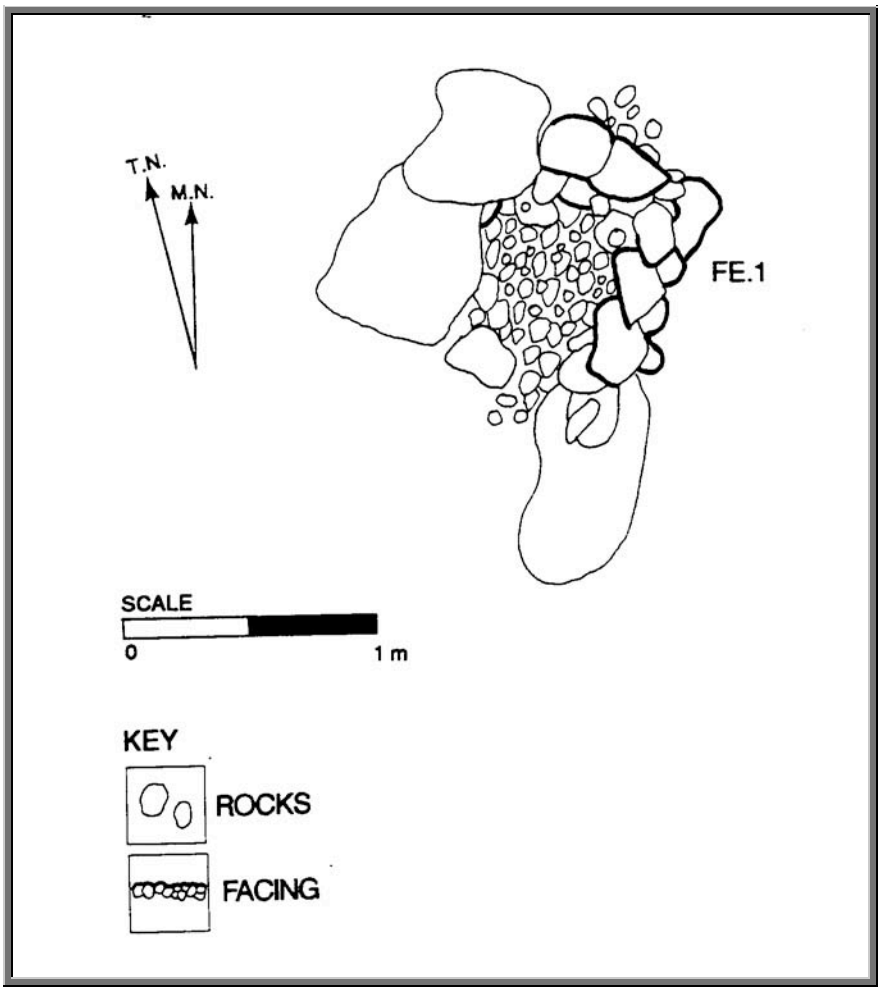
Site 1147, Feature 1. Coastal enclosure west of Hakina Gulch. From Dixon and Major 1993.



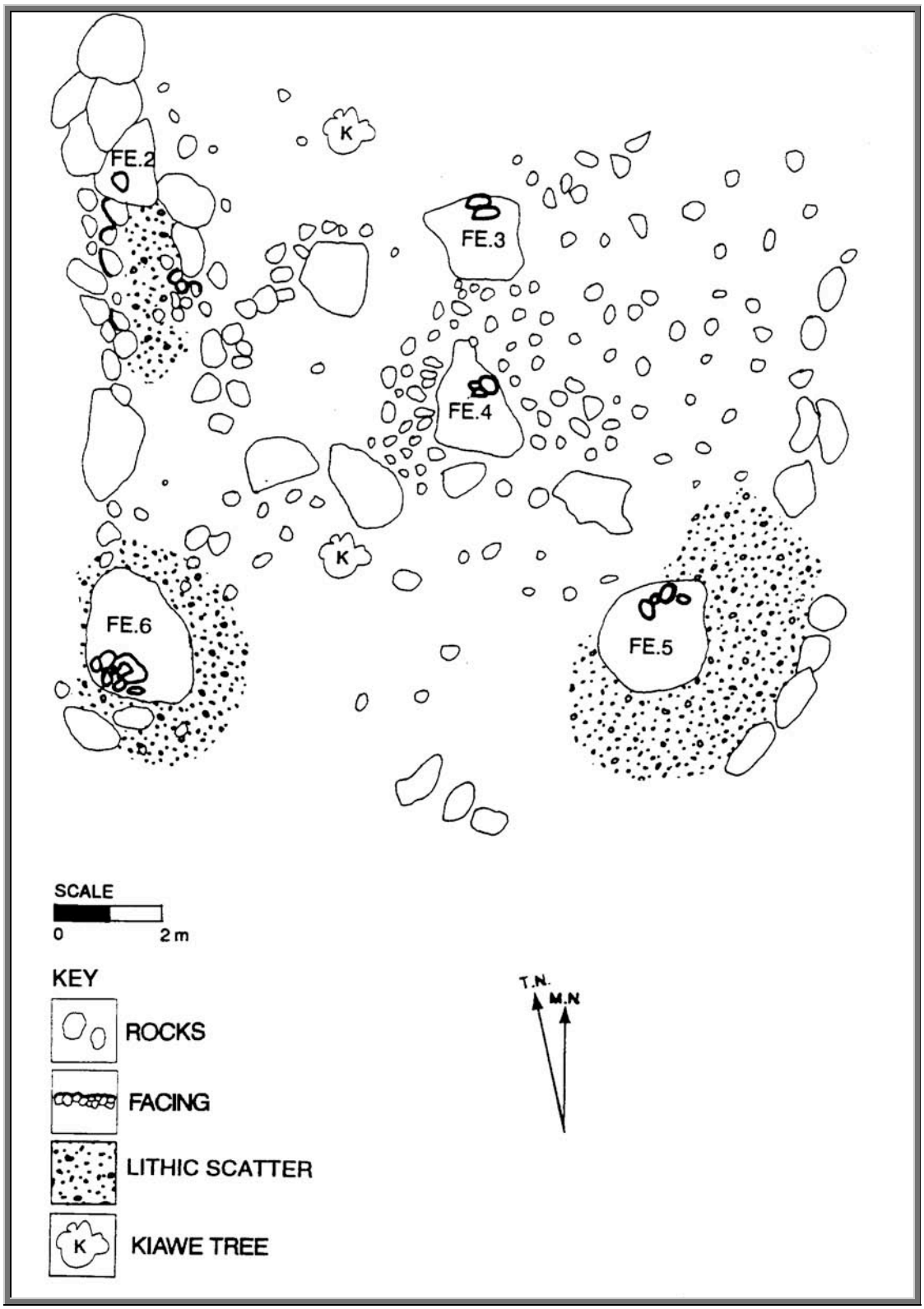
Site 1147, Feature 3. Coastal terrace and cupboard west of Hakina Gulch. From Dixon and Major 1993.



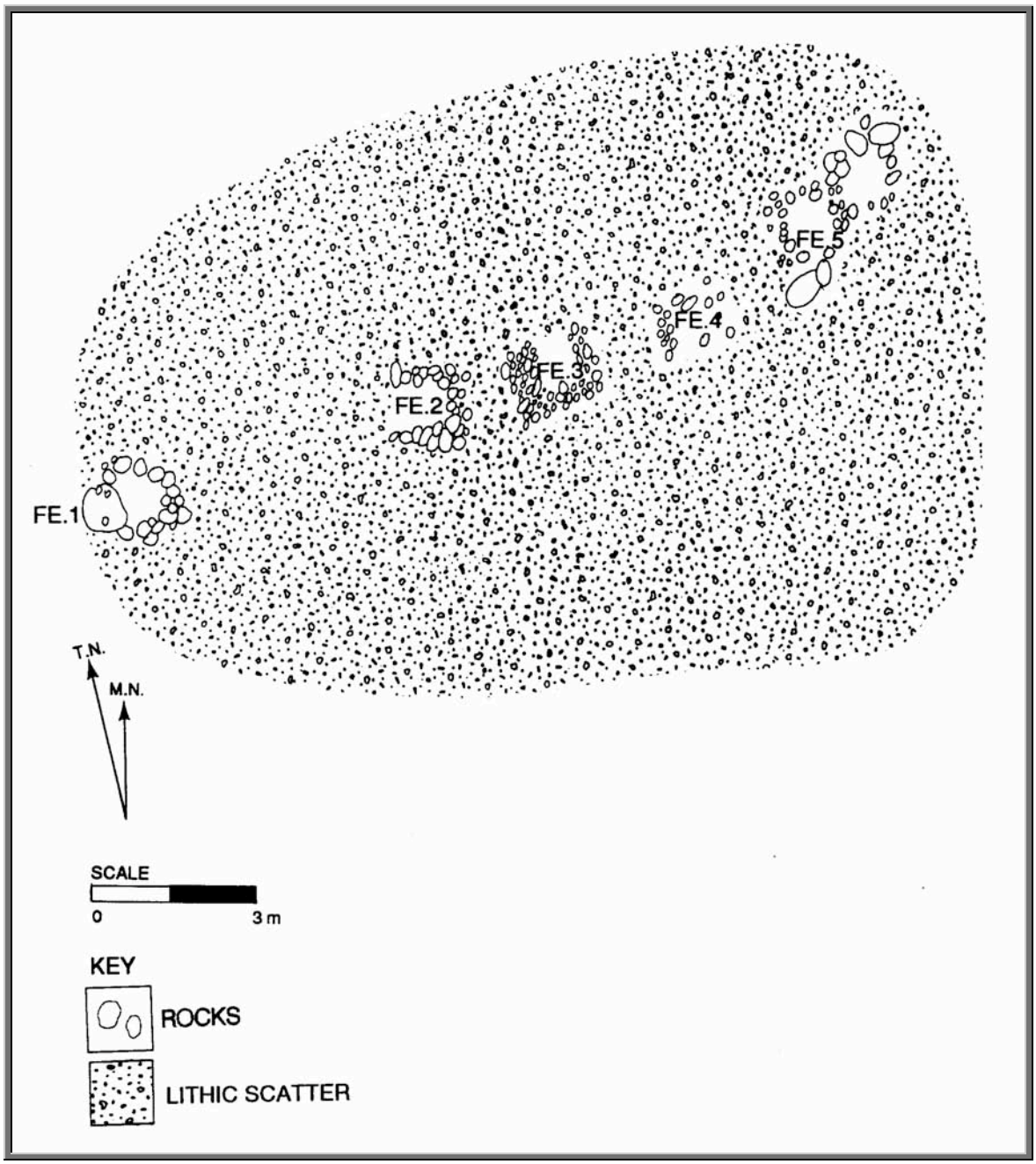
Site 1147, Feature 4. Coastal mound (possible shrine or burial) and lithic work area west of Hakina Gulch. From Dixon and Major 1993.



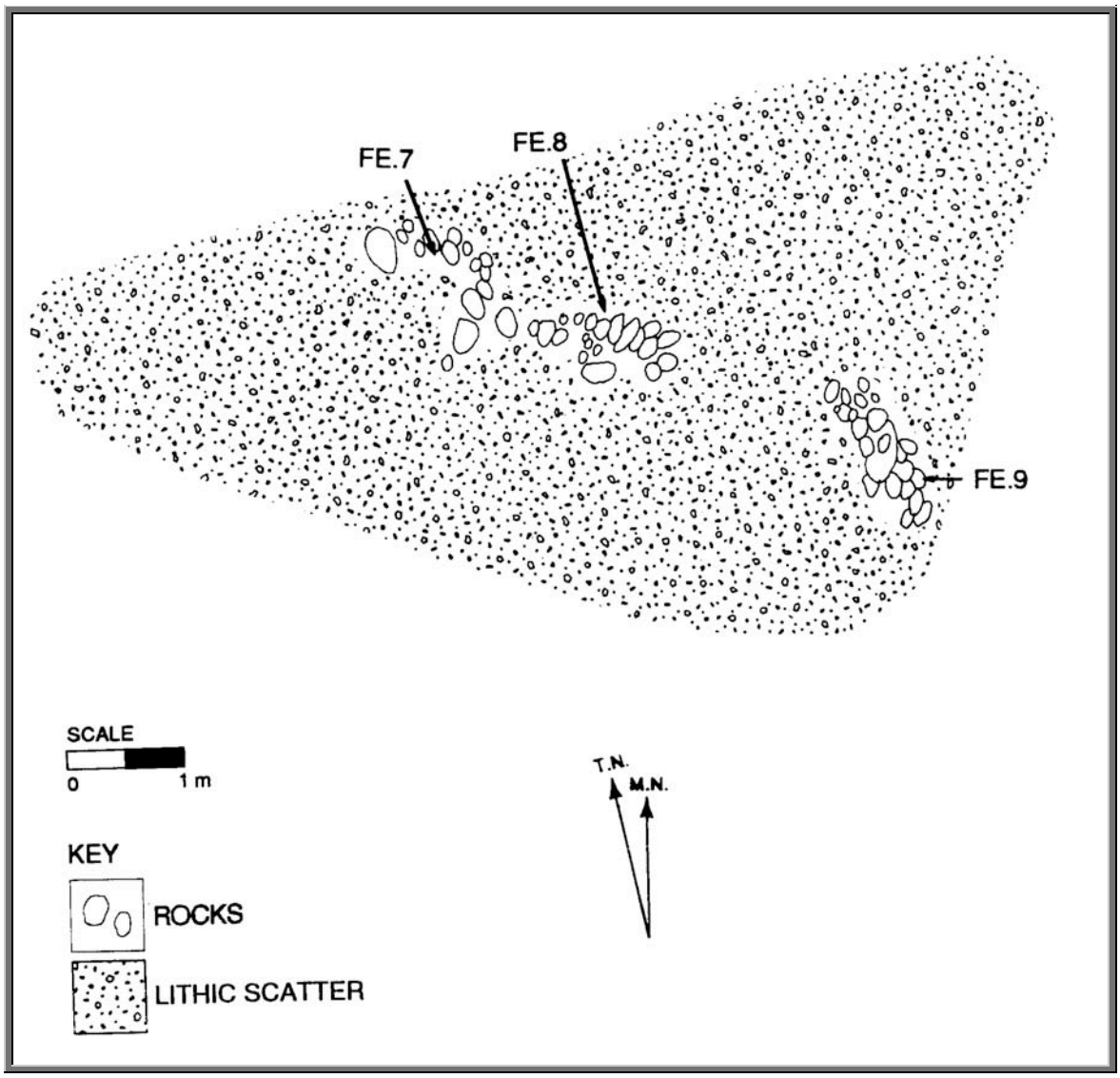
Site 1150, Feature 1. Koʻa shrine west of Hakina Gulch. From Dixon and Major 1993.



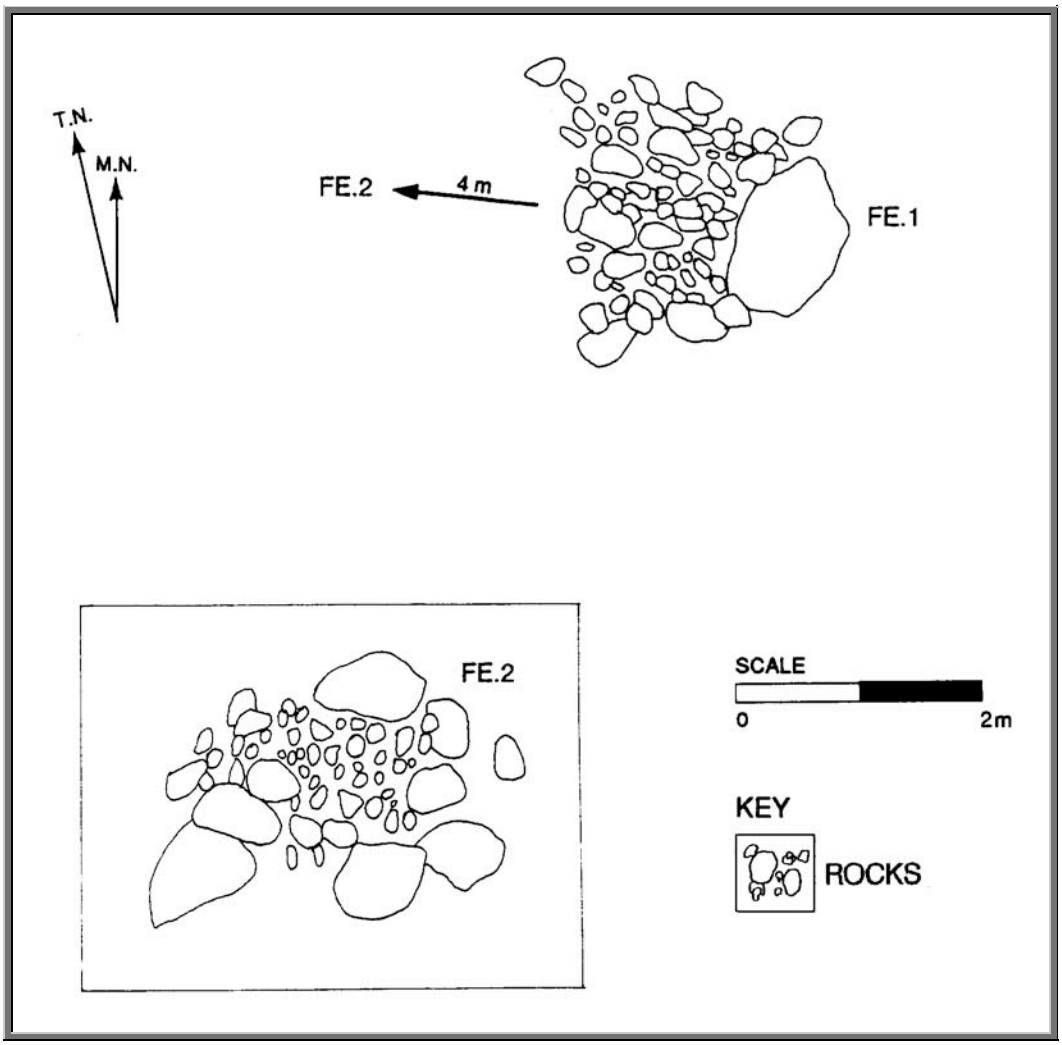
Site 1150, Features 2 – 6. Cairns and lithic work area west of Hakina Gulch. From Dixon and Major 1993.



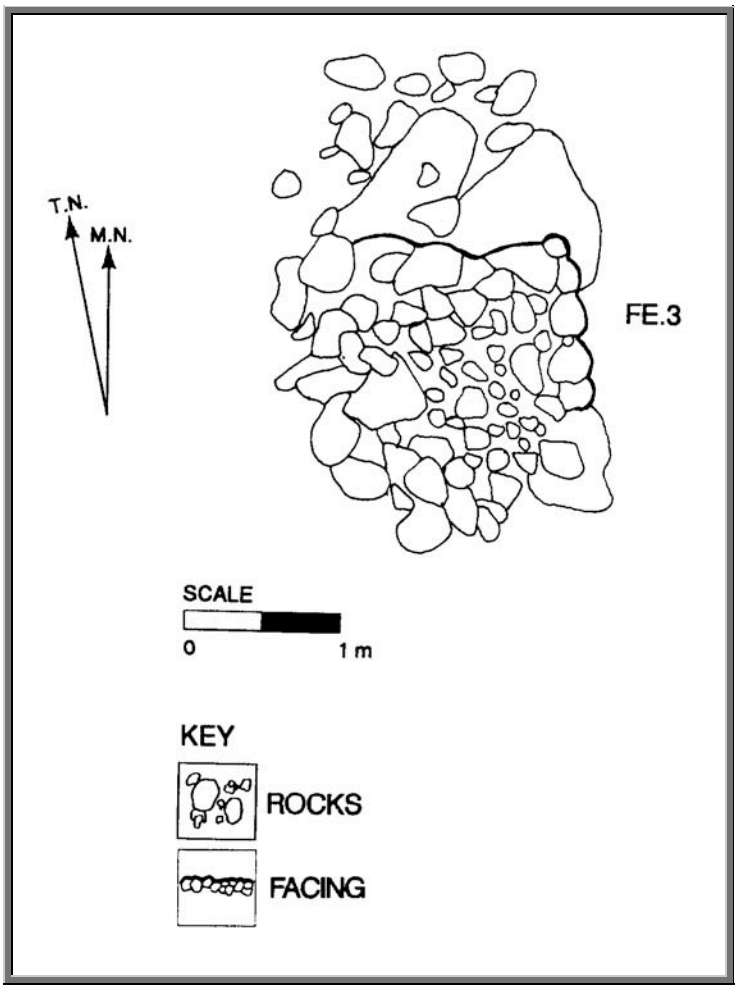
Site 1151, Features 1–6. Coastal ridge lithic work area at Pu'u Hakina. From Dixon and Major 1993.



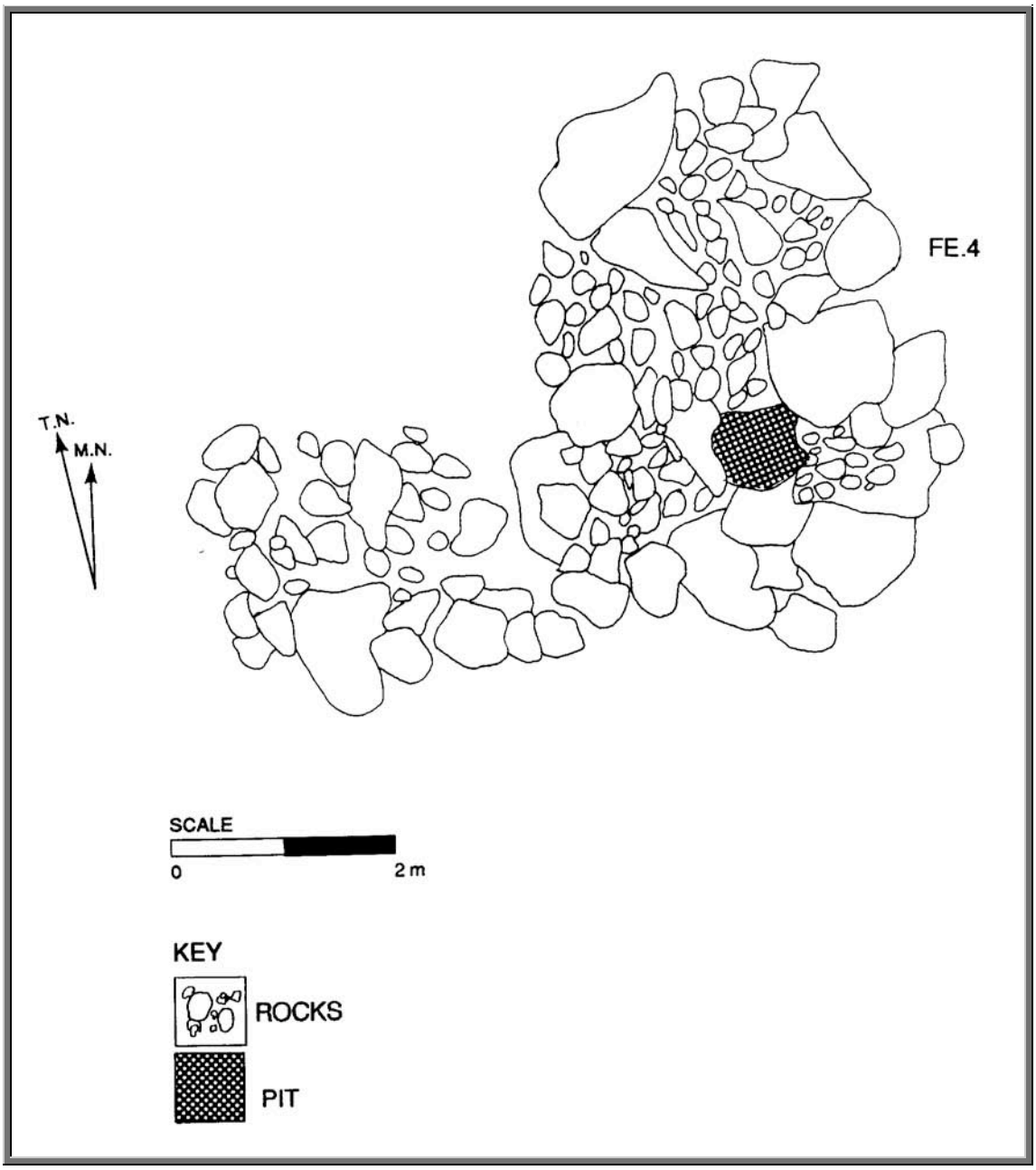
Site 1151, Features 7-9. Coastal ridge lithic work area at Pu'u Hakina. From Dixon and Major 1993.



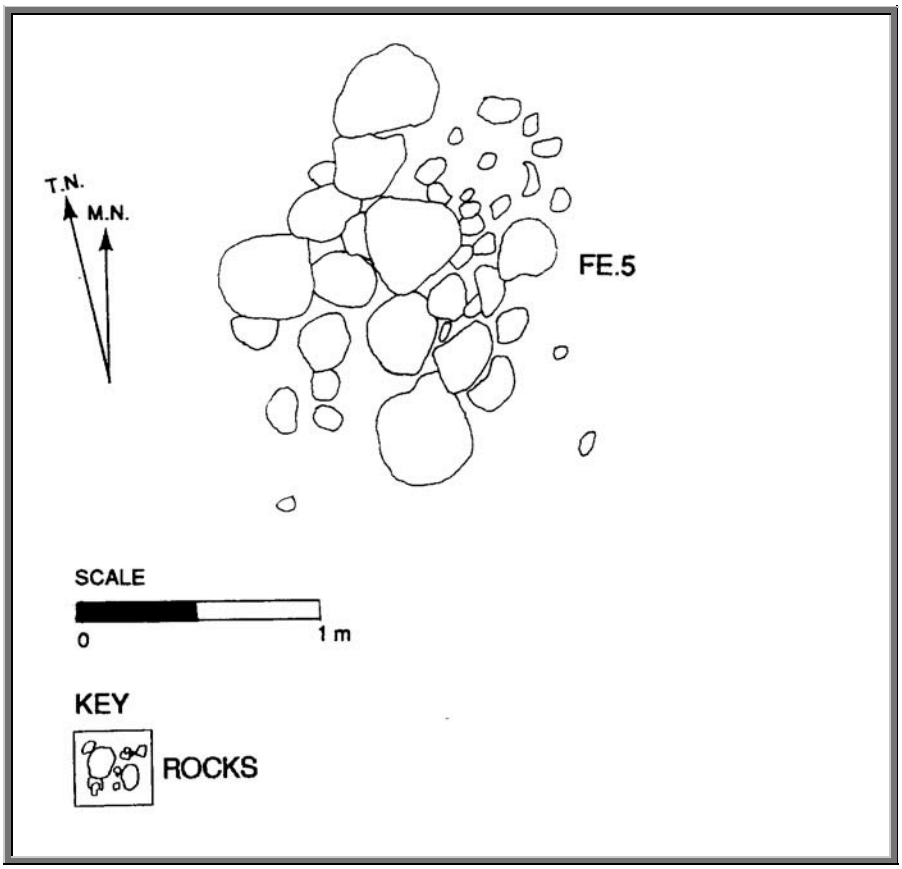
Site 1152, Features 1–2. Possible burial mounds, coastal Pu'u Hakina. From Dixon and Major 1993.



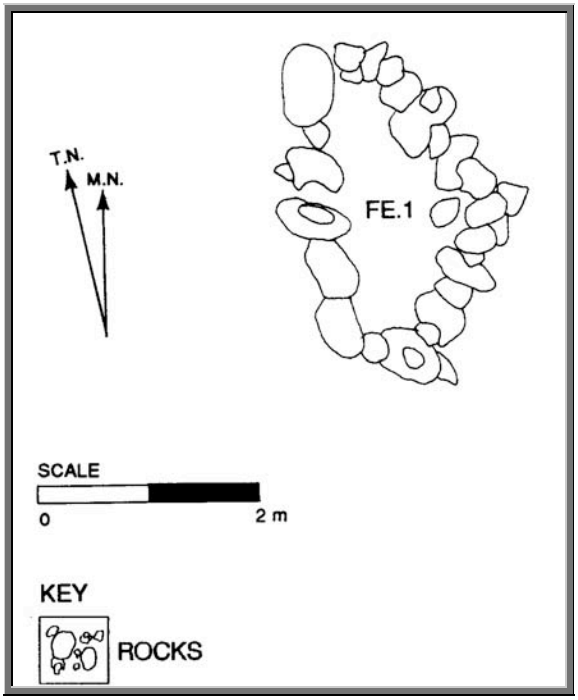
Site 1152, Feature 3. Coastal ridge platform burial at Pu'u Hakina. From Dixon and Major 1993.



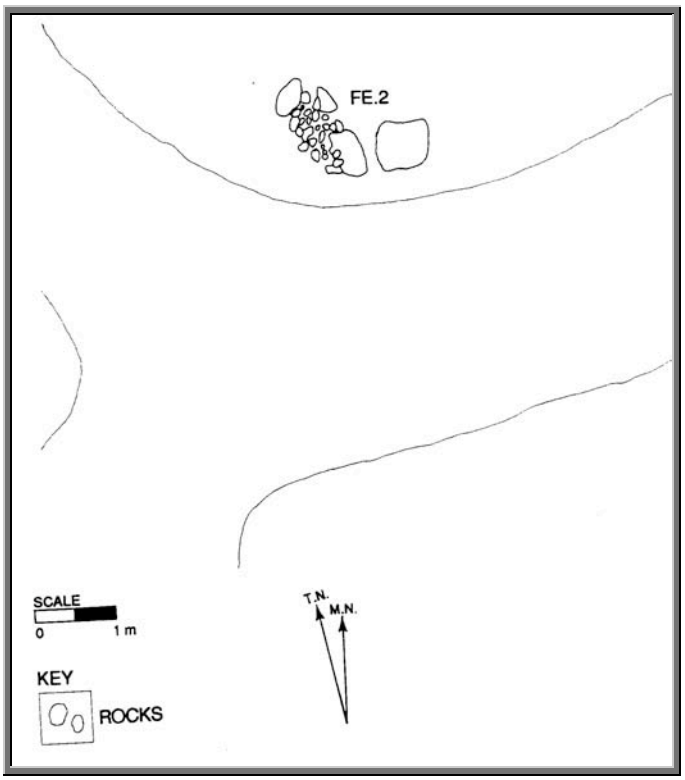
Site 1152, Feature 4. Coastal ridge koʻa at Puʻu Hakina. From Dixon and Major 1993.



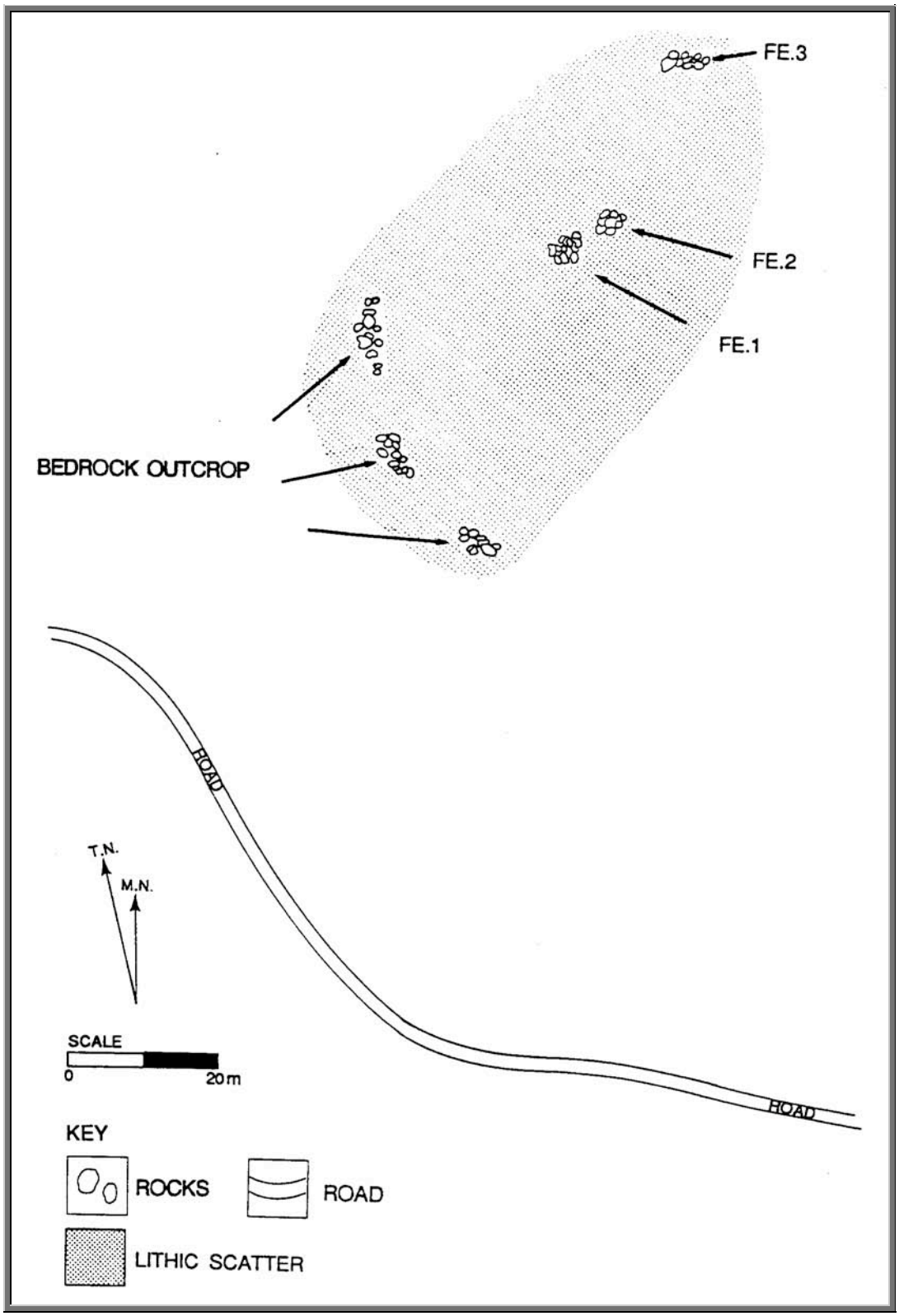
Site 1152, Feature 5. Coastal ridge non-burial mound at Puʻu Hakina. From Dixon and Major 1993.



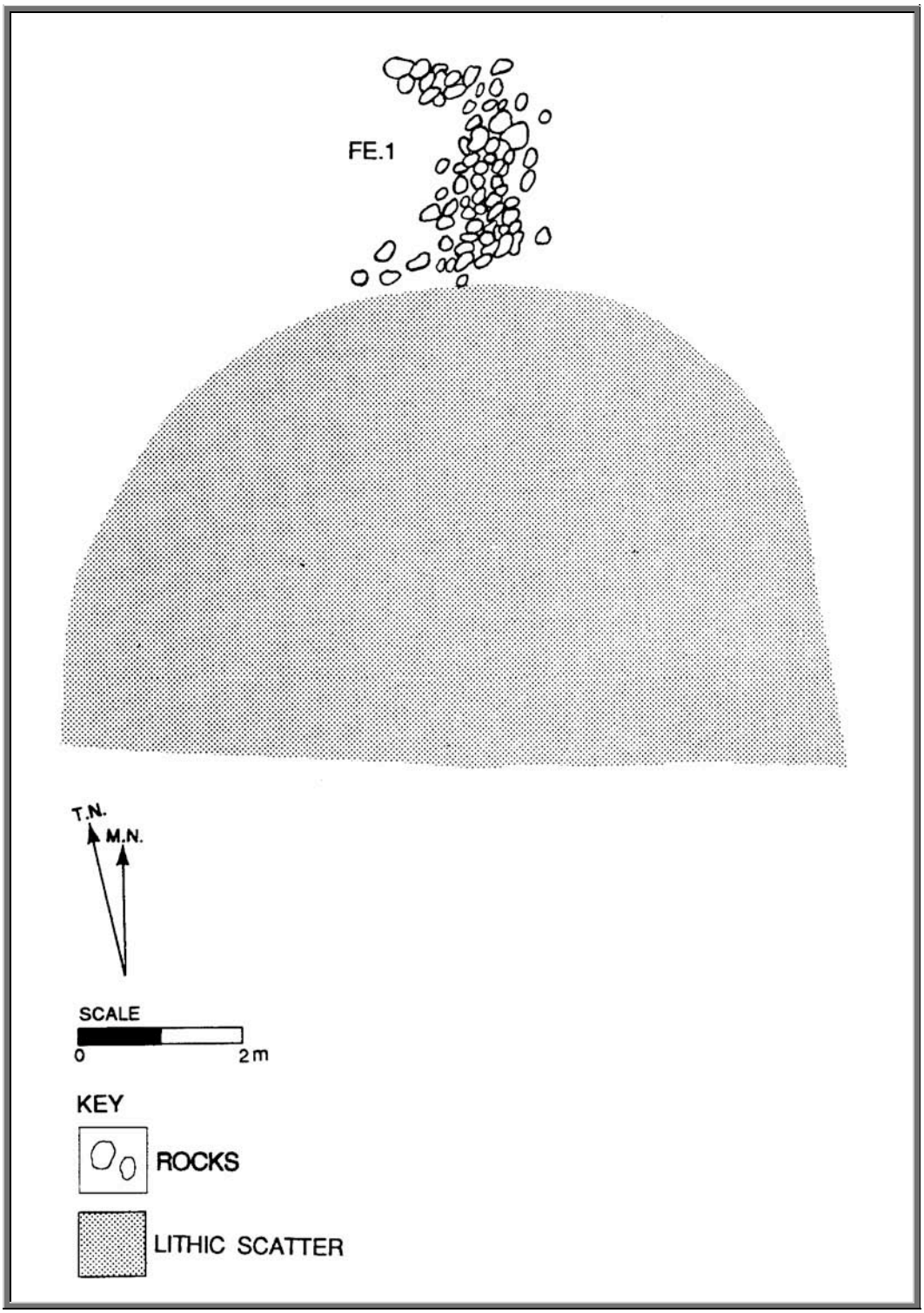
Site 1153, Feature 1. Coastal ridge enclosure at Puʻu Hakina. From Dixon and Major 1993.



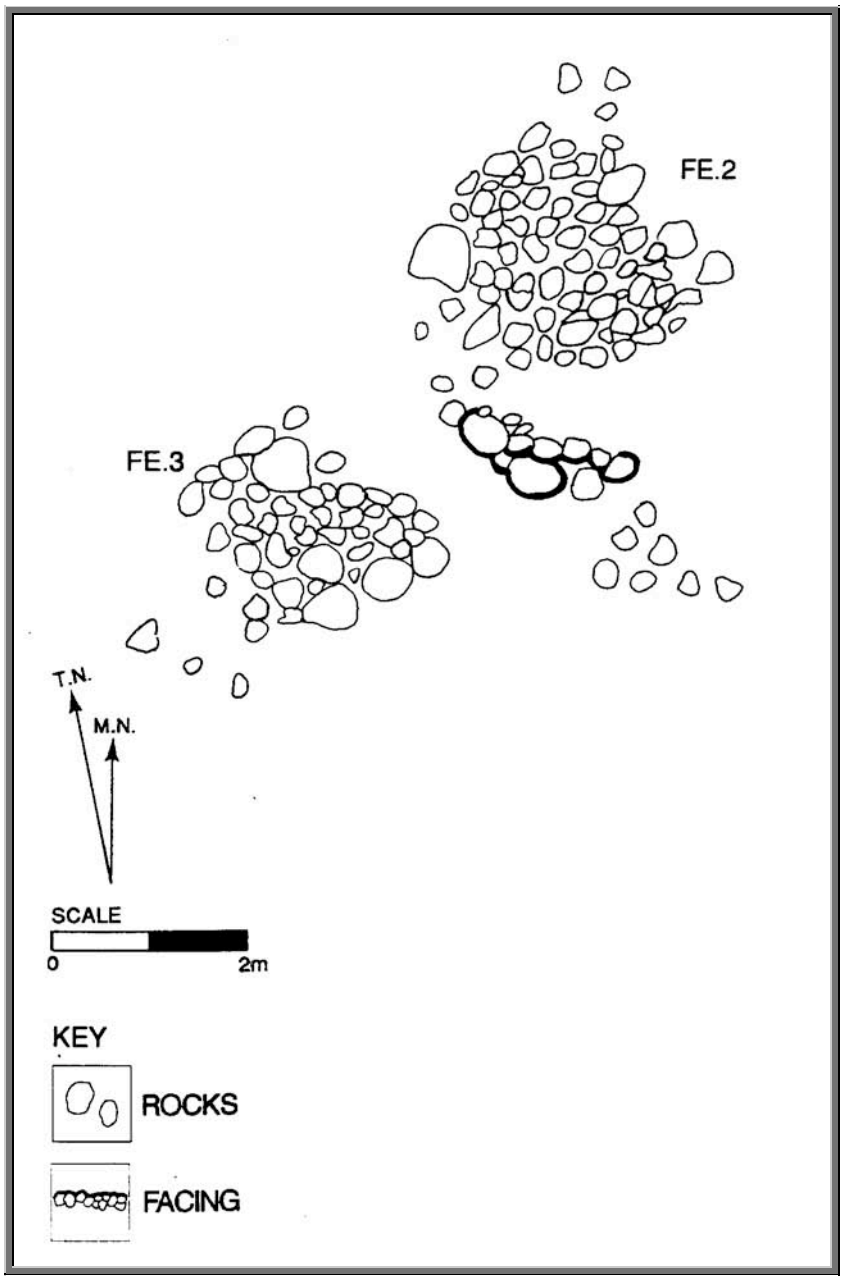
Site 1153, Feature 2. Coastal ridge mound at Puʻu Hakina. From Dixon and Major 1993.



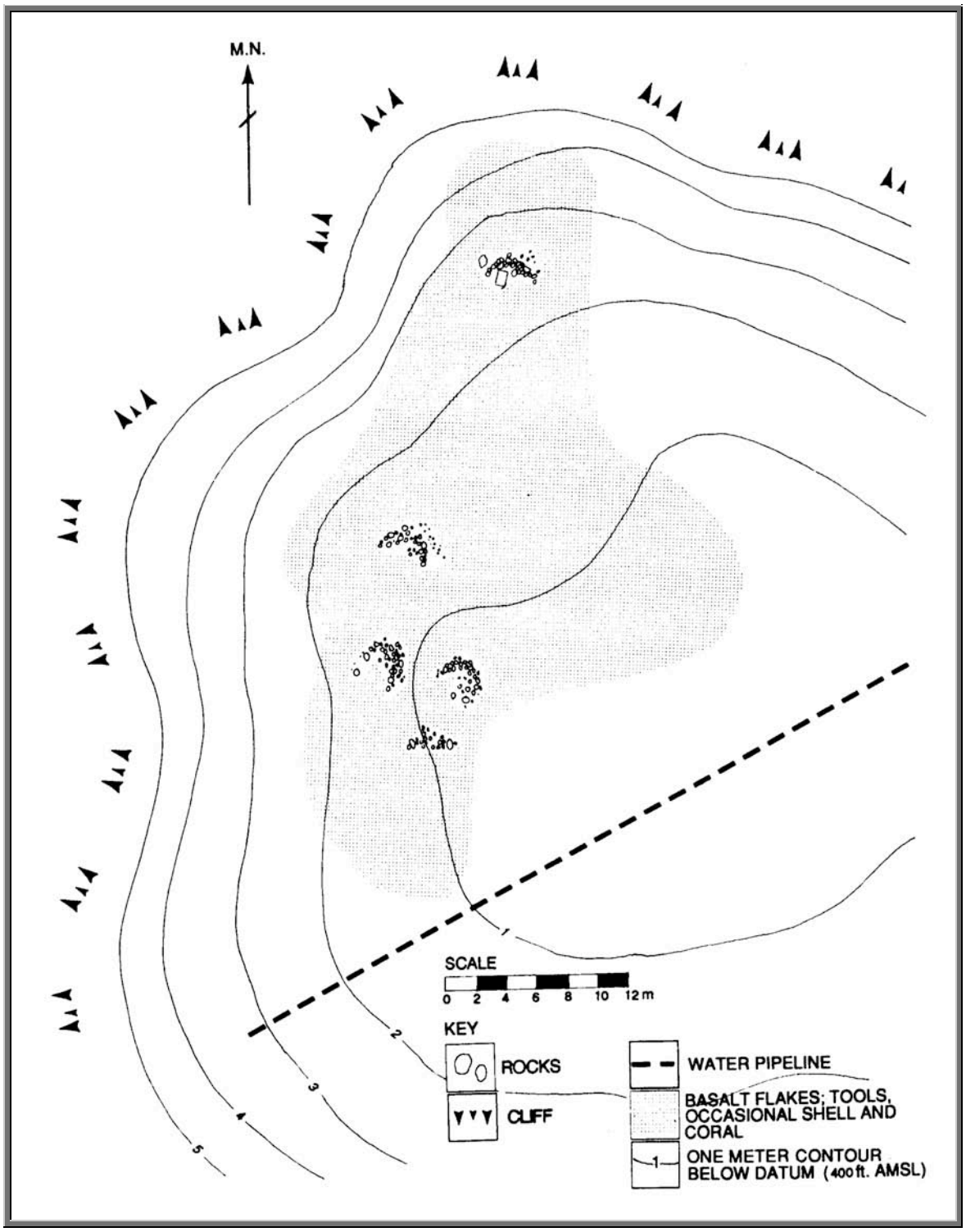
Site 1154. Lithic work area at Pu'u Hakina. From Dixon and Major 1993.



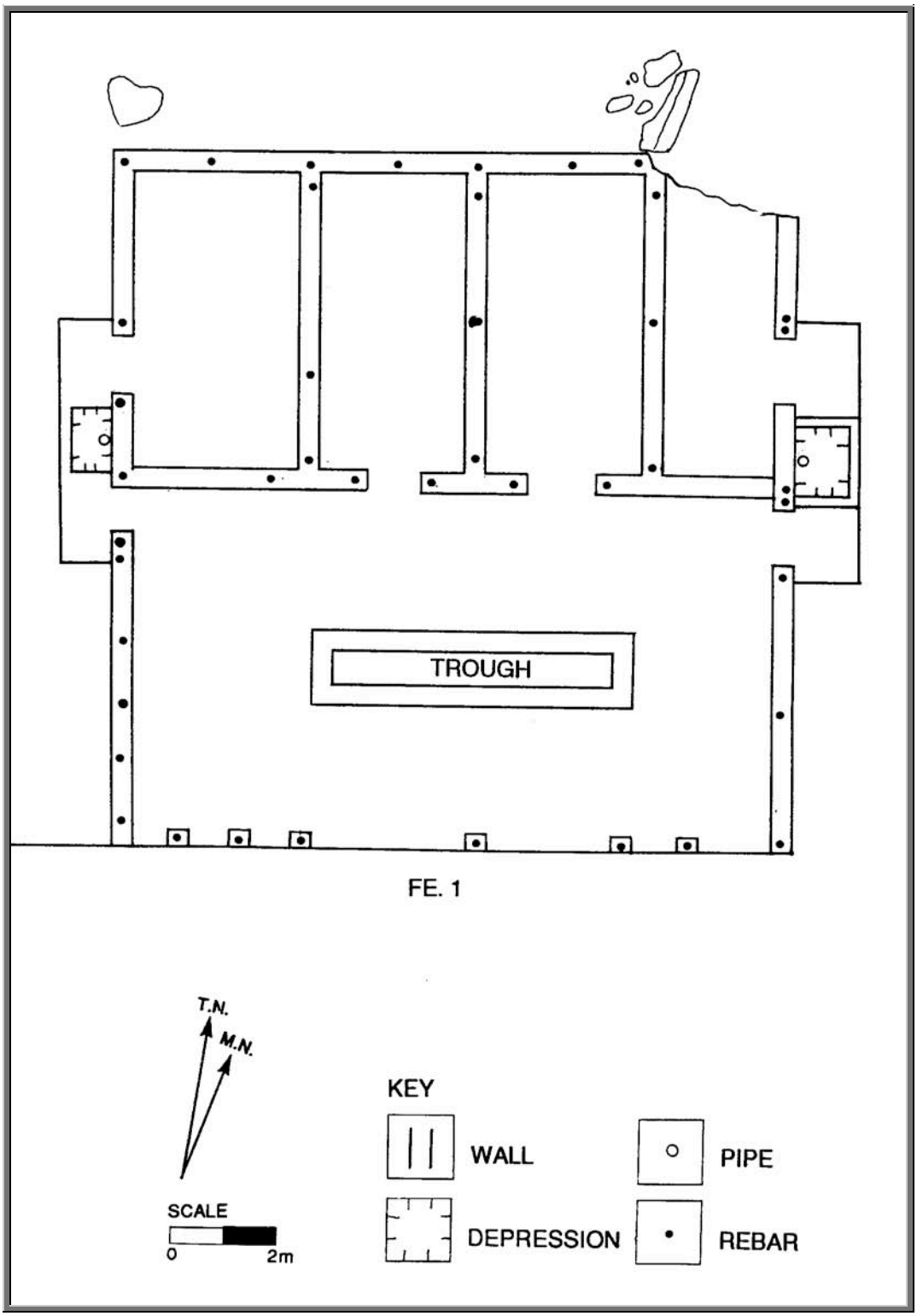
Site 1155, Feature 1. Lithic work area at Pu'u Hakina. From Dixon and Major 1993.



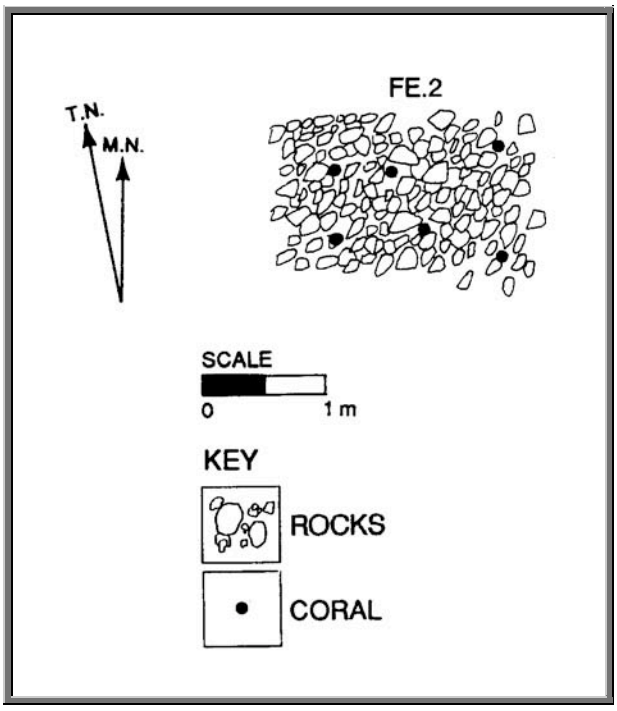
Site 1155, Features 2-3. Possible burial mounds at Pu'u Hakina. From Dixon and Major 1993.



Site 1156. Lithic work area near head of Kaunalu Gulch (400′ elevation). From Dixon and Major 1993.



Site 1160, Feature 1. Historic Ranch structure foundation. From Dixon and Major 1993,



Site 1160, Feature 2, burial. From Dixon and Major 1993.

Sample Text For Signs

Example A: Buffer Marker

"This site was built and used centuries ago by Hawaiians. Please help preserve this place by staying on marked trails and by not moving rocks. Damage to sites is punishable under Hawai'i law (Chapter 6E-11). Take with you memories and photos, but please remove no objects from this site. Aloha."

Example B: Interpretive Sign

SITE 656 – STONE TOOL QUARRY

By about 1400 AD, Hawaiians often ventured inland from their coastal settlements to quarry dense-grained basalt that was used to make adzes and other tools. This became so common that the name of the land district in west Moloka'i came to be "Kaluako'i" meaning "the adze pit."

Hawaiians used other stones to strike this fine basalt, chipping away flakes until the rough shape of an adze emerged. Some of this work occurred here, where workers would camp. Polished adzes are uncommon here, but are more so at the coast, leading archaeologists to believe that final stages of manufacture occurred at the more permanent settlements by the ocean.

[Illustration showing hammerstone and adze preform, and perhaps map of quarry location.]

Example C: Photo of Sign and Fencing at Kaupoa Camp.