

SYNTHESIS OF RESULTS

Helen Leidemann

Data recovery investigations at Site 1887 have produced information covering a wide time span, from perhaps the twelfth to the twentieth century, supporting the earlier findings that agriculture was well underway in several areas of this upland site by A.D. 1350 (Allen et al. 1987:229). Data recovery efforts could not, however, confirm the inventory survey conclusion that pondfield agriculture was present in portions of the site by the fifth century or earlier (Allen et al. 1987:179; Allen et al. 2002). Activities represented at Site 1887 primarily involve irrigated agriculture, including evidence for construction and repair of terraces and irrigation canals. Possible early dryland agriculture is also seen in some areas. In addition, there is limited evidence of lithic tool manufacture and use along with temporary habitation, similar to the situation seen at several sites in surrounding areas (Allen et al. 2002; Dockall et al. 2003; Leidemann et al. 2003). Nineteenth to twentieth century discard behavior is also evident in various areas of Site 1887.

This chapter begins with a summary of the areas of this very large site presented in Chapter 2, followed by an examination of the excavation results as they relate to the multiple research questions that guided these investigations.

AREA SUMMARIES

Area 1

Data recovery excavations in Area 1 were used to supplement findings from the inventory survey, with excavations on Features 3, 4, 6, and 10. No new radiocarbon dates were obtained from the terrace features in Area 1, but inventory survey dates for dryland and pondfield layers of Features 4, 5, and 9 are between the thirteenth and fifteenth century (Table 4.1).

Excavation at terrace Features 3 and 4 revealed basal colluvial deposits underlying a single gleyed, irrigated agricultural stratigraphic unit. More recent, nongleyed layers probably represent the banana farming period. In Feature 6 there is the additional find of an initial, possible dryland (or not fully irrigated) agricultural layer below the gleyed, irrigated layer. These differences between the terraces suggest different agricultural histories—Features 3 and 4 may have been constructed and cultivated as an irrigated terrace only after Feature 6 had been transformed from a dryland terrace into a *lo'i*. Unlike the inventory survey investigations, no evidence of buried facings or of a stone-lined

Table 4.1. Results of radiocarbon dating from inventory survey (IS) and data recovery (DR) phases, Site 1887, sorted by date.

Feature	Layer	Description	Cal. A.D. Date	Date range (Cal. A.D.)	Depth (cmbs)	Phase	Lab Number
35	VIII	pondfield	538	321–620	120–130	IS	B-13477
35	VIII	pondfield—same sample as I-14520	676	432–1004	130–150	IS	B-16266
38	VIb	pondfield	1275	1045–1340	60–70	IS	B-12563
4	VIIa	dryland agriculture	1307, 1369, 1379	1254–1425	82	IS	B-12561
181	---	firepit on ridge above terraces	1307, 1360, 1379	1282–1414	41–64	DR	B-62637
50	IV	dryland agriculture	1315, 1347, 1390	1179–1507	40–48	DR	B-153766
4	VI	pondfield	1315, 1347, 1390	1284–1431	70–80	IS	B-12560
30	III	imperfectly ponded field	1322, 1340, 1393	1246–1458	20–25	IS	B-13479
9	VI	pondfield	1398	1223–1518	65–75	IS	B-12559
---	VIII	pre-agricultural alluvial layer below Fe. 35	1403	1292–1447	95–120	DR	B-153760
5	V	pondfield	1410	1301–1458	76	IS	B-12562
13.1	IV	lowest pondfield	1426	1297–1521	65–115	DR	B-153765
35	III	pondfield	1449	1378–1666	33	IS	B-13478
38	VII/2	pondfield subsoil	1478	1428–1649	60–85	DR	B-153761
151	IX	gleyed sands and cobbles (natural?)	1530, 1537, 1635	1410–1889	117–129	DR	B-45352
35	VIb	pondfield	1638	1390–1950	65–75	IS	I-14558
9	IIIb	pondfield subsoil	1641	1439–1693	40–42	IS	B-16264
9	III	cultivated	1644	1459–1681	20–30	IS	B-13480
181.5	---	firepit on ridge above terraces	1651	1451–1705	23–46	DR	B-62636
35	VIII	pondfield—same sample as B-16266	1654	1451–1891	130–150	IS	I-14520
53/54	IV	pondfield	1657	1475–1824	30–66	DR	B-153767
9	VI	pondfield	1675, 1777, 1798	1629–1955	56–66	IS	B-16267
24	V	pondfield	1669, 1786, 1793	1632–1895	80–100	DR	B-153763
10	VIIIb	cultivated	1683, 1745, 1807	1645–1950	65–80	IS	B-16265
---	III	below activity area at Feature 32	1702, 1718, 1819, 1860, 1917	1672–1946	40–70	DR	B-86880
150	IV	pondfield	1710, 1822, 1833, 1882, 1912	1669–1949	45–50	DR	B-45353
151	VIII	pondfield	1955	1660–1955	89–117	DR	B-45351
26	III	uppermost pondfield	1955	1779–1943	10–20	DR	B-153764
38	IV	pondfield subsoil	1955	1801–1941	25–35	DR	B-153762

'*auwai* feature was recovered. However, on Feature 3 there was a possible small, unlined ditch seen in profile at the northern end of this terrace, associated with the main gleyed agricultural layer. Excavations on the south part of this terrace, closer to the stream, uncovered no further evidence of such a subsurface feature, or of much agricultural activity at all. Instead, it appeared that fairly recent terraces or terrace extensions had been constructed over streambed deposits in this area closest to the stream. If an '*auwai* did exist on this terrace, it appears that it would have led from a water source to the north.

The presence of a yellowish-brown lens of fine-grained silts and sands, observed in diminishing thickness across Feature 6 as it trends from north to south toward the stream, probably represents an historic period erosional or slopewash event. Interestingly, a thicker deposit of this same lens is observed to the north on Feature 2 in Area 7, above the level of a cobble-paved and infilled ditch segment. This erosional ditch (which can be seen cutting through portions of Features 6–10) appears to turn south toward the stream below Feature 10. Data recovery excavations below Feature 10 revealed loose fill deposits, historic materials, and worn road coral to a relatively great depth. The excavation data from Area 1 suggests that uncontrolled runoff and erosion, perhaps related to abandoned or unsupervised irrigation practices, has been a problem in recent times.

Area 2

Most of the data recovery excavations took place in Area 2, where the terraces appear to be of different construction than those of Area 1. They also were claimed by different people during the Mahele period, based on comparison of feature areas and Land Commission Award (LCA) maps (Allen et al. 1987:235). Inventory survey excavation had revealed that several of the terrace facings in Area 2 were rebuilt over time, probably in response to erosional damage, and similar subsurface features were observed during data recovery. Conflicting inventory survey dates for terrace Feature 35 were interpreted by the investigators as evidence of agricultural activities in the first millennium, with other dates for Features 35 and 38 between the eleventh and seventeenth century (Allen et al. 1987:174–179, 229).

One data recovery excavation unit was set up specifically to test the Feature 35 gleyed layer that had returned early dates during the inventory survey. The layer in question was not encountered again, suggesting it was instead a discrete lens—either a stream-deposited lens that was never a formal layer over the entire terrace, or else a remnant of a layer that had been otherwise eroded or washed away. Note that the inventory survey excavations of these layers or lenses found no buried facings associated with the very early dated layer (Allen 1991:127). The lowest layer uncovered in the data recovery excavation at Feature 35 appears to be an ungleyed alluvial deposit of sand, silt, and rock, below the level of the Feature 35 facing; a charcoal sample at 95–120 cmbs produced a date of Cal. A.D. 1403. If the date and layer interpretation are correct, then the stream-deposited charcoal could reflect activities occurring upslope, prior to terrace construction in this location at Feature 35. This alluvial deposit is above the depth of the two very early dated samples from gleyed deposits (120–130 cmbs, and 130–150 cmbs) seen during inventory survey excavations but not data recovery (see Table 4.1). The earliest pondfield layer uncovered from this excavation unit during data recovery (from adjacent Feature 38), yielded a radiocarbon sample dated Cal. A.D. 1478. Additional gleyed layers developed later at Features 35 and 38, following colluvial deposition indicating a period of temporary field abandonment.

Data recovery excavation of terrace Features 12, 13.1, and 14, at the upslope end of Area 2, showed differences in the construction histories of these adjacent terraces. Feature 13.1, the middle terrace, has at least two gleyed layers and evidence of rebuilding of the terrace facing. The earliest gleyed layer of Feature 13.1, dated to Cal. A.D. 1297–1521, predates the upslope Feature 12 and the

downslope Feature 14, which each have only a single gleyed layer correlated to the upper gleyed layer in Feature 13.1.

Investigation of Features 46, 47, 48, also in this western, upslope portion of Area 2, revealed that these streamside formations are definitely recent, and probably noncultural.

Features 21, 25, 26, and 29, in the southern portion of Area 2 close to the stream, seem to have similar sequences consisting of recent soils over two gleyed agricultural layers. Basal, non-cultural layers appear to represent changing conditions in an active stream environment.

Features 24, 27, 30, and 31 are close to the base of the hillside in the northern portion of Area 2, where the terraces are larger and more regular in shape than those closer to the stream. The earliest cultural layer in Feature 24 is a non-gleyed, possible dryland layer associated with a buried facing. It is followed by a series of alternating colluvial and gleyed deposits. The lowest gleyed unit—Layer IV, dated A.D. 1632–1895—is associated with a buried facing. Stratigraphy in Features 27 and 30 is somewhat similar, although apparently lacking the dryland component. These findings tend to support the inventory description of this steeper area as being especially prone to colluvial deposition, but the gleyed layers do not suggest any differences in intensity of irrigation between this area and the lower, streamside terraces (Allen et al. 1987:88). Pollen analysis from a column sample through the Feature 24 profile was not highly successful, but did provide some information. *Pandanus* is evident in the ca seventeenth century pondfield Layer IV, but diminishes in later layers where there is a subsequent increase in pollen of grasses and shrubs. Such a transformation is interpreted as being the result of land clearance, and it is interesting that Layer III is a colluvial deposit, perhaps representing post-clearance erosion. Nearby Feature 31, oriented along the base of the hillside at right angles to Feature 30, has only one minimally gleyed layer that may have some agricultural function. Artifacts from this layer indicate relatively recent deposition. Interestingly, the inventory survey investigation of Feature 30, which tested an area of the terrace closer to the stream, produced a date range for the upper gley layer (A.D. 1245–1425) that is much earlier than the ca seventeenth century date for the lowest gleyed layer at Feature 24 (see Table 4.1). These dates, and the apparent late construction of Feature 31, suggest that areas closer to the stream were utilized long before the steeper areas by the hillside were terraced.

Feature 33.1 is a spillway of rock, concentrated at the juncture of four terraces that meet halfway between the stream and the hillside. Excavation suggests the feature would have been built during or after the construction of Feature 33, on which it is based. If the large, regular terraces furthest from the stream were indeed constructed later than the streamside terraces, then Feature 33.1 and the other spillway features in Area 2 must also have been later constructions. The abundance of sands, pebbles, and cobbles that appear to represent stream deposits in the lower layers of this area indicate additional support for the idea of a southwardly migrating stream, first proposed by Allen et al. (1987:87).

Excavation of Features 41 and 45.1 in the eastern, downslope portion of Area 2 revealed a buried facing (Feature 41.1) and pondfield soils separated by alluvial sands and cobbles. Although these layers were not radiocarbon dated, upper layers (including the uppermost agricultural pondfield and subsoil) contain modern materials. The shallow nature of the Feature 45 mound suggests that it, too, is a recent construction.

Excavation of terrace Features 138 and 189, at the easternmost edge of Area 2, revealed a buried facing and probably one pondfield layer. An *imu* (Feature 138.1) was observed in profile in the layer above the pondfield. Lower layers in all excavations of this eastern area reflect extensive stream deposition.

Area 3

Two feature types—rock mounds and terraces—are present in this area, just south of Luluku Stream along a dry stream channel. The amorphous rock mounds (Features 94, 95, and 96, and 188) are either clearing mounds or natural accumulations of surface rock, supporting the interpretation by Allen et al. (1987:70) that the area “clearly reflects the influences of repeated colluvial deposition and erosion (especially by overland floods).”

The terraces south of Luluku Stream exhibit characteristics of dryland and irrigated agriculture. Excavation of the Feature 50 terrace revealed at least two episodes of construction. Ungleyed soils in early layers suggest dryland agriculture may have taken precedence over extensive irrigation here. The calibrated date range from agricultural Layer IV—A.D. 1179–1507—accords with many of the dates obtained from the inventory survey investigations (see Table 4.1).

Nearby Features 53 and 54 reflect similar construction techniques, as well as the possibility of two building events and eventual abandonment under heavy alluvial or colluvial deposition. Gleyed soils indicate irrigation here. The most likely calibrated date range for Layer IV—A.D. 1475–1824—covers the late pre-Contact into the post-Contact period. It is possible that Feature 54 was constructed and cultivated prior to the construction and use of Feature 53.

Three terraces (Features 66, 67, and 68), higher up the slope where feral *kalo* was observed, have a single gleyed layer indicating irrigation, with no evidence of repeated episodes of terrace construction. Nontraditional artifacts from the lowest cultural layer of Feature 66 suggests it is of more recent construction, and used for a relatively short period. Surface gullies and wavy layer boundaries suggest erosion on this steep slope, possibly extensive enough to end further attempts at agriculture here.

Area 4

Low rock alignments or one-course facings were the only surface features evident in this area. Excavation, however, revealed substantial buried terrace facings, a berm, a stone-lined *‘auwai*, and a possible spillway. Stratigraphy varied across the area, with multiple gleyed agricultural layers in the area closest to the stream, but only a single gleyed layer further south. The relatively recent radiocarbon dates (no earlier than the fifteenth century) suggest that terracing developed later in Area 4 than in Areas 1, 2 or 3, upslope to the west. Excavation also uncovered additional information concerning stream course changes, with the terrace features in Area 4 apparently constructed atop streambed deposits. The fact that the Area 4 features are buried suggests that erosion from upslope could not be controlled, and the terraced agricultural areas were not rebuilt.

Area 5

This area is interesting stratigraphically because of the presence of prepared pondfields above stream flood and alluvial deposits. Upper layers of terrace Feature 106, for example, are gleyed agricultural soils. Lower gleyed layers, however, contain sand and silt lenses and facies and an abundance of rock of various sizes, suggesting stream-related deposition. Excavations of possible rock features at the stream edge revealed similar deposits, with no evidence of agricultural use.

Area 6

This terraced area at the easternmost, downslope edge of the project area had not been included within the bounds of the inventory survey project, and so had not been previously mapped or recorded. The majority of the terraces (particularly those at the downslope end of this area) are low and lack the

formal, multi-course rock facing seen in the upslope terraces, suggesting either a different style of initial construction or extensive alteration. Excavation of a rock-faced terrace at the upslope end of Area 6 revealed several construction episodes and two periods of pondfield use. Lower, pre-construction layers indicated stream deposits. These findings are similar in general outline to those from Area 2. Stratigraphic analysis of a trench through five other terrace features added to the information on early, noncultural deposits in this area and suggested that these terraces, although also supporting irrigated agriculture, were of more recent construction. A possible *'auwai* or natural stream channel was also observed in the subsurface deposits.

Area 7

It is striking to note that the excavations on the Feature 2 terrace uncovered no gleyed layers such as those seen in excavations of nearby Features 3–10 in Area 1, which are interpreted as pondfield soils in agricultural terraces. Not only is Feature 2 set apart spatially from the other terraces but it also differs in time of construction, depositional history, and function. Much of the construction of this feature occurred in the post-Contact period, perhaps related to infilling of a ditch (portions of which are still visible upslope and downslope of Feature 2) which might have served once as an *'auwai*. Human bone fragments from Area 7 were not within a burial pit, but were found in the widespread, fill-like layer between the two ditch sections, apparently secondarily transported from areas upslope that had been disturbed by ranching or farming activities. There are indications that a substantial flooding or slopewash event occurred in this area after the ditch had been filled and the Feature 2.4 stone pavement laid; evidence for the same event, in diminished effect, is seen in Feature 6, Area 1.

Area 8

The subsurface pit features and portable artifacts of glass, ceramic, and metal in this ridge area indicate use in the late nineteenth or early twentieth centuries. None of the artifacts are dated to the early Contact period (ca A.D. 1778–1830). Suggested activities include cooking or trash burning and discard. The mix of personal items and household goods suggests a domestic association, although no evidence of a house structure was found and there is a general lack of architectural remains other than nails. The postmolds might indicate a fence rather than a habitation structure or shelter. The area as a whole is somewhat similar to the southwestern ridge at nearby Site 1897 (Leidemann et al. 2003), where multiple subsurface pits and scatters of post-Contact artifacts were revealed.

Area 9

This ridge-top activity area includes five postmolds that suggest pole-and-thatch construction of some kind. Four firepits were also uncovered, surrounded by a relatively large concentration of volcanic glass flakes, cores, and tools. One of the firepits is among the oldest dated features excavated during data recovery investigations—Cal. A.D. 1282–1414 (see Table 4.1). Another firepit date indicates use sometime between the fifteenth to eighteenth century. The lithic artifacts represent generalized core reduction and small flake production. This combination of fire features, postmolds, and an assemblage of small volcanic glass artifacts has been documented for other, nearby ridge sites interpreted as Native Hawaiian temporary habitations (Allen et al. 2002; Dockall et al. 2003; Leidemann et al. 2003).

Area 10

A boulder alignment next to the Feature 103 road, at a lower elevation than the historic period discard features of Area 8, is of unknown function. It does not appear to be agricultural in nature, although there

are some slightly gleyed soil deposits well below the base of the feature. Excavation in the area revealed nontraditional artifacts above an apparent subsurface cobble pavement that was associated with traditional lithic artifacts and a small firepit. These features are thought to be of post-Contact construction. The nontraditional artifacts are similar to the types encountered in Area 8, upslope.

Area 11

Excavations in this area showed a trail that could be an infilled *'auwai*, winding around the base of a ridge above the agricultural terraces in Area 2. There were, however, no gleyed agricultural deposits noted in this steeply sloped area that would suggest irrigation took place here. Stone alignments on the ridge are probably erosional in nature; excavation indicates that the original suggestion that these features were dryland terrace facings is unlikely. In a flat area downslope of the trail or *'auwai*, two parallel alignments are interpreted as a rock-lined trail segment.

Area 12

Features in this discontinuous and widely separated “area” have post-Contact elements unrelated to the main agricultural function of Site 1887. Two surface features are interpreted as either natural or related to previous highway construction. A lithic artifact scatter probably represents non-traditional, twentieth century activities. Excavation of two other, nearby features represent a late nineteenth century refuse dump and possibly related trashpit. A slab-lined hearth may be associated with nineteenth century use of LCA 7619, awarded to Kikane.

RESEARCH QUESTIONS

The research questions presented in Chapter 1 are focused on the nature of change in the Hawaiian culture and environment, specifically in relation to agriculture. The following sections deal with general themes suggested by the research questions and the recovered evidence. Note that previous archaeological reports on the windward portion of the Interstate Route H-3 project area have provided information to aid in answering some these questions (Allen et al. 2002; Dockall et al. 2003; Leidemann et al. 2003), information which may be reiterated here.

EVIDENCE FOR IRRIGATED CULTIVATION FROM OTHER *'ILI*

Although *kalo* cultivation was apparently widespread throughout Kāneʻohe (Handy et al. 1972), little archaeological evidence of pondfield agriculture has been found in the five *'ili* within the Kāneʻohe Interchange project area (Lulukū, Punaluʻu Mauka, Kapalai, Pau, and Keaʻahala), suggesting that the upland Kāneʻohe area close to the base of the Koʻolau *pali* was used only on a very limited scale for irrigated agricultural fields. Site 1887 in Lulukū *'ili*, with its multiple irrigated agricultural terraces along Lulukū Stream, is a notable exception. Dryland and irrigated agricultural terraces in Lulukū have provided numerous radiocarbon dates falling between a suggested peak period of use of A.D. 1250 to 1425 (Allen et al. 1987:230; see Table 4.1). Relatively few other sites in the windward portion of the Interstate Route H-3 or adjacent project areas have features clearly identified as having a pre-Contact agricultural function. Extensive survey and monitoring of the Windward Highway corridor revealed only a small number of irrigated agricultural terraces at Site 2202 in Kahuauli *'ili* (Dockall et al. 2003).

A wood sample from deposits predating the irrigated pondfield facing at this site dates to A.D. 1161–1301 (Dockall et al. 2003; Williams 1992); the necessarily later pondfield layers would likely fall into the peak period of use as seen at Site 1887. A relatively late irrigated pondfield area consisting of three large terraces was uncovered in the *'ili* of Kapalai at Site 2462, dating to A.D. 1645–1894 (Leidemann et al. 2003). No archaeological traces of pondfields have yet been found in Punalu'u Mauka, Pau, or Kea'ahala *'ili* (see Allen et al. 1987 and Dockall et al. 2003), although historic documents do show that pondfields were present in the downslope sections of Punalu'u Mauka and Kea'ahala Mauka in the mid-1800's (Klieger n.d., Leidemann et al. 2003), outside the Interstate Route H-3 corridor. Shun et al. (1987) recorded Site 2938, a possible pondfield complex along Kamo'oali'i Stream in the Minami project area, but indicated that overall there were not the kinds of agricultural features that had been expected. Although surface indications of irrigated terraces might have been destroyed by post-Contact activities throughout the upland area, the gleyed, irrigated soils retained by the terraces and buried facing elements (as seen at Sites 1887 and 2202) certainly would have been visible to the archaeologists monitoring the bulldozing of the highway corridor. Rather than being a false pattern created by post-Contact disturbance, the small number of sites with evidence of irrigated agriculture in the upland Kāne'ohē area would seem to mirror actual land use.

It is interesting that Luluku *'ili*, where the most extensive pondfields have been observed archaeologically, is also mentioned as a *kalo* producing area in a Kāne'ohē legend (Rose n.d.; Sterling and Summers 1978:206). In this story there are two brothers who are farmers, another who is a fisherman, and a sister who lives on the offshore island of Moku o Loe. One of the brothers, Kahuauli, farms in Luluku. The other farmer, Kahoe, has two residences in Kea'ahala, one looking out toward Kāne'ohē Bay and another on the Ha'ikū cliffside. The story tells of how the four siblings share their marine and cultivated foods (or in this case, fail to share equitably). During a time of famine Pahu, the fisherman, has to rely on his farmer brothers for *kalo* and *poi*, even though he has cheated them in the past. The Luluku farmer's name, Kahuauli, is also the name of the *'ili* immediately south of Luluku, where archaeological traces of pondfields at Site 2202 have been recorded that probably date to the peak period of irrigated agriculture in Luluku.

It is elsewhere in Kāne'ohē, however, that the full extent of irrigated *kalo* cultivation must have taken place. Prior to the recent investigations along the Interstate Route H-3 corridor, Handy et al. (1972:456) noted that the flatter, coastal areas of the *ahupua'a* exhibited more agricultural acreage than hillier inland areas and suggested a reason for this contrast in land use:

As the ground rises steeply from the stream beds along their upper courses, there is little evidence of systematic terracing observable in these areas, as might have been expected. The lowland *lo'i* areas were so extensive that evidently the more laborious terracing of the interior slopes was not regarded by the early Hawaiians as necessary.

Klieger's (n.d.) summary of Kāne'ohē LCA locales and their uses points to a distinct contrast, for the mid-nineteenth century at least, between the western end of the *ahupua'a* at the base of the steep cliffs, and the extreme eastern, arable region nearer the coast, with numerous streams and *'auwai*. For example, three rather small coastal *'ili* bordering Kaneohe Stream where it flows into Kaneohe Bay have a combined total of 48 awarded and unawarded claims—Punalu'u Makai (17 claims), Kea'ahala Iki (13 claims), and Waikalua Loko (18 claims) (Table 4.2). In contrast, the seven *'ili* neighboring Luluku have only approximately 25 awarded and unawarded claims (Table 4.3). These are Ho'oleinaiwa (2 claims),

Table 4.2. Land Commission Awards in Selected Coastal 'Ili by Kaneohe Stream, in the Ahupua'a of Kāne'ohe, O'ahu (adapted from Klieger n.d.).

'Ili	LCA No.	Claimant	Type	Hectares
Kea'ahala Iki	1856.3	Kukeliikahaoa and Mahu	10 lo'i	0.58
	1858.1	Kanealauwahine	1 lo'i (1 lo'i na)	0.15
	1859(7).2	Kaopihi	5 lo'i	0.38
	1864	Kauhimahu 2	5 lo'i	0.93
	1957 na	Ioela Kua'ana	3 lo'i & kula	---
	1959B	Namokuelua	4 lo'i	0.44
	1960	Lilipuni	3 lo'i (house site na)	0.53
	1962.1	Mehekulu	6 lo'i & kula	0.64
	2941.1	Kekalei	6 lo'i (6 lo'i na)	0.60
	3429B na	Kaheleua	3 lo'i & house site	---
	5323	Kawana	16 lo'i (na)	---
	7174.1	Kauhi	2 lo'i	0.20
	7174.3	Kauhi	house site	0.10
	10202.3	Mahakea	2 lo'i	0.34
Punalu'u Makai	1855	Kapuaapilau	8 lo'i (house site na)	0.33
	1859.1 na	Kalei	4 lo'i & kula	---
	1859.2 na	Kalei	1 lo'i	---
	1879.1	Palau	house site	0.69
	1879.2	Palau	14 lo'i & house site	0.66
	1899.3	Opunui	house site & kula	0.68
	1956.1	Kapaula	3 lo'i, 1 kula, 1 house site	1.04
	1958.6	Mahu	house site	0.13
	2004B.1	Kumuhonua	house site	1.06
	2323.3	Peha	house site	0.45
	2476 na	Kalauao	5 lo'i, 1 kula, 1 house site	---
	2485 na	Keaweau	14 pō'alima lo'i, 1 kula, 1 house site	---
	2491	Kalaikilo	5 lo'i & house site	1.12
	2584	Hina'aimalama	4 lo'i	0.35
	2584B.3	Makea	house site	0.53
	2941.3	Kekalei	house site & kula	0.43
	3344	Naiwieha	hala grove (na)	---
	4489	Kahooanohano	7 lo'i (7 lo'i, 6 kō'ele, 2 kula, 1 house site na)	0.42
	10194.1	Meemano	house site	0.64
10194.2	Meemano	14 lo'i	0.36	
Waikalua Loko	1856.1	Kukeliikahoia & Mahu	pandanus grove	0.01
	1856.4	Kukeliikahoia & Mahu	mo'o 'āina	0.30
	1856.5	Kukeliikahoia & Mahu	pu'uone	0.19
	1858.2	Kanealauwahine	house site	0.05
	1859.1	Kaopihi	house site & kula	0.14
	2477.1	Kahau	1 lo'i	0.20
	2477.2	Kahau	3 lo'i (2 pu'uone, 3 sweet potato fields na)	0.09

(continued)

<i>ʻIli</i>	LCA No.	Claimant	Type	Hectares
Waikalua Loko (continued)	2477.3	Kahau	house site & <i>kula</i>	0.89
	2628.3	Paele	<i>puʻuone</i>	0.15
	2941.2	Kekalei	2 <i>loʻi</i>	0.26
	3692B.3	Keaka	1 <i>loʻi</i>	0.04
	3693B.2	Kahilikulani	2 <i>loʻi</i>	0.24
	3694B.1	Kauhimahu	house site	0.04
	4216	Naiheekolu	<i>kula</i> (1 <i>loʻi</i> & 1 house site na)	1.67
	4217.1	Kaula	house site & <i>kula</i>	0.56
	4217.4	Kaula	<i>kula</i> & <i>puʻuone</i>	1.06
	4471.1	Piʻikea	1 <i>loʻi</i> (1 <i>moʻo</i> of sweet potato & 1 house site na)	0.09
	7170.1	Kekuna	<i>moʻo ʻāina</i>	0.10
	7170.2	Kekuna	house site	0.07
	7170.3	Kekuna	3 <i>loʻi</i>	0.21
	7171.2	Kamakahi	house site	0.10
	9639.4	Kaniau	25 <i>loʻi</i>	0.36
	10202.1	Mahakea	<i>loko</i>	0.07
	10739.3	Pa	house site & <i>kula</i>	0.30
11015.2	Palanaiki	1 <i>loʻi</i>	0.05	

na = not awarded

Table 4.3. Land Commission Awards in Selected Upland *ʻIli* Within or near Project Area, in the *Ahupuaʻa* of Kāneʻohe, Oʻahu (adapted from Klieger n.d.).

<i>ʻIli</i>	LCA No.	Claimant	Type	Hectares
Kuou	4482 na	Hau	10 <i>loʻi</i> , 1 <i>kula</i> , 1 house site, 1 breadfruit tree	---
	4484 na	Keoho	19 <i>loʻi</i> , 1 <i>kula</i> , 1 house site	---
	4491.2	Kuapuu	18 <i>loʻi</i> , 2 breadfruit trees	1.6
	7536 na	Kekipi	3 <i>loʻi</i>	---
	7620 na	Keoa	<i>puʻuone</i>	---
	8219 na	Iaukea	<i>moʻo ʻāina, kula, mala</i>	---
Kahuauili	8219 na	Iaukea	house site	---
	10213 na	Maunahina	<i>ʻili ʻāina</i>	---
Lulukū	2514	Makaiohua	<i>moʻo ʻāina</i> (3 <i>moʻo ʻāina</i> na)*	1.49
	2539	Upai	5 <i>loʻi</i> & <i>kula</i>	0.74
	2539B	Piho	5 <i>loʻi</i> , 1 <i>kula</i> , 2 dry taro patches	0.74
	2574.1	Hewahewanui	<i>moʻo ʻāina</i> (2 <i>moʻo ʻāina</i> na)	0.68
	2574.2, 3	Hewahewanui	<i>kula</i>	2.02
	2589	Palapu	<i>moʻo ʻāina</i> (5 <i>loʻi</i> na)	3.96
	4223	Kapawa	26 <i>loʻi</i> , 2 <i>kula</i> , 1 lemon & 1 orange tree	1.21
	4224 na	Kanihokea	9 <i>loʻi</i> & <i>kula</i>	---
	4225.1	Kaneihoe	house site	0.25
	4225.2	Kaneihoe	6 <i>loʻi</i>	0.92
	4490	Kawelau	18 <i>loʻi</i> & <i>kula</i> (house site na)	1.01
	4491.1	Kuapuu	house site & <i>kula</i>	0.10
	7619	Kikane	<i>moʻo ʻāina</i> (1 <i>kula</i> , 7 <i>loʻi</i> , 1 house site na)	1.09
	7536 na	Kekipi	9 <i>loʻi</i> , 1 <i>kula</i> , 1 house site	---
	10213 na	Maunahina	9 <i>loʻi</i> & house site	---

<i>'Ili</i>	LCA No.	Claimant	Type	Hectares
Punalu'u Mauka	7533	Kaiwi	45 <i>lo'i</i> , 1 house site, 1 <i>noni</i> , 2 guava, 1 <i>'ōhi'a</i> tree	1.41
Kapalai	1862	Kaluau	1 <i>lo'i</i> (na)	---
	1889	Lihue	34 <i>lo'i</i> & <i>kula</i> (house site na)	4.77
	2098	Kahili	2 <i>lo'i</i> & <i>kula</i> (na)	---
	7233	Luluu	13 <i>lo'i</i> & <i>kula</i> (house site na)	2.34
	7522	Kaia	house site (na)	---
	7534	Kahawai	26 <i>lo'i</i> & <i>kula</i> (house site na)	0.88
Pau	MA 57	Ke	<i>'ili 'āina</i>	5.26
	3121	James Mahony	<i>'ili 'āina</i>	7.97
Kea'ahala Mauka	3430B	Kawakawa	10 <i>lo'i</i> (house site na)	2.49
	4173B.1	Kaheleua	<i>mo'o 'āina</i>	0.64
	4173B.2	Kaheleua	3 <i>lo'i</i> & house site	1.13
	4235.1	Kane	4 <i>lo'i</i> & <i>kula</i> (house site na)	0.33
	4235.2	Kane	2 <i>lo'i</i>	0.68
	5081.1	Kuiaia	1 <i>lo'i</i>	0.09
	5081.2	Kuiaia	1 <i>lo'i</i>	0.09
	5081.3	Kuiaia	2 <i>lo'i</i>	0.23
	5820.1	Kapunai	2 <i>lo'i</i> & <i>kula</i>	0.43
	5820.2	Kapunai	1 <i>kō'ele lo'i</i>	0.08
	5820.3	Kapunai	house site & <i>kula</i>	0.36
5822	Koolau	1 <i>lo'i</i> (11 <i>mala</i> of sweet potato 4 <i>mala</i> of gourd, 1 house site na)	0.07	

Kuou (6 claims), and Kahuauili (2 claims) to the south of Lulukū, and Punalu'u Mauka (1 claim), Kapalai (6 claims), Pau (2 claims), and Kea'ahala Mauka (6 claims), to the north¹. The three coastal *'ili*, with an approximate combined area of less than 50 ha, have nearly twice the number of claims as the seven upland *'ili*, which have a combined size of ca 400 ha. Interestingly, Lulukū *'ili* (159.8 ha), with a total of 13 awarded and unawarded claims (six of them within the bounds of Site 1887), appears to be outside the general range of upland areas in number of claims made.

The general lack of upland Kāne'ōhe terracing in archaeological sites or in historical documents suggests that Handy et al. (1972) were correct in their assessment of the relative densities of irrigated agricultural terracing in the upland and lowland areas of Kāne'ōhe. Earle (1978:21) similarly noted that historical sources showed the traditional Hawaiian irrigation systems of extensive terraces on the coastal plains were "economically dominant" over small terrace complexes in valley interiors. If such a pattern also prevailed in the pre-Contact period in Kāne'ōhe, it would explain the relatively meager evidence of irrigated pondfields within most of the upland region, with Site 1887 in Lulukū *'ili* perhaps being a special case outside the more general pattern. Lulukū *'ili*, with its extensive evidence of agricultural, residential, and ceremonial structures (apparently unmatched elsewhere in the upland Kāne'ōhe area), may have been set apart for specialized functions not assigned to the neighboring *'ili*.

¹Many of these claims are in the most downslope section of the *'ili*, well outside the Interstate Route H-3 corridor.

EARLY AGRICULTURAL USE OF SITE 1887

Constructing a sequence of agricultural development at Site 1887 is hampered somewhat by the limitations of the data recovery excavations, which did not investigate the many terrace features upslope above Likelike Highway outside of the project area, and excavated few terrace features at the downslope end of the site. Data recovery investigations provided nine new dates for agricultural terrace features in Areas 2, 3, and 4, to add to the 15 dates from inventory survey (terraces in Areas 1 and 2). Additional data recovery radiocarbon dates were obtained for dispersed charcoal in possible pre-terrace contexts (two dates) and for ridgetop fire features (two dates). These dates represent use of four of the six areas with agricultural terracing investigated during this phase of the project.

No early first millennium dates, such as those reported by Allen et al. (1987:176) for Feature 35, were recovered from the data recovery investigations. Recent excavation of Feature 35, in fact, suggests that a reappraisal of the context of the early inventory survey dates might be useful. Graves and Addison (1996:4) suggest that “early first millennium A.D. radiocarbon dates reported for Hawai‘i may reflect the few early occupations of a small colonizing population which have been progressively altered or disturbed through time. A variety of natural and cultural formation processes have operated over time to progressively change the archaeological context of these earliest sites and the dated samples associated with them”. Spriggs (1981:105) observes that charcoal found in pondfields may not relate to time of use of the pondfields, and states that “in cases where charcoal has been fluvially transported into the garden area, there is a possibility that it will give a date far older than that of the time of its incorporation into the soil because of charcoal storage in sites in the catchment”, and that “the most secure dates are those obtained from *in situ* hearths or ovens”. Note that the dates from the fire features in Area 9 overlooking the terraces, which would meet Spriggs’ definition of secure context, appear to coincide with all but the two very earliest dates obtained during inventory survey. Although early use of Site 1887 might have occurred, the amount of erosion and stream alteration suggested by the appearance of the lower layers at the site will make finding such *in situ* dating samples difficult.

If we consider as valid the two early date ranges for Feature 35 from inventory survey—and reject as unsound the fifteenth century or later date range that is also assigned to one of these samples (see Table 4.1)—it would appear that irrigated agriculture began early in Luluku ‘ili, perhaps between the fifth and seventh century. However, little evidence of irrigated agriculture, or any other kind of use, has been found for this very early period in upland Kāne‘ohe. If the early dates for this area are accurate but there are no other, similar dates approaching the proposed scenario for initial pondfield terracing from either this or adjacent project areas (see Meeker 1995; Allen et al. 2002; Dockall et al. 2003; Leidemann et al. 2003), it might suggest those hypothesized early pondfield efforts were unsuccessful and abandoned for several centuries.

EVIDENCE OF LAND CLEARANCE AND DRYLAND AGRICULTURE

Kirch (2000:293) notes that for the earliest period of Hawaiian history, “pollen and microcharcoal evidence from sediment cores on O‘ahu indicates that forest clearance for agriculture was under way as early as A.D. 800”. The recent report on archaeological investigations in the Windward Highway project area found scattered charcoal at a few windward sites that could be viewed as evidence of preparing lands for crop planting through forest burning—although the botanical signatures of some of these charcoal collections suggest instead habitation-related debris, and the presence of some Polynesian introductions indicates that not all the charcoal resulted from initial burning of an indigenous forest (Dockall et al. 2003). Isolated fire features in the upland Kāne‘ohe area, interpreted by Williams (1992)

as “garden ovens,” could be indirect evidence for non-irrigated agriculture as areas where cultivators would rest and prepare a meal. Another line of evidence that could indicate dryland agriculture is mentioned by Meeker (1995:128, 131), who suggests that the presence of such items as taro and sweet potato in upland fire features, as at Sites 4128, 4133, and 4148 in the Minami project area, indicates preparation of crops gathered from cultivated sources nearby. In upland Kāne’ohe, a few sites potentially representing forest clearing and dryland agriculture have been dated to the tenth to thirteenth century (Allen et al. 1987, 2002; Dockall et al. 2003; Leidemann et al. 2003; Williams 1992). No dryland fields have been identified so far in the *‘ili* of Kapalai, Pau, or Kea’ahala, although scattered charcoal from Site 1903 in Kea’ahala, dated to A.D. 1158–1437 (Beta-30514), could be interpreted as evidence of forest burning and clearing in preparation for or maintenance of dryland fields (Dockall et al. 2003). Layers interpreted as dryland fields have been found so far in two *‘ili* within the Kāne’ohe Interchange project area. A terraced, non-irrigated, charcoal-bearing layer at Site 1888, in Punalu’u Mauka *‘ili*, produced a date range of A.D. 915–1280 (Beta-13476; Allen et al. 1987). Site 1887 in Luluku *‘ili* yielded possible twelfth or thirteenth century dates for non-irrigated, charcoal-bearing layers at Feature 4 (Area 1) and Feature 50 (Area 3), and for an imperfectly ponded layer at Feature 30 in Area 2 (see Table 4.1). Data recovery excavations at Feature 6 in Area 1 also suggest early agricultural use that was either unirrigated or not fully irrigated; this layer was not dated. Other undated, possible dryland fields were observed in Area 2, in initial agricultural layers associated with the Feature 24.2 facing, and in Feature 27. Excavation of Features 99 and 100, in Area 11, however, indicated that these features are not dryland terraces, as originally suggested.

The relative lack of identified pre-Contact dryland agricultural features in the project area could be due to the extensive reworking of soils and disturbance of minimally constructed surface features from mechanized banana cultivation. Alternatively, it is possible that most of the upland area, other than streamside locations suited for irrigated *kalo* cultivation, was reserved for nonagricultural, forest collection activities. Meeker (1995:135) formed this conclusion after surveying the Minami project area; he suggests that the upland area was used principally for discontinuous, nonagricultural activities and that the lower areas closer to the coast contained the permanent agricultural and habitation zones.

Identifications of dated botanical remains from the data recovery project can be used to examine changes in the natural environment at Site 1887 that might have occurred as a result of agricultural use (Table 4.4). The changes are only slight, and the data set too small to make any definitive conclusions, especially from negative evidence. It does not appear that there was wholesale destruction of the native forest in the area. There are native species that occur throughout the sequence. Nearly all of the species identified are well within their known environmental limits. The 20 species of *kōlea* (*Myrsine*) are generally found in elevations over 215 masl, but it is likely that previous ranges for many plants were much wider in the past. The Polynesian-introduced species are also found throughout the sequence, suggesting that these plants were well established during the period this site was used. There may be a slight trend to more Polynesian-introduced species in the later samples, with the inclusion of *kī* and *ipu* in the post-Contact period. Patterns in charcoal suggest that there may be a shift in species, as larger natives, such as *kōpiko*, *‘ōhi‘a lehua*, *kōlea*, *‘ahakea* occur only in samples more than 200 years old; natives that persist or are found only in the later period are smaller and shrubbier (*māmaki*, *lama*, *‘ākia* and *ko‘oko‘olau*). These two facts suggest that the older, mature forest was altered to include a larger proportion of smaller, shrubbier species. This might be associated with land clearance or other human

activities². Pollen analysis produced somewhat similar findings for a later period, suggesting that shrubs gave way to grasses ca the seventeenth century.

Table 4.4. Identifications of dated botanical samples, Site 1887.

Area	Provenience	Beta#	Conv age BP	Contents
3	Fe 50, Unit 57, L. IV	153766	620 ± 110	'akoko
9	Fe 181, Unit 62	62637*	610 ± 60	naio, kukui, lama, Syzygium
2	Fe 13.1, Unit 29, L. IV	153765	510 ± 80	kukui cf. 'ahakea
2	Fe 38, Unit 32, L. VII/2	153761	390 ± 70	cf. 'ōhi'a lehua, 'ulu, kōpiko, 'akoko, kukui, 'ōhi'a 'ai, common guava; kukui seed coats
4	Fe 151, Unit 4, L. IX	45352*	320 ± 140	'ōhi'a lehua, kōlea, cf. Abutilon, Syzygium.
3	Fe 53 & 54, Unit 71, L. IV	153767	250 ± 90	'ōhi'a lehua, 'ahakea
2	Fe 24, Unit 35, L. VII	153763	210 ± 60	cf. kukui, 'ulu, niu, 'ahakea, 'ōhi'a lehua, lama, 'ōhi'a 'ai; kukui seed coat
4	Fe 150, Unit 8	45353	110 ± 80	all guava
2	Fe 38, Unit 32, L. IV	153762	80 ± 60	'akoko, cf. 'ulu, māmaki; unid seed coats
10	Fe 24, Unit 35, L. III	86880	80 ± 60	kī, 'ulu, cf. kukui, lama; kukui seed coats; ipu rind
4	Fe 151, Unit 4, L. VIII	45351*	70 ± 110	kī, 'ulu, strawberry guava, cf. Syzygium
2	Fe 26, Unit 26, L. III	153764	40 ± 80	cf. ko'oko'olau, 'ākia, Senna

* close to original ¹⁴C sample.

PEAK PERIOD OF IRRIGATED AGRICULTURE

The peak period of irrigated agriculture in Luluku 'ili was initially defined as ca A.D. 1250–1450 (Allen et al. 1987). This time frame fits within the early Expansion Period of Hawaiian history (A.D. 1100–1650), a dynamic period of great change with exponential population growth when “production systems were intensified, ritual architecture was elaborated, and a system of hierarchical territorial land units was formalized” (Kirch 2000:293). Dates from gleyed, irrigated layers excavated at Site 1887 during the data recovery phase appear to be only slightly later than the dates revealed so far for the non-irrigated, charcoal-bearing layers that may represent dryland fields. Terraces in Area 1 (Features 4, 5, and 9) and Area 2 (Features 13.1, 35, and 38) fall into this period (see Table 4.1). Although the data recovery date range for Feature 38 (Layer VII/2, 60–85 cmbs, A.D. 1428–1649) does not agree at two standard deviations with the inventory survey date range (Layer VIb, 60–70 cmbs, A.D. 1045–1340), the feature could still be assumed to have been used for irrigated agriculture during the defined peak period. Pondfield strata at terrace Feature 50, in Area 3, would be later than the dated non-irrigated layer and would perhaps fit within the peak period as well. If so, then it would appear that both sides of the stream were being irrigated at this point. Interestingly, in Area 2 the features that appear to date to this period are close to the stream. The more northern terraces in Area 2, which in some cases are larger and more regular in outline than those closer to the stream, may not have been constructed at the peak

²Post-Contact species (common guava, strawberry guava) are mostly limited to the later samples, but there may be some problem with the identification of common guava from Beta-153761.

period, but at a later date. The terraces downslope in Area 6 have not been radiocarbon dated, but it appears on examination of the simple stratigraphic sequence revealed there (a single period of pondfield construction and use, without evidence of rebuilding) that they are relatively recent. The upslope terraces outside the project area have not been excavated, precluding a complete determination of the extent of the Site 1887 terraces ca A.D. 1250–1450.

WATER CONTROL FEATURES

The similar dates for irrigated terraces in Area 1, 2, and 3 suggest that Lulukū Stream and the intersecting, currently dry, stream channel were providing water for agricultural use at about the same time. Unfortunately, little concrete information about *'auwai* and other water control devices was recovered from the data recovery investigations. Unlike the recent investigations of hydrology in the terrace systems of Anahulu Valley (Kirch 1992), *'auwai* were not visible on the surface at Site 1887, and although some tantalizing subsurface evidence was recovered, it is not enough to provide the kinds of measurements needed to determine water flow capacities. Considering the degree of slope at Site 1887³ and the archaeological evidence of flood damage, it is likely that most signs of the irrigation and water transport infrastructure at Site 1887 have been buried under post-abandonment flood debris.

The small, stone-lined ditch previously described at Feature 3 (Allen et al. 1987) was not found in profile during further data recovery excavations of this terrace. Allen (1991:125) places the use of this feature in the mid-fifteenth or early sixteenth century. Data recovery excavation of Feature 3 did uncover evidence of a small, unlined ditch at the north end of the terrace, but not further south. It is possible that these represent smaller inlets (*makawai*) that did not continue along the entire length of the terrace. If so, they must have led from a peripheral *'auwai* to the north that watered the larger system. Such placement of an *'auwai* between terraces and an adjacent hillside has been recorded elsewhere (e.g., Earle 1978:94; Kirch 1992:120; Kirch and Kelly 1975:84). The erosional ditch feature in Area 1 could be the remains of such an *'auwai* that collected water from upslope sections of Lulukū Stream or from other upslope tributaries, although the fact that it cuts through the northern edges of the terraces suggests it represents an uncontrolled (perhaps post-abandonment) flow of water.

A buried, stone-lined ditch was uncovered in Area 4, and excavated for a short distance. Feature 154 is aligned perpendicularly to Lulukū Stream, and may have led from it to water the buried terraces here. The late dates for layers below the depth of Feature 154 indicate that this *'auwai* was a late construction.

Although a feature revealed in profile in Area 6, Feature 159.1, might be interpreted as an *'auwai*, it is more likely an example of a cross-section of a stream meander. Better evidence of an *'auwai* in this area was noted at the base of the ridge of adjacent Site 1897, running along the north edge of the Area 6 terraces (Leidemann et al. 2003). This large ditch with sloping sides and a flat bottom (Feature 13) was interpreted as a post-Contact structure which, combined with the shallow stratigraphy in Area 6, reinforces the idea of the terraces there as late additions.

A few other possible locations for an *'auwai* exist, such as the Feature 102 trail that winds along the base of the ridges to the north of Areas 1 and 2. Allen et al. (1987:60) initially suggested that water

³ Kirch notes slopes of between 3 and 8% for the various systems in Anahulu (1992). Topographic profiles of terraces at Site 1887 (Allen et al. 1987:54–55) indicate slopes of 20% for the area above the highway, 14% for Area 1, and 11% for Area 2.

ran around the ridge below Area 11 along Feature 102, and into the Area 2 terraces. A single data recovery excavation produced no conclusive evidence of the feature being a filled-in *'auwai*.

The lack of long pre-Contact *'auwai* in the archaeological record at Site 1887 is reflected in historic documents. Records, including LCA descriptions and maps, show no *'auwai* in Luluku *'ili*, although several long *'auwai* are mapped (and some are even named) for other *'ili* closer to the coast; these longer *'auwai* are perhaps needed in areas of lesser slope. It could be that the irrigation pattern for portions of Site 1887 was similar to that seen for some systems in Anahulu, O'ahu and Halelea, Kaua'i, where shorter, simple intake canals and lateral spillways delivered water to the fields, which was then spread by gravity-assisted, field-to-field flow (Earle 1978:94; Kirch 1992:133, 134). The topographic slope evident at much of Site 1887 would have allowed for such field-to-field flow, although erosion and facing damage would have been a problem (see Kirch 1992:138). The several spillways noted in Area 2, and also perhaps subsurface in Area 4, might have been a way to control such a flow, serving not only to provide water to lower fields but also to slow the flow of water to inhibit erosion at the bases of such transfer features (Treacy and Denevan 1994:99).

LANDSCAPE CHANGE

Kāne'ohe has amphitheater-headed drainage basins where stream flow tends to fluctuate markedly. Archaeological evidence of stream meandering was presented in the inventory survey report (Allen et al. 1987), and substantial additional evidence was revealed by the deep excavations of the data recovery phase. It appears that many of the Site 1887 terraces were built on streambed deposits, but that with subsequent human intervention in the area—in the form of soil terracing and water regulation—the stream became entrenched within its banks.

The use of directed water flow in and over the terraces of Site 1887, and the steepness of the surrounding area, brings up the question of colluvial erosion and damage from flash flooding, which is a concern for other irrigated systems as well, as seen in Anahulu (Kirch 1992:143), Halelea (Earle 1978:73–74, 139), and perhaps Hālawā, Moloka'i (Kirch and Kelly 1975:107–111). Allen et al. (1987:250) state that “the construction and maintenance of steeply stepped terraces in a dynamic, colluvial environment was labor intensive. If repairs and careful control over nature were not diligently maintained, washouts, landslides, and “soil avalanches” . . . could be expected to (and did) destroy irrigated fields.” The archaeological evidence for Site 1887 shows that damage occurred in several areas, necessitating reconstruction of terrace facings, as seen at Features 4, 9, and 35 during inventory survey excavations (Allen et al. 1987) and Features 6, 24, and 27 excavated in the data recovery phase.

There is the opposite but related issue of sedimentation. Mention has already been made of the botanical information indicating forest clearing, which could have led to extensive soil loss from surrounding areas and eventual accumulation at the site. Previous work has demonstrated a large number of deeply buried sites and features in the area, not only in the valley bottoms but also on the tops and sides of ridges (Williams 1992:69). At Site 1887, not only are there buried deposits in all areas with terrace features, but in some cases there are buried features in areas where no surface indications exist, such as the Feature 182 pondfield soils in Area 2 and the buried terraces and *'auwai* in Area 4. These buried features lie directly across from each other, on either side of the stream, where the slope lessens dramatically and where colluvially and alluvially transported sediments might tend to settle. Such sedimentation processes could have additional, significant impacts on areas downslope, well outside the project area (Allen et al. 1987:258–260).

PRE-CONTACT HABITATION

Short term use or temporary habitation sites that are in the same early time frame suggested for non-irrigated cultural layers may be associated with initial clearing, planting, harvesting, or agricultural maintenance (Dockall et al. 2003; Leidemann et al. 2003). In areas south of Luluku *'ili*, a fire feature at Site 2209 has a date range of A.D. 979–1263 (Beta-34012), and a temporary habitation *imu* and lithic activity area at Site 2207 has a date range of A.D. 1019–1278 (Beta-34016). In Luluku *'ili* at Site 1897, a habitation site on the ridge to the north of Site 1887, one feature dates to A. D. 791–1164 (Beta-45363) and an adjacent, associated feature dates to A.D. 1046–1293 (Beta-45362), suggesting that the overlap between the two (mid-eleventh to twelfth century) is a probable range. These early fields and fire features may be evidence of the ca A.D. 1100 population expansion thought by Allen et al. (1987:241) to have “set the stage for much more intensive and expansive use of the Kāne‘ohe slopes by A.D. 1300 or 1400”.

A minimal amount of pre-Contact habitation evidence—firepits, postmolds, and small expedient lithic flake tools—was recovered from Area 9 of Site 1887, similar to that found in the supplemental inventory survey of ridgetop areas to the north and south of Luluku Stream (Allen et al. 2002). The Feature 181 *imu* in Area 9 provided one of the earlier dates from the data recovery excavations, at A.D. 1282–1414 (see Table 4.1); dates for temporary habitation in nearby areas are also in this range. Feature 181.5, another firepit in Area 9, dates to a slightly later period, A.D. 1451–1705. These dates suggest that the area was used during the same periods that the terraces were under cultivation, with farmers eating and sheltering near their fields, although perhaps not on a permanent basis. The lithic activity/workshop area at Site 4483 to the north is also dated to this period, with extensive remains of manufacture and use of lithic tools (Allen et al. 2002). It must be noted that none of these ridge sites have deep or extensive cultural deposits or stone structures that would indicate a substantial investment of time or energy in the organization of the site. Recent excavations in the surrounding upland Kāne‘ohe area (Dockall et al. 2003; Williams 1992) concluded that the majority of the sites in this region are of a temporary nature, with a low density of dates prior to Cal A.D. 1200 but an increasing density of dated features from the thirteenth century onward. Only a few permanent habitation sites were found late in the pre-Contact period in upland Kāne‘ohe. The location of the majority of the permanent habitations is unknown; if, as suspected, they were closer to the coast, they may never be found since the coastal areas have been extensively altered by modern construction.

SOCIAL STRUCTURE

Little can be said about Native Hawaiian social structure based on the excavations at Site 1887. Native Hawaiian historians and ethnographers (Kamakau 1964; Malo 1951) describe a multi-tiered ruling *ali‘i* class—including *kahuna* (priests) and *konohiki* (overseers or administrators)—separate from the *maka‘āinana*, the main body of population, and a less discussed, outcast group, the *kauwā* or *kauā*. Although it is possible that members of any of these various classes used or visited the area, no specific evidence of a particular pre-Contact social class, such as burials or high status artifacts, was found at Site 1887.

Some assumptions can be made based on archaeological interpretation of site activities and correlations with the ethnohistoric data. If it was the chiefly elite who invested heavily in irrigation works in the pre-Contact period (Kirch 2000:295), then the terraces themselves are indicators of *ali‘i* involvement; such chiefly input is known for post-Contact times (Handy et al. 1972:61; ‘Ī‘ī 1959:68; Kirch 1992). Upai, who was awarded *kuleana* lands in Luluku (but not at Site 1887), is listed in the

Mahele Book, and appears to be one of the lesser *ali'i* (Barrère 1994). The inclusion of supervisory *konohiki* in the system could be assumed, at some level. In the post-Contact period, the downslope terraces in Site 1887 (LCA 4225 to Kaneihoe) were obtained from Kawana, who was *konohiki* during the time of Kamehameha II, between 1819 and 1824 (Klieger n.d.). The presence in Luluku *'ili* of the large agricultural Kukuiokāne Heiau is also an important indicator, since “increased hierarchization of the Hawaiian chiefly class . . . is best reflected in the archaeological record through the temple system, which became more elaborated during the later Expansion Period” (Kirch 2000:295–96). Such a *heiau* would have needed the involvement of *kahuna* specialists as well as other groups of *ali'i*.

Within the *maka'āinana*, there were specialists who cultivated the land and fished the oceans, plus those who specialized in making particular material goods—hooks, nets, canoes, tapa and tapa implements, feather work, wooden bowls, etc. (Kamakau 1964). Lithic specialists may have worked at Site 4483, the nearby workshop site (Allen et al. 2002). Tool making was probably a male specialty, although spatial division between basalt and volcanic glass artifact assemblages, such as observed at Site 4483, suggests gender-specific tasks (Dockall et al. 2003). The interpretation of agricultural use at Site 1887 would suggest that the *maka'āinana* were the ones utilizing the site features on a regular basis. In the western Hawaiian Islands, irrigated agriculture was men's work, as opposed to the eastern islands where men and women worked the dryland fields (Kamakau 1961).

EVIDENCE OF LATER AGRICULTURAL USE

Evidence of use of the upland area in the fifteenth through seventeenth centuries comes from several agricultural features. Date ranges for multiple terraces in Areas 1 and 2 fall into this range, and agricultural activity is also indicated for this period in Area 3, at Features 53 and 54 (see Table 4.1). Some pondfields at Site 1887 may be even later, likely dating to the late pre-Contact to post-Contact period. Pondfield layers at the buried terraces in Area 4, that were initially assumed to be early because of their depth, instead yielded surprisingly late dates. A deep, possibly pre-terrace layer below Feature 151 contained charcoal that dated to perhaps the sixteenth or seventeenth century, and a definite pondfield layer at Feature 150 does not appear to be earlier than the eighteenth century. Possible seventeenth to eighteenth century dates have also been obtained for terraces in Areas 1, 2, and 3 (Features 9, 10, 24, and 151), and for a layer below an activity area of undetermined function at Feature 32 in Area 10 (see Table 4.1; Allen et al. 1987). The fact that many of the terraces date to this later period, with an additional area apparently being utilized for the first time, would argue against a decline in agricultural production after A.D. 1600. Instead, there seems to be not only a stability of irrigated cultivation in established fields, but increased production through construction of new fields. If so, it would be unlikely that a hypothesized population decrease sometime prior to European contact would be associated. Radiocarbon dating to this late pre-Contact period is far from exact, however, and should be considered cautiously.

Even later dates, which appear to be definitely post-Contact, are assumed for upper pondfield soils at Features 26 and 38 in Area 2. The presence of nontraditional artifacts in the gleyed agricultural layer of Feature 66 indicates post-Contact use for Area 3, as well. Interestingly, with no indication of earlier terrace episodes, it would appear that the post-Contact construction of Feature 66 is the initial agricultural use of this very steep slope at the western end of Area 3.

Aside from these potentially late dates, no information was recovered from the excavations to definitively answer the question concerning Site 1887 terrace use in the early Contact period (ca 1778–1830). No nontraditional artifacts that could be dated to this period have been recovered. The lack

of such early artifacts, which were more likely to become the property of the *ali'i*, does not mean that the terraces were not in use at this time, only that the people living and working in this rural area did not have (or did not discard) such items here.

POST-CONTACT LAND USE

Rather than excavated artifacts, it is mid-nineteenth century documentation that provides the evidence for use of the Site 1887 terraces in the early post-Contact period. Documents for the six LCAs within the site boundaries note acquisition occurred during the time of various rulers of O'ahu, translating to between A.D. 1795 and 1839. Kawelau claimed 16 *lo'i*, two weed-grown *lo'i*, and a parcel of *kula* as LCA 4490, having acquired the property from Kamohomoho during the time of Kamehameha I (1795–1819) (BCQLT LCA 4490, 4:708; BCQLT NR 4490, 4:309; BCQLT FT 4490, 14:189). These terraces are upslope of Likelike Highway, outside the bounds of the data recovery project, and the highest terraces in the system. Many of the *lo'i* of Area 2 are found within LCA 2514, obtained by Makaiohua from Kawelau when Liliha was the O'ahu governor (1829–1830); Kawelau had previously received the land during the time of Kamehameha I (BCQLT LCA 2514, 9:353; BCQLT LCA 4490, 4:708; BCQLT NR 2514, 3:532; BCQLT FT 2514, 14:191). Hewahewanui acquired LCA 2574, also during the time of Liliha (BCQLT FT 2574, 14:195); some of the Area 3 terraces could be included in this claim. This area was still being used for *kalo* production as late as 1910, but was later leased for banana farming; rice was also grown on or near this parcel (Klieger n.d.). LCA 4223, south of Luluku Stream, was acquired by Kapawa, again from Kawelau during the time of Liliha (BCQLT LCA 4223, 3:877; BCQLT FT 4223, 14:192); the 26 *lo'i* of this award are not visible on the surface, but may have referred to terraces buried in Area 4. LCA 7619 was awarded to Kikane, who acquired his parcel from Kawelau during the time of district chief Kaiakoili (1831) (BCQLT NR 7619, 5:417; BCQLT LCA 7619, 3:879; BCQLT NR 7619, 5:417); this LCA corresponds to the terraces in Area 1. Kaneihoe claimed two '*āpana* of LCA 4225, obtained from Kawana in 1839 (BCQLT FT 4225, 14:193; BCQLT LCA 4225, 4:721; BCQLT NR 4225, 4:227). '*Āpana* 1, a house site, was originally further northeast, but was later transferred to the northern border of '*āpana* 2. '*Āpana* 2, bordered on the south by Luluku Stream, included six *lo'i*, perhaps the fields in Area 5 and the western part of Area 6. The housesite portion may be seen in the archaeological remains of Site 1897, on a ridge to the north of Site 1887 (Leidemann et al. 2003).

Kawelau is prominent in these documents. His appears as the oldest claim, dating to the time of Kamehameha I. Kawelau's terraces are the uppermost *lo'i* in the system, and downslope terrace lands claimed by Kikane, Makaiohua, and Kapawa were received from him. It is possible that there is a family link in these spatially associated holdings in upper Luluku. Such a link can be demonstrated for nearby claims, e.g., LCAs 2539 and 2539B, where Upai, prior to filing his claim, had divided his land equally between himself and his sister's son-in-law Piho, with Piho's land surrounding Upai's land on three sides (Klieger n.d.). The much more detailed and heavily documented analysis of LCA holdings within the Anahulu terrace system of leeward O'ahu diagrams social relationships in terms of placement of land holdings and connecting watercourses, and led to the "discovery that the primary determinant of the hydraulic infrastructure in Hawaiian (and, indeed, evidently most if not all Oceanic) irrigation systems is sociological" (Kirch 1992:157). Based on this information, it is not unlikely that Kawelau was in some way related to those people downslope who held their land through him and probably depended ultimately on water that originated in his holdings.

Despite the archaeological evidence of a nearly millennium-long tradition of varied activities in the upland region (including forest clearance, agriculture, short-term habitation, forest resource collection, and lithic workshop craft specialization), historical records show that most of the food production and habitation activities in Kāneʻohe were concentrated at the coast in post-Contact times. This pattern is similar to that found for other *ahupuaʻa* in Koʻolaupoko district, where “the majority of the *kuleana* were located along the main streams and adjacent lowlands where stream water could be brought by *ʻauwai* to irrigate the taro terraces” (Devaney et al. 1982). For the historical background section of this data recovery project, maps of individual *ʻili* were constructed (Klieger n.d.), showing locations of *kuleana*, *ʻauwai*, streams, springs, ponds, *heiau*, and other features described in LCA documents, along with information on *loʻi* and *kula* lands, where available. These maps show a clear preference for *kuleana* claims in a strip of land within a half kilometer of the coast, and especially in the central coastal section along and between Kāneʻohe and Kāwā Streams. The *ʻili* of Punaluʻu Makai, Keaʻahala Iki, Waikalua Loko, Kaluapuhi, and Keana contain dozens of awarded and nonawarded land claims, and multiple, long *ʻauwai*. In contrast, upland *ʻili* show a limited number of land claims, with those that do exist situated for the most part at the extreme eastern, downslope edge of the *ʻili*. It is possible that this pattern merely reflects a late, inland-to-coast shift in population, similar to that documented for other areas on Oʻahu and elsewhere in the islands, following post-Contact depopulation (Sweeney 1992). However, the mid-nineteenth century pattern as shown in the maps for the upland *ʻili* of Hoʻoleinaiwa, Kuou, Kahuauili, Lulukū, Punaluʻu Mauka, Kapalai, Pau, and Keaʻahala Mauka, appears to confirm the generally negative archaeological findings for pre-Contact permanent habitation in this section of Kāneʻohe.

CONTINUITY AND CHANGE IN UPLAND KĀNEʻOHE AGRICULTURE

The many surface and subsurface features at Site 1887 primarily reflect an extensive traditional Native Hawaiian *loʻi* agricultural complex designed to tap water from Lulukū Stream and its tributaries (Allen et al. 1987). Standing on one of the small ridges just north of the stream in the central part of Site 1887, it is often possible to observe the gray, water-laden clouds offshore over Kāneʻohe Bay as they move inland, massing along the serrated, knife-edge folds of the Koʻolau mountains. Rain, sometimes misting and sometimes torrential, forms ephemeral waterfalls that cascade to the base of the *pali*. A word picture of such precipitation and its effects is given in the saying of the rain “that moves and roars through the pandanus grove of Kekele and Lulukū” (*Ka Naʻi Aupuni*, 15 January 1906), and in the goddess Hiʻiaka’s rain chant as she travels the windward side of Oʻahu:

‘Twas in Koolau I met with the rain:
It comes with lifting and tossing of dust,
Advancing in columns, dashing along.
The rain, it sighs in the forest;
The rain, it beats and whelms, like the surf;
It smites, it smites now the land.

Pasty the earth from the stamping rain;
 Full run the streams, a rushing flood;
 The mountain walls leap with the rain.
 See the water chafing its bounds like a dog.
 A raging dog, gnawing its way to pass out.
 [Emerson 1909:59; see also Luomala 1955:38]

These rain waters eventually feed Lulukū Stream, where numerous cobbles and boulders demonstrate the effects of colluvial transport and water rounding on basalt broken off the Ko‘olau cliffs. Interestingly, at Site 1887 the areas to either side of the Lulukū Stream are virtually free of large surface rock, aside from the extensive and expert construction of terrace facings utilizing such rounded and subrounded materials.

During the periods when the Site 1887 terraces were in active cultivation, water from the stream was diverted for irrigation purposes, to grow food for the terrace builders and cultivators, and all those they supported in turn—their *‘ohana* and the *ali‘i*. The legend of Keahiakahoe tells of the expectations of mutual support between family members, in the exchange of upland *poi* for ocean fish (Sterling and Summers 1978:206), and provides evidence of the rich *kalo* lands at Lulukū: “Through the motivating device of a famine in one of the episodes, three families are forced to depend upon one person to supply them with taro and *poi* that their brother Kahuauili farms at Ka‘akauwai (The-right-[hand]-stream), Lulukū. His name is preserved as the name of an *‘ili* bordering Lulukū, as well as the Ko‘olau peak behind” (Rose n.d.). Interestingly, irrigated fields that might have provided such taro and *poi* have been found in both Lulukū (Site 1887) and Kahuauili *‘ili* (Site 2202), dating to at least ca A.D. 1100–1300, and perhaps earlier (Allen et al. 1987; Dockall et al. 2003). These dated sites may coincide with the traditional twelfth to thirteenth century time frame for the era when the Hawaiian Islands became established as chief-ruled kingdoms, after Kapawa was made a ruling chief and “established the kapus of the chiefs and the kapus of the gods, and who caused a separation between the kapus of the chiefs and of the gods” (Klieger n.d.). Additional radiocarbon dates from Lulukū (Allen et al. 1987) suggest that the terraces at Site 1887 continued in use during the late fifteenth or early sixteenth centuries, a time when the *ahupua‘a* were divided by Mā‘ilikūkahi, a wise and just ruler during a time of widespread prosperity on O‘ahu (Klieger n.d.).

Excavations at the Site 1887 agricultural terraces and elsewhere in the Kāne‘ohe uplands have found little archaeological evidence of use prior to approximately A.D. 1000–1100. The first long-term change here may have been at the beginning of the second millennium A.D., when initial mature forest cover was cleared with the aid of fire, in preparation perhaps for dryland gardening efforts. Earlier excursions into the uplands were likely for short-term habitation while collecting forest resources, but data recovery excavations were unable to confirm Allen’s (1991, 1992b; Allen et al. 2002) suggestion that pondfields were established at Site 1887 by A.D. 500–600, shortly after initial colonization. At Site 1887, the dryland gardens do not have a long history. They were replaced with an irrigated pondfield terrace system constructed on both sides of Lulukū Stream, which was well established by the thirteenth or fourteenth century.

Throughout the Site 1887 archaeological sequences, the multiple stratigraphic layers and radiocarbon dates show changes and alterations over time, as more land was put into terraced cultivation. Terraced areas were expanded, as *lo‘i* were built in areas already under cultivation and in previously unirrigated areas, including areas farther from the stream and in steeper hillside locations. The stratigraphic evidence seems to show that not all the terraces in a set were built at once (such as at Features 53 and 54 in Area 3, and Features 12, 13.1, and 14 in Area 2), suggesting that in some cases

terrace construction was accretional. Allen (1991:121) suggests that a suprafamily level of coordination was needed to construct the terraces and to regulate the irrigation networks at Site 1887, and that the processes involved in this coordination led to the development of the *ahupua'a* socioeconomic system. Earle (1978), however, suggests that irrigation, of the scale seen in Halelea, Kauai at least, does not necessarily require the coordination of a centralized authority beyond the level of the family. And, although increased human labor is needed to initially build pondfield terraces and irrigation canals, once intensive work of building them is over, “the labor required to maintain them may be relatively low. This is especially true for pondfield irrigation of *Colocasia* taro, which produces significantly higher yields than dryland cultivation but does not require greater labor once the terrace pondfields have been constructed” (Kirch 2000:318). Spriggs (1981:154), working in Melanesia, notes that although actual irrigated gardening work is not particularly heavy or difficult, a gardener must keep his eye on the garden constantly (visiting at least twice a week), to weed as needed and to check that the water supply is flowing freely. The need to attend to similar tasks would account for the presence of the temporary habitation sites in and around Site 1887. The dates for irrigated terraces and temporary habitation fire features at Site 1887 correlate with dates from nearby temporary habitation and work sites, which show an increasing density of dated features from the thirteenth century onward (Allen et al. 2002; Leidemann et al. 2003). These activities at Site 1887 and elsewhere in upland Kāneʻohe occurred during the period identified archaeologically as one of accelerated inland expansion. The recent archaeological work here well illustrates Kirch’s (1999:328) comment about Hawaiian agriculture, in which “pondfield irrigation (a classic form of landesque capital intensification) expanded rapidly over landscapes which had formerly been under less intensive forms of cultivation (shifting cultivation or other dryland gardening) beginning in the Expansion Period (ca. A.D. 1200–1650), corresponding to a major phase of population increase”.

Some later dates, as well as documentary evidence, show terraces were used through the late pre-Contact and into the post-Contact period; post-Contact use includes cultivation of rice and banana at Site 1887, in addition to, or replacing, taro. Allen (1991:127) suggests that any late use of the terraces might be associated with new demands of the time, “when the Hawaiian states were increasingly influenced by foreigners, and when Kamehameha I needed large numbers of supplies for the developing exchange with foreign ships’ captains”. This history suggests continuity in place over a long period, as well as expansion to new areas and shifts in land use with population changes (see Leidemann et al. 2003 for similar trends in upland Kāneʻohe habitation).

The apparent lack of pondfield terraces so close to the base of the Koʻolau *pali*, other than the extensive Site 1887 features, is of note; irrigated pondfield terrace construction on the level of those at Site 1887 is apparently not replicated elsewhere in upland Kāneʻohe, at least as far as archaeological investigations have determined so far. The recent Interstate Route H-3 investigations indicate that the upland Kāneʻohe region as a whole was not the scene of large-scale irrigated cultivation in the pre-Contact period, aside from the extensive pondfield terracing at Site 1887. Although discussions of the development of the *ahupua'a* as an economic unit and taxation base have emphasized the role of agricultural surpluses (e.g., Allen 1991, 1992b; Kirch 1984, 1985; Hommon 1976), it would seem that creation of this sort of surplus was not the key reason for utilizing the upland areas of Kāneʻohe. With limited evidence of irrigated or dryland agriculture, compared to the Kāneʻohe lowlands at least, the upland Kāneʻohe area as a whole does not appear to have been foremost in helping to provide surplus agricultural goods. Although this area was very obviously known and used on a regular basis from an early period (Dockall et al. 2003; Leidemann et al. 2003), there are few terraces at this elevation. Most

of the LCAs shown in mid-nineteenth century Mahele records, and most of the terraces seen in early twentieth century aerial photos, are further downslope.

One reason for this lack may be the relatively high degree of slope, where terraces are subject to damage from multiple sources. The Site 1887 terraces are characterized by Allen et al. (1987) as "Type V", meaning they are constructed on steep slopes, commonly interrupted by colluvial transport of gravels from upslope; Allen (1987:4) notes that inventory survey excavations revealed at least five separate intervals of cultivation. The evidence of buried fields and facings, multiple building events, and reuse of terraces indicates that when erosional or flooding disasters occurred at Site 1887, the terrace system was repaired. Earle (1978:43) suggests that it is the labor needed for the repair to a damaged system, rather than initial construction or maintenance, that would have required coordinated effort beyond that possible by a family group. He points out that although historically, and ethnographically, construction and maintenance of irrigation systems do not necessarily require centralization of authority, natural disasters are another matter:

An irrigation system represents a major capital investment for an area. Over a period of time, labor is invested in the construction of dams, ditches, and field terraces so as to increase the area's agricultural productivity. Although a system may have been constructed by accretion, its present value is represented by the total labor and materials necessary to rebuild the system. This point is dramatized in a disaster. Because irrigation systems are compact and highly organized, they are susceptible to extensive damage during a natural disaster....this is an abrupt loss which must be reconstructed in order to regain the previous productivity of the area. . . . If a population is heavily dependent on irrigation and has no sufficient alternative food source, an irrigation system must be rebuilt quickly and large labor crews may be necessary.

Allen (1991:120–121) also notes the role that chiefs could have played "during later droughts, devastating storms, and other periods of hardship". This aspect of the issue of coordination beyond that which could be managed by a family group is of especial interest at Site 1887, where there is substantial evidence of reconstruction of terrace facings, to repair seasonal deterioration and catastrophic damage.

The question remains as to why the Site 1887 terraces, which needed substantial, periodic repair and reconstruction, were built along this steep portion of Lulukū Stream. It is apparent that not all the upland Kāne'ōhe area that could be irrigated was under pondfield cultivation, so population pressure appears an unlikely reason. If Lulukū Stream is not hydrologically superior to other streams and tributaries in Kāne'ōhe, then alternative reasons for the location of these terraces should be examined. A possible explanation centers on cultural factors related to Kāne, "the god of flowing waters and procreation" (Kirch 2000:295), factors that distinguish Lulukū 'ili from surrounding areas. The agricultural class *heiau* named Kukuiokāne, "of platform character and large size", was reported to be somewhere in Lulukū (Thrum 1915; McAllister 1933). The name could translate to "torch or light of Kāne", as suggested by the similar *heiau* names of Kukuiohāpu'u and Kukuiofono (Pukui et al. 1974:122). Perhaps the location of the *heiau* in this well-watered area reflected not only the symbolic or metaphysical aspects of the god Kāne, but also the abundant physical presence of water, one of the most critical requirements for irrigated agriculture of *kalo*, the staple food plant of the windward districts. Of the eight named streams that flowed through this upland area, three of them are associated with wives of Kāne—Māmalahoa, Kahuaiki, and Hi'ilaniwai (McAllister 1933). Their legendary place of meeting, where they join to form Lulukū Stream and where "they enjoy each other's company and decide how they can best supply the people with water" is a *pana* (celebrated, noted, distinguished place) known as *Ho'okui ana keia o nā wai a Kāne* (McAllister 1933:177; Sterling and Summers

1978:207). It is likely that the central area of Site 1887 is close to this *pana*. It is interesting to note that if the three wives became jealous, then water would be diverted, causing the people to suffer (McAllister 1933:177)—diversion that could indicate water flowing in unaccustomed areas, possibly in an uncontrolled fashion. It is also interesting that the name of Luluku *'ili*, where these three wifely streams come together, means “destruction” (Pukui et al. 1974:136). The data recovery phase of archaeological investigations presented here revealed that destruction of the agricultural terraces occurred many times at Site 1887, causing damage that needed to be repaired quickly, perhaps possible only with the help of a suprafamily-level organization. Such an interpretation of the meaning of Luluku’s place name is not the only possibility of course, but it is an intriguing combination of elements.

The introduction to this synthesis chapter presented mythological and legendary references to rain in the *'ili* of Luluku. It is perhaps appropriate, then, that these similar references to the resulting Luluku streams, and occasional floods, end the chapter. It is likely that the history of Site 1887—of its terraces, irrigation canals, episodes of use, abandonment, and reconstruction—are intimately tied to these cultural and environmental factors.

Today much of Site 1887, including terrace features in Areas 1, 2, and 3 that once produced *kalo*, are part of a large parcel of land reserved as a preservation zone intended for interpretive display accessible to the community for educational purposes (Allen 1990a:22). One of the goals of the preservation plan presented to the Hawaii Department of Transportation is to reintroduce *kalo* to some of these fields (Allen 1987:24; Office of Hawaiian Affairs 1995:22). The concept of conservation and continuity of Native Hawaiian tradition that has been presented in this concluding section would be greatly enhanced by such a visual link to the ways of the past in upland Kāne‘ohe.