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Context	Phase	Depth*	Description	Interpretation
8	1	130–150+	Dark reddish brown (5YR 3/2) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 5				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–65	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	65–110	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; clear, wavy lower boundary	Natural deposition process
8	1	110–145+	Dark reddish brown (5YR 3/2) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 6				
1	3	0–50	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	50–100	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
8	1	100–140+	Dark reddish brown (5YR 3/2) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 7				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–90	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	90–150+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 8				
1	3	0–30	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
10	3	30–100	Dark reddish brown (2.5YR 2.5/4) terrestrial silty clay loam; moderately sticky, moderately plastic; *diffuse*, wavy lower boundary	Natural deposition event
11	1	100–140+	Red (2.5YR 4/8) terrestrial gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

Backhoe Trenches 7, 10, 12–15, 17–21, and 31 were all excavated in the same general area and had similar soils (fig. 17, table 8). They contained the plow zone soil, Context 1, to depths ranging from 35 to 50 cm below surface. Context 1 overlay Context 2, a dark reddish brown silty clay loam hardpan soil present to depths ranging from 80 to 130 cm below surface. Context 2 overlay Context 9, a dark brown silty clay loam present to the base of excavation in each trench. This was the most commonly observed profile within the project parcel.

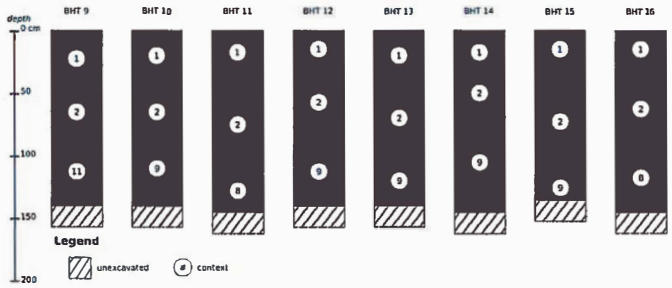

Figure 17: Stratigraphic profiles for Backhoe Trenches 9–16.

Table 8: Sediment descriptions for Backhoe Trenches 9–16

Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 10				
1	3	0–50	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	50–80	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	80–140+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 11				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–115	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
8	1	115–145+	Dark reddish brown (5YR 3/2) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 12				
1	3	0–30	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	30–85	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	85–140+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 13				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
2	1	40–100	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	100–140+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 14				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–65	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	65–145+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 15				
1	3	0–30	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	30–115	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	115–135+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 16				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–90	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
8	1	90–145+	Dark reddish brown (5YR 3/2) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 9				
1	3	0–45	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	45–85	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
11	1	85–140+	Red (2.5YR 4/8) terrestrial gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

Backhoe Trench 21 contained a subsurface cultural deposit recorded as Site 50-40-98-1981 (see fig. 9, p. 77). The deposit, documented as Context 12, was a truncated fire-pit remnant exposed in the southern profile of the trench (fig. 18). The fire-pit has been truncated by the plow zone layer, Context 1, present to a depth of 35 cm below surface. It appears to have been hit by a plow moving east to west as the charcoal from the fire-pit is scattered an additional 65 cm to the west along the bottom of the Context 1 plow zone layer. The fire-pit is approximately 65 cm in width, approximately 10 cm thick, basin shaped, and is present between 35 and 45 cm below surface. A single rounded volcanic cobble was observed within the feature. The fire-pit has been excavated into Context 2, a dark reddish brown silty clay hardpan soil present to a depth of 100 cm below surface. The interface between the fire-pit and the Context 2 soil it had been excavated into was recorded as Context 13. Context 2 overlay Context 9, a dark brown silty clay loam present to the base of excavation at 150 cm below surface. A charcoal sample was collected from the Context 12 fire-pit for wood taxa and ^{14}C analysis.

Backhoe Trench 31 was excavated near Backhoe Trench 21 to search for any additional fire-pit features or associated cultural materials. Backhoe Trench 31 contained the same stratigraphic profile as documented in Backhoe Trench 21. A water line excavation trench with an associated 6 in. PVC pipe was observed in the eastern profile of the backhoe trench. It was recorded as Context 14 and was approximately 25 cm in width and extended to a depth of 140 cm below surface. No additional cultural deposits were documented and no cultural materials were collected from the trench.

Backhoe Trenches 6, 11, 16, and 24 also had similar soils (fig. 19, table 9). They contained the plow zone soil, Context 1, to depths ranging from 35 to 50 cm below surface. Context 1 overlay Context 2, a dark reddish brown silty clay loam hardpan soil present to depths ranging from 70 to 115 cm below surface. Context 2 overlay Context 8, a dark reddish brown silty clay loam with gray and red degrading rock fragments to the base of excavation in each trench.

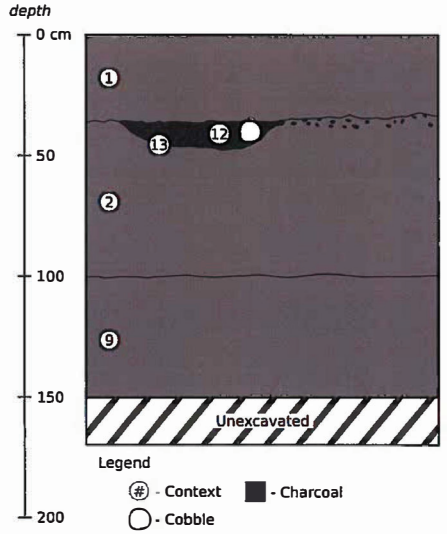

Figure 18: Stratigraphic profile for the Context 12 fire-pit located in Backhoe Trench 21. The feature was later designated Site 50-40-98-1981.

Table 9: Sediment descriptions for Backhoe Trenches 17–24

Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 17				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	40–85	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	85–135+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 18				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	40–75	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	75–150+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 19				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	40–130	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	130–150+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 20				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–110	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	110–140+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 21				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
12	2	35–45	Black (5YR 2.5/1); very abrupt, *irregular* lower boundary	Cultural deposition event

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
2	1	45–100	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	100–150+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 22				
1	3	0–55	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	55–140+	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 23				
1	3	0–45	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	45–120	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
7	1	120–145+	Dark reddish brown (5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 24				
1	3	0–50	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	50–70	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
8	1	70–150+	Dark reddish brown (5YR 3/2) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

Backhoe Trenches 23 and 29 were excavated along the southernmost portion of the project area. They contained the plow zone soil, Context 1, to depths ranging from 40 to 45 cm below surface. Context 1 overlay Context 2, a dark reddish brown silty clay loam

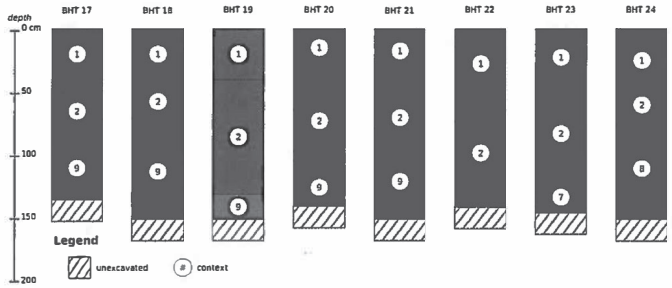

Figure 19: Stratigraphic profiles for Backhoe Trenches 17–24. Note that Backhoe Trench 21 contained the Context 12 fire-pit. See figure 18.

hardpan soil present to depths ranging from 115 to 120 cm below surface. Context 2 overlay Context 7, a dark reddish brown silty clay loam present to the base of excavation in each trench.

Backhoe Trenches 25 and 30 were excavated within the northernmost portion of the parcel located on the east side of Miki Road. They contained the plow zone soil, Context 1, to depths ranging from 35 to 40 cm below surface. Context 1 overlay Context 2, a dark reddish brown silty clay loam hardpan soil present to depths ranging from 65 to 70 cm below surface. Context 2 overlay Context 3, a brown silty clay loam present to the base of excavation in each trench.

Backhoe Trenches 26 and 27 were excavated within the easternmost portion of the parcel located on the east side of Miki Road (fig. 20, table 10). They contained the plow zone soil, Context 1, to depths ranging from 35 to 40 cm below surface. Context 1 overlay Context 2, a dark reddish brown silty clay loam hardpan soil present to depths ranging from 75 to 110 cm below surface. Context 2 overlay Context 6, a very dark gray silty clay loam with degrading rock fragments present to the base of excavation in each trench.

Table 10: Sediment descriptions for Backhoe Trenches 25–31

Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 25				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
2	1	40–70	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
3	1	70–140+	Strong brown (7.5YR 4/6) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 26				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	40–110	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
6	1	110–150+	Very dark gray (5YR 3/1) terrestrial very stony silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 27				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–75	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
6	1	75–145+	Very dark gray (5YR 3/1) terrestrial very stony silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 28				
1	3	0–30	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
4	1	30–60	Dark reddish brown (2.5YR 3/4) terrestrial gravelly silty clay loam; moderately sticky, moderately plastic; diffuse, irregular lower boundary	Natural deposition process
5	1	60–145+	Dark reddish brown (2.5YR 2.5/4) terrestrial very gravelly silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

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Context	Phase	Depth*	Description	Interpretation
Backhoe Trench 29				
1	3	0–40	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	40–115	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
7	1	115–135+	Dark reddish brown (5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 30				
1	3	0–35	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	35–65	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
3	1	65–150+	Strong brown (7.5YR 4/6) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process
Backhoe Trench 31				
1	3	0–25	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; abrupt, smooth lower boundary	Secondary deposition event
2	1	25–85	Dark reddish brown (2.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; gradual, smooth lower boundary	Natural deposition process
9	1	85–150+	Dark brown (7.5YR 3/4) terrestrial silty clay loam; moderately sticky, moderately plastic; base of excavation	Natural deposition process

* Centimeters below surface.

Four of the backhoe trenches contained unique or anomalous profiles. The first, Backhoe Trench 8, contained the plow zone soil, Context 1, to a depth of 30 cm below surface. Context 1 overlay Context 10, a dark reddish brown secondarily deposited plow zone soil with plastic fragments and tubing present to a depth of 100 cm below surface. Context 10 overlay Context 11, a red gravelly silty clay loam with degrading rock present to the base of excavation at 140 cm below surface.

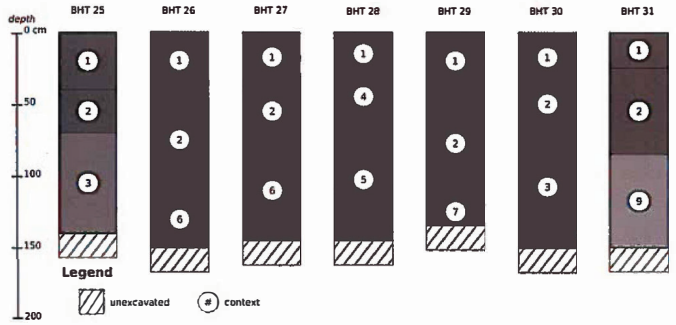

Figure 20: Stratigraphic profiles for Backhoe Trenches 25–31.

Backhoe Trench 9 contained the plow zone soil, Context 1, to a depth of 45 cm below surface. Context 1 overlay Context 2, a dark reddish brown red silty clay hardpan soil present to a depth of 85 cm below surface. Context 2 overlay Context 11, a red gravelly silty clay loam present to the base of excavation at 140 cm below surface.

Backhoe Trench 22 contained the plow zone soil, Context 1, to a depth of 55 cm below surface. Context 1 overlay Context 2, a dark reddish brown silty clay loam hardpan soil present to the base of excavation at 140 cm below surface.

Backhoe Trench 28 contained the plow zone soil, Context 1, to a depth of 30 cm below surface. Context 1 overlay Context 4, a dark reddish brown silty clay loam with degrading rock fragments present to a depth of 60 cm below surface. Context 4 overlay Context 5, a dark reddish brown silty clay loam with red and black degrading rock fragments present to the base of excavation at 145 cm below surface.

5 Summary and Conclusions

At the request of Pulama Lāna'i, T. S. Dye & Colleagues, Archaeologists has completed an archaeological inventory survey for the Miki Basin 200 Acre Industrial Development. Pedestrian survey and subsurface testing were conducted to determine the presence or absence of historic properties and cultural materials within the Miki Basin 200 Acre Industrial Development. During the project, a 100 percent pedestrian survey of the area was conducted and 31 backhoe trenches were excavated. Black plastic fragments, indicative of pineapple cultivation, were observed within the surface layer of soil over the entire project area.

The pedestrian survey resulted in the identification and documentation of a secondarily deposited historic artifact scatter, a secondarily deposited lithic scatter, and an historic

property, Site 50-40-98-1980. Because the two secondary artifact scatters lack integrity of setting, location, and association with other sites and features, they do not represent historic properties and no further investigations of the scatters are warranted.

Subsurface testing included the excavation of 31 backhoe trenches. A truncated fire-pit feature, designated Site 50-40-98-1981, was documented in one of the backhoe trenches. All of the backhoe trenches contained plow zone soils overlying natural hardpan and natural silty clay loam, some of which had degrading rock fragments. No artifacts were collected from any of the trenches excavated.

Both historic properties are evaluated as significant for the important information on Hawaiian history and prehistory that they have yielded. The Miki Basin 200 Acre Industrial Development will have an adverse effect on both historic properties and it is recommended that a data recovery plan be developed for Sites 50-40-98-1980 and 50-40-98-1981, and that this plan be implemented prior to proposed construction activities within the parcel.

It is further recommended that the data recovery plan develop research questions that can be addressed with data yielded by the following laboratory tasks.

Site 50-40-98-1980 Analysis of the wood charcoal collected from the Context 15 fire-pit for taxa identification and ^{14}C dating. Analysis of artifacts collected from the Context 18 lithic scatter to further investigate the tool-making reduction sequence utilized on the island [32].

Site 50-40-98-1981 Analysis of the wood charcoal collected from the Context 12 fire-pit for taxa identification and ^{14}C dating.

A Stratigraphic Contexts

Context	Description
0	Surface of the project area.
1	Dark reddish brown silty clay loam plow zone soil with black plastic fragments and tubing throughout.
2	Dark reddish brown silty clay loam hardpan soil.
3	Brown silty clay loam.
4	Dark reddish brown silty clay loam with degrading rock fragments throughout.
5	Dark reddish brown silty clay loam with red and black degrading rock fragments throughout.
6	Very dark gray silty clay loam with degrading rock fragments throughout.
7	Dark reddish brown silty clay loam.
8	Dark reddish brown silty clay loam with gray and red degrading rock fragments.
9	Dark brown silty clay loam.
10	Secondarily deposited plow zone soils with plastic fragments and tubing.
11	Orange brown silty clay loam with degrading rock throughout.
12	Fire-pit located in Backhoe Trench 21.
13	Interface between the Context 12 fire-pit and the material it had been excavated into, Context 2.

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Context	Description
14	Excavation trench for a 6 in. PVC waterline.
15	Fire-pit remnant exposed on the surface of the Context 2 soil.
16	Secondarily deposited silty clay loam sediment covering the Context 15 deposit.
17	Interface between the Context 15 fire-pit and the soil it had been excavated into, Context 2.
18	Surface scatter of flakes, coral, a cowry shell fragment, two adze rejects, and two possible hammerstones located near the Context 15 fire-pit.
19	Surface scatter of flakes and a single hammerstone.
20	Historic artifact scatter located on the ground surface.

B Field Catalog

Catalog	Site	Unit	Context	Contents
1	No site number	Backhoe Trench 30	1	Sediment
2	No site number	Backhoe Trench 30	2	Sediment
3	No site number	Backhoe Trench 30	3	Sediment
4	No site number	Backhoe Trench 28	4	Sediment
5	No site number	Backhoe Trench 28	5	Sediment
6	No site number	Backhoe Trench 27	6	Sediment
7	No site number	Backhoe Trench 29	7	Sediment
8	No site number	Backhoe Trench 16	8	Sediment
9	No site number	Backhoe Trench 5	9	Sediment
10	No site number	Backhoe Trench 8	10	Sediment
11	No site number	Backhoe Trench 8	11	Sediment
12	No site number	Backhoe Trench 21	12	Charcoal sample
13	No site number	Ground surface	15	Charcoal sample
14	No site number	Ground surface	20	Artifacts
15	No site number	Isolated Find 1	0	Adze reject
16	No site number	No unit	19	Artifacts
17	No site number	No unit	18	Artifacts
18	No site number	No unit	18	Artifacts
19	No site number	Isolated Find 2	0	Adze reject

C Artifact List

Bag	Material	Class	Period*	#	Wt.†	Whole	Notes
15	stone	adze reject	trad.	1	86.1		Discarded due to a transverse fracture sustained during flaking; length 6.7 cm; width 3.7 cm; thickness 1.9 cm

* trad. = Traditional, hist. = Historic; † Weight in grams.

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Bag	Material	Class	Period*	#	Wt.†	Whole	Notes
19	stone	adze reject	trad.	1	242.5		Adze reject proximal end. Sustained a transverse fracture while attempting to remove flakes across the dorsal side; length 6.0 cm; width 3.4 cm; thickness 2.2 cm
Context 18							
17	coral	manuport	trad.	1	30.7		Length 5.4 cm; width 3.4 cm; thickness 2.1 cm
17	stone	adze reject	trad.	1	126.8		Proximal end of an adze reject discarded due to an end shock fracture; length 7.8 cm; width 4.2 cm; thickness 2.7 cm
17	stone	adze reject	trad.	1	76.4		Distal end of an adze reject, likely broken off due to an end shock fracture. The artifact has *cortex* on its dorsal side and shows evidence of problems thinning the cross section of the artifact during flaking; length 6.0 cm; width 3.9 cm; thickness 1.9 cm
17	stone	adze reject	trad.	1	110.5		Distal portion of a large flake with signs of heavy step fracturing along one edge. It is likely to have been discarded due to a transverse fracture sustained during flaking along the edge in addition to trouble removing flakes across the artifact. Made of a dark gray fine-grained basalt; length 8.5 cm; width 4.6 cm; thickness 2.3 cm
18	stone	hammerstone	trad.	1	144.5		Large waterworn pebble manuport with battering on at least one edge from use as a hammerstone; length 5.8 cm; width 5.2 cm; thickness 3.6 cm

* trad. = Traditional, hist. = Historic; † Weight in grams.

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Bag	Material	Class	Period*	#	Wt.†	Whole	Notes
18	stone	waterworn pebble	trad.	1	53.8		Waterworn pebble manuport, possibly a sling stone; length 3.9 cm; width 3.3 cm; thickness 2.8 cm
Context 19							
16	stone	adze reject	trad.	1	20.6		The distal end of an adze reject broken due to an end shock fracture during flaking; length 4.8 cm; width 2.6 cm; thickness 1.2 cm
16	stone	waterworn cobble	trad.	1	142.2		Small waterworn cobble manuport; length 8.7 cm; width 4.6 cm; thickness 2.8 cm
Context 20							
14	ceramic	semi-porcelain	hist.	1	26.7		Undecorated base sherd with footring and partial cobalt blue maker's mark that reads "TRADEMARK/MADE IN JAPAN" with a rising sun logo between the lettering. "Made in Japan" maker's marks on ceramics were required starting in 1921 and continued to 1941. Part of the same vessel as the hand-painted fragment; length 5.7 cm; width 5.3 cm; thickness 0.6 cm
14	ceramic	semi-porcelain	hist.	1	12.6		Body sherd with footring and a hand-painted cobalt blue design with crisscrossing lines. Part of the same vessel as the sherd with the maker's mark; length 5.1 cm; width 3.0 cm; thickness 0.6 cm
14	ceramic	semi-porcelain	hist.	1	0.9		Rim sherd that is undecorated on the inside and has a green glaze on the outside; length 2.4 cm; width 0.8 cm; thickness 0.2 cm

* trad. = Traditional, hist. = Historic; † Weight in grams.

Continued on next page

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Bag	Material	Class	Period*	#	Wt.‡	Whole	Notes
14	ceramic	semi-porcelain	hist.	1	0.4		Undecorated body sherd; length 1.3 cm; width 1.2 cm; thickness 0.3 cm
14	ceramic	white earthenware	hist.	1	6.7		Undecorated rim sherd; length 4.0 cm; width 2.5 cm; thickness 0.6 cm
14	ceramic	white earthenware	hist.	1	6.7		Undecorated body sherd with footring; length 3.1 cm; width 2.9 cm; thickness 0.6 cm
14	glass	bottle	hist.	1	19.0		Clear glass bottle shoulder shard; length 5.4 cm; width 3.6 cm; thickness 0.6 cm

* trad. = Traditional, hist. = Historic; ‡ Weight in grams.

Glossary

abrupt A transition between *horizons* that is 0.5 cm or greater but still less than 2 cm. See also horizon.

caldera A caldera is a cauldron-like volcanic feature usually formed by the collapse of land following a volcanic eruption. They are sometimes confused with volcanic craters.

Christmas berry The ornamental tree, *Schinus terebinthifolius*, known for its bright red berry-like fruits.

clay Fine earth particles less than 0.002 mm.

clear A transition between horizons that is 2 cm or greater but still less than 5 cm. See also horizon.

cobble Rock fragment ranging from 76 mm to less than 250 mm.

Contact A period in Hawaiian history marked by the arrival of Captain James Cook in 1778 and characterized by the social changes that eventually brought about the end of traditional Hawai'i.

context A unit of stratification associated with a natural or cultural process or event.

cortex The weathered outer rind that covers the unweathered inner material of a piece of tool stone.

diffuse A transition between horizons that is 15 cm or greater. See also horizon.

fee simple An estate of inheritance, held without limitation to a particular class of heirs; unconditional inheritance.

fire-pit A pit of varying depth, often bowl shaped at the base, usually identified by a concentration of charcoal and/or burned material in the fill, especially at the feature interface.

gradual A transition between horizons that is 5 cm or greater but still less than 15 cm. See also horizon.

guava The historically introduced tree or shrub, *Psidium guajava*, common in Hawai'i today.

historic property According to Hawai'i Administrative Rules §13-198-2, an "historic property" is any building, structure, object, district, area, or site, including underwater site, that is significant in the history, architecture, archaeology, or culture of the state of Hawai'i, its communities, or the nation.

irregular A soil boundary in which the depth of undulation is greater than its width.

manuport A natural object found in an unnatural position, having been carried there by man.

material culture In *rock art* recording, a category which includes images that are cultural objects, e.g., spears, paddles, gourds, cape, etc.

midden A heap or stratum of refuse normally found on the site of an ancient settlement. In Hawai'i, the term generally refers to food remains, whether or not they appear as a heap or stratum.

moderately plastic A 4 mm diameter roll of soil will support itself if held on end, but a 2 mm diameter roll of soil will not.

moderately sticky Soil adheres to both fingers, after release of pressure and stretches some on separation of fingers.

phase A grouping between an individual unit of stratification and a *period*: several units of stratification make up a phase and several phases compose a period.

phasing Arrangement of the stratification into a stratigraphic sequence, and the division of the sequence into phases and periods. See also *periodization*.

project The archaeological investigation, including laboratory analyses and report preparation. See also *undertaking*.

significance A quality of a historic property that possesses integrity of location, design, setting, materials, workmanship, feeling, and association. The qualities are set out in SHPD administrative rule §13-275-6, *Evaluations of Significance*.

site The fundamental unit of archaeological investigation, a location that exhibits material evidence of past human activity.

smooth A soil boundary which is planar with few or no irregularities.

stone Rock fragment ranging from 250 mm to less than 600 mm.

stratigraphic relationships These are either of a superpositional nature, where one deposit lies above another, or they are made up of correlations, where strata or features have been cut into isolated parts by later digging.

sugarcane A grass, *Saccharum officinarum*, widely grown in warm regions as a source of sugar. See also *kō*.

unit of stratification number A number assigned to each natural and man-made layer, upstanding stratum, and vertical and *horizontal feature interface*. Once numbered, each unit will automatically have a set of stratigraphic relationships which must be defined and recorded.

wavy A soil boundary in which the width of undulation is greater than its depth.

Hawaiian Terms

ahu Heap, pile; altar, shrine, cairn.
ahupua'a Traditional Hawaiian land division, usually extending from the uplands to the sea.
'āina Land, earth.
akua God, goddess, spirit, ghost, devil, image, corpse.
'alae A bird, *Fulica americana alae*, the mudhen or Hawaiian gallinule. See also *'alae kea*.
ali'i Chief, chiefess, officer, ruler, monarch, peer, head man, noble, aristocrat, king, queen, commander.
aloha Love, affection, compassion, mercy, sympathy, etc.
'apapane A honeycreeper, *Himatione sanguinea* with crimson body and black wings and tail, found on all the main Hawaiian Islands. Its feathers occasionally were used for featherwork.
'aumakua Family or personal gods, deified ancestors who might assume the shape of animals, rocks, clouds, or plants.
'awa A shrub, *Piper methysticum*, the root of which is the source of a narcotic drink of the same name used in ceremonies, prepared formerly by chewing, later by pounding.
hale House, building, station, hall.
he'e Octopus.
heiau Traditional Hawaiian place of worship.
helu To count, number, compute, take a census, figure enumerate, list, include, impute; to assess, as taxes; to chant a list of names, as of genealogy; including, counting, enumeration, census, list, rate, number, figure, total, inventory; statistics.
'ili A land section, next in importance to *ahupua'a*, and usually a subdivision of an *ahupua'a*.
'iliahi Native trees and shrubs belonging to the genus *Santalum*, or sandalwood. Traditionally, it was powdered and mixed with coconut oil to make perfume for *kapa*.
imu Underground oven.
ipu The gourd, *Lagenaria siceraria*.
Kahiki Tahiti, foreign land.
kahuna Priest, sorcerer, magician, wizard, minister, expert in any profession.
kala A generic name for fish in the Unicornfish genus *Naso*. It is generally caught in nets or with a spear. The flesh has a strong odor and is rarely eaten raw; it is often broiled or partially dried and broiled.
kalo The taro, *Colocasia esculenta*, was a staple food in traditional Hawai'i and all parts of the plant were used. The rootstock was baked or steamed, then eaten sliced or pounded to make *poi*, raw taro was also grated and mixed with coconut milk to make desserts, the leaves, leaf stems and flowers were also used in cooking. Medicinally the leaves and rootstock were used to treat many ailments. The plant was also used ritually, as bait for fish, glue, and to make dye.
kama'āina Native-born, one born in a place, host.
kapa Tapa cloth, as made from *wauke* or *māmaki* bark.
kapu Taboo, prohibition; special privilege or exemption from ordinary taboo; sacredness; prohibited, forbidden; sacred, holy, consecrated; no trespassing, keep out.

kāula Prophet, seer, magician.
kawakawa Bonito, little tunny (*Euthynnus yaito*).
kihāpai Small land division, smaller than a *paukū*; cultivated patch, garden, orchard, field, small farm.
kō Sugarcane, *Saccharum officinarum*, was introduced to Hawai'i by Polynesian settlers, who cultivated it widely. The stalk was chewed between meals for its sweetness, brought on long journeys to ease hunger, and eaten in times of famine; juice from the stalk was fed to nursing babies, and used as a sweetening agent in medicinal herbal concoctions; the leaves were used as thatching for houses; the leaf midrib was used for plaiting braids that were made into hats; the stem of the flower was used to make darts for a child's game.
ko'a Shrine, often consisting of circular piles of coral or stone, built along the shore or by ponds or streams, used in ceremonies as to make fish multiply; also built on bird islands, and used in ceremonies to make birds multiply.
koa haole A historically introduced small tree, *Leucaena glauca*.
Kona Leeward sides of the Hawaiian Islands. Name of a leeward wind.
konohiki Head man of an *ahupua'a* land division under the chief; land or fishing rights under control of the *konohiki*. See also *ahupua'a*.
Ko'olau Windward sides of the Hawaiian Islands.
kūkini Runner, swift messenger, as employed by old chiefs, with a premium on their speed.
kukui The candlenut tree, *Aleurites moluccana*, introduced to Hawai'i by Polynesian settlers. The outer husk of the fruit or nut was used to make a black dye for tapa and tattooing; sap from the fruit was used as medicine to treat thrush, and used as a purgative; the hard shell of the nut was used in *lei* making; the kernel of the nut was the source of an oil that was burned for illumination and also used as a wood varnish for surfboards and canoes; the kernel was also chewed and spit on rough seas to calm the ocean and baked kernels were mixed with salt and chili pepper to make a relish (*'inamona*); the trunk was used to make canoes and floats for fishing nets; a reddish dye was made from the bark and/or root; a gum exuded from wounded bark was used to treat tapa; the flower was mixed with sweet potato to treat thrush; the leaves were used in a poultice for swelling and infection.
kula 1. Plain, field, open country, pasture; land with no water rights. 2. School.
kuleana Right, title, property, portion, responsibility, jurisdiction, authority, interest, claim, ownership.
lawai'a Fisherman; to catch fish.
lehua The flower of the *'ōhi'a* tree, *Metrosideros polymorpha*; also the tree itself. See also *'ōhi'a lehua*.
lei Garland, wreath.
mahalo Thanks, gratitude.
Māhele The mid-nineteenth century land division responsible for the introduction of fee simple land title in Hawai'i.
mai'a All kinds of bananas and plantains.

maika Ancient Hawaiian game suggesting bowling.

maile A native twining shrub, *Alyxia olivaeformis*, used in traditional Hawaiian religion to evoke Laka, the goddess of hula. *Maile* sticks gummed with lime were used as part of a rig to catch birds.

māla Garden, plantation, patch, cultivated field.

māmane A native tree, *Sophora chrysophylla*, that thrives at high altitudes. Traditionally the wood was used for a variety of wood implements, and also in *hōlua* sleds. The flower was used medicinally as an astringent.

manō Shark. In Hawaiian culture, there are two classes of sharks. *Manō kānaka* are sharks with human affiliations, and *manō i'a* are wild sharks. *Manō kānaka* were revered and cared for, and were *akua* or *'aumakua*.

mō'ī King, queen, sovereign, monarch, or a rank of chiefs who could succeed to the government but who were of lower rank than chiefs descended from the god Kāne.

mo'o 1. Narrow strip of land, smaller than an *'ili*; 2. Lizard, reptile of any kind, dragon, serpent; water spirit.

naio A native tree, *Myoporum sandwicense*, with hard, dark, yellow-green wood. The wood was used traditionally for the main timbers of houses.

pala A native fern (*Marattia douglasii*), with a short trunk and large, long-stemmed, much divided, dark green fronds. In time of famine, the thick, starchy, hoof-shaped bases of the frond stems, which cover the short trunk, were eaten after being baked in an *imu* overnight. The mucilaginous water resulting from slicing and soaking the raw stems in water was used medicinally. Pieces of the fronds mixed with *maile lei* enhanced their fragrance. The fern was also used in *heiau* ceremonies.

pānini A cactus, *Opuntia megacantha*, introduced to Hawai'i in the 1800s. The Hawaiian name means "unfriendly wall." Hawaiians made a fermented drink from the fruits and also ate them raw.

paukū A land section smaller than a *mo'o*.

pili A native grass, *Heteropogon contortus*, whose leaves were used traditionally as house thatch.

pipi 1. Hawaiian pearl oyster, *Pinctada radiata*. In songs this is known as the *i'a hāmau leo o 'Ewa*, 'Ewa's silent sea creature—it was believed that talking would cause a breeze to ripple the water and frighten the *pipi*. 2. Cattle.

poi The Hawaiian staff of life, made from cooked taro corms, or rarely breadfruit, pounded and thinned with water.

pua kala A native perennial herb, *Argemone glauca*, whose seeds mixed with a yellow sap from the stalk were used as a narcotic for pain relief; the sap was also used to treat warts.

pūhi Any eel.

pule Prayer, magic spell, incantation, blessing.

'uala The sweet potato, *Ipomoea batatas*, introduced to Hawai'i by Polynesian settlers, was a staple food. The tuber was cooked whole and eaten or it was made into poi and mixed with coconut milk to make a dessert; it was used as bait for mackerel fishing; and to make a fermented drink called 'uala 'awa'awa. The vine made a *lei* which was worn by nursing mothers to ensure a good flow of milk; when dried, the

vine was also used as padding underneath floor mats. All parts of the plant were used as food for pigs. Kamapua'a was the god of the sweet potato.

uhu An adult fish in the family Scaridae.

'ulu 1. Discoidal, smooth stone as used in *'ulu maika* game; 2. Breadfruit, *Artocarpus altilis*.

wahine Woman, lady, wife; sister-in-law, female cousin-in-law of a man.

wauke A small tree or shrub, *Broussonetia papyrifera*, whose bark was made into *kapa* cloth. The inner bark was used to make cordage, and the shoots were used to treat childhood diseases. The leaves, along with banana and taro leaves, were used ceremonially to wrap the bodies of *ali'i* after death.

weke Certain species of Mullidae, surmullets, or goatfish, which have large scales and are usually found in reefs. Red and light-colored *weke* were popular as offering to the gods.

Abbreviations

ac. A unit of land area equal to 4,840 square yards (0.405 hectare).

AD *Anno Domini*, the Christian era in the Gregorian calendar, starting from the year AD 1 as the calculated year in which Christ was born.

cm The centimeter, a derived unit of length in the International System of Units, equal to 10^{-2} m. See also m.

GPS Global Positioning System, operated by the government of the United States. The term is often used for the unit used to communicate with the GPS.

in. A unit of linear measure equal to one twelfth of a foot (2.54 cm).

LCA Awards issued by the Board of Commissioners to Quiet Land Titles between 1846 and 1855 to persons who filed claims to land between 1846 and 1848.

m The meter, a base unit of length in the International System of Units, equal to the length of the path traveled by light in vacuum during a time interval of 1/299,792,458 of a second.

USGS A federal agency that provides reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the quality of life.

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STATE HISTORIC PRESERVATION DIVISION ARCHAEOLOGICAL INVENTORY SURVEY ACCEPTANCE LETTER

APPENDIX

D-2

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

August 4, 2020

IN REPLY REFER TO:
Log No.: 2020.01586
Doc. No.: 2008AM02
Archaeology

Glen Ueno, Administrator
County of Maui
Department of Public Works
Development Services Administration Division
250 South High Street
Wailuku, Maui, Hawai‘i 96793

Dear Glen Ueno:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Miki Basin Industrial Park Project
Archaeological Inventory Survey
Kamoku Ahupua‘a, Lāhaina District, Lāna‘i Island
TMK: (2) 4-9-002:061 por.

This letter provides the State Historic Preservation Division's (SHPD) review of the draft report titled, *Archaeological Inventory Survey for the Miki Basin 200 Acre Industrial Development* (DiVito et al., May 2018), produced by T.S. Dye and Colleagues, Archaeologist, Inc. (TSD) for the Pūlama Lāna‘i, Miki Basin Industrial Park project. SHPD received a draft environmental assessment (EA) report (Ho‘okuleana LLC, June 2020) for the project on December 5, 2019 (Log No. 2019.02674) and a final EA report on July 8, 2020 along with a cover letter prepared on behalf of Pūlama Lāna‘i, an HRS 6E Submittal Form, the subject archaeological inventory survey (AIS) report (Log No. 2020.01586).

The Miki Basin Industrial Park project is a 200-acre master-planned light and heavy industrial development on land adjoining the Lāna‘i Airport, the Maui Electric Company (MECO) 5-acre power plant and the existing 20-acre Miki Basin Industrial Condominium. The current submittal does not include a permit set, however Pūlama Lāna‘i indicates the proposed 200-acre Miki Basin Industrial Park is planned to be developed incrementally over a 30-year period.

TSD initially completed the subject AIS in 2016 (Log No. 2016.02655) and the report was subsequently withdrawn by Pūlama Lāna‘i. TSD conducted additional archaeological work in the project area and presented the findings from both survey efforts in the current AIS report (DiVito et al., May 2018). The report indicates the AIS was conducted to identify historic properties and cultural materials in the project area to support a proposed zoning change and construction activities associated with the Miki Basin Industrial Park project.

The subject AIS report includes a detailed analysis of historic land use, cultural practices in the area, an artifact analysis section, a summary of previous archaeological investigations, and the results of the archaeological testing. The survey included a 100 percent coverage pedestrian survey of the project area conducted using transects spaced at 10-meter (m) intervals. Subsurface testing of the project area included the excavation of 31 backhoe trenches. The test trenches were excavated to 145 cm below ground surface, measured 3 to 4 m in length, and were each 1 m wide. The GPS data for the locations of each trench excavation was recorded and the locations are depicted on a map of the project area. The report includes soil descriptions using Munsell colors and USDA descriptions and attributes.

TSD identified two historic properties during AIS testing (Table 1). SIHP # 50–40–98–1980 is comprised of two features including a lithic scatter and an eroded exposed fire-pit. SIHP # 50-40-98-1981 is a subsurface truncated fire-pit feature. TSD assessed SIHP # 50–40–98–1980 and 50–40–98–1981 as significant for the information on Hawaiian history and prehistory that they have yielded. The report indicates the Miki Basin Industrial Park project will adversely impact both historic properties and it is recommended that data recovery excavation be conducted as mitigation for SIHP #s 50-40-98-1980 and 50-40-98-1981.

Table 1: Historic properties identified within the current project area.

SIHP # 50-40-98-	Formal Type	Significance Assessment	Description	Mitigation
1980	artifact scatter and fire-pit	d	Surface lithic scatter and exposed fire-pit	Data recovery
1981	fire-pit	d	Subsurface fire-pit (Backhoe Trench 21)	Data recovery (tested)

The report meets the minimum requirements of HAR §13-275-6. **It is accepted**. Please send two hard copies of the document, clearly marked FINAL, along with a copy of this acceptance letter and text-searchable PDF version of the report to the Kapolei SHPD office, attention SHPD Library. Additionally, please send a digital copy of the final AIS report (DiVito et al., May 2018) to lehua.k.soares@hawaii.gov.

The current submittal includes a cover letter from Pūlama Lānaʻi dated July 5, 2020 that requests an HRS 6E-42 project effect determination of "*effect, with proposed mitigation commitments*," with mitigation in the form of data recovery. Honua Consulting recommends that a data recovery plan be developed for SIHP #s 50–40–98–1980 and 50–40–98–1981 and a program of archaeological monitoring for the Miki Basin Industrial Park project.

SHPD concurs with the significance assessments and mitigation recommendations for SIHP #s 50–40–98–1980 and 50–40–98–1981. However, the **SHPD notifies the County of Maui** that our office has not yet received a County permit submittal triggering an HRS 6E-42 review. Therefore, our division cannot make a project effect determination at this time.

SHPD requests to be consulted prior to the issuance of any permits associated with the Miki Basin Industrial Park project on the subject property, allowing our division the opportunity to review the proposed project and to make an HRS 6E project effect determination in accordance with HAR §13-284-3 and, if necessary, any appropriate mitigation.

Please contact Andrew McCallister, Historic Preservation Archaeologist IV, at Andrew.McCallister@hawaii.gov or at (808) 692-8010 for matters regarding archaeological resources or this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Keiki-Pua S. Dancil, Pūlama Lānaʻi, kdancil@pulamalanai.com
Trisha Kehaulani Watson, Honua Consulting, watson@honuaconsulting.com
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Daniel E. Orodenker, Land Use Commission, daniel.e.orodenker@hawaii.gov

ARCHAEOLOGICAL DATA RECOVERY PLAN AND ARCHAEOLOGICAL DATA RECOVERY REPORT

APPENDIX

D-3

Pūlama Lānaʻi

January 6, 2021

Alan Downer, Ph.D.
Deputy State Historic Preservation Officer
State Historic Preservation Division
Kakuhihewa Building
601 Kamokila Boulevard, Suite 555
Kapolei, Hawaii 96706

By HICRIS

Dear Dr. Downer:

Subject: Miki Basin Industrial Park Project
Data Recovery Plan and Data Recovery Report
Project No.: 2020PR33693, Log No. 2020.01586, Doc. No.: 2008AM02
Kamoku Ahupuaʻa, Lāhaina District, Lānaʻi Island
TMK: (2) 4-9-002:061 (por.)

Pūlama Lānaʻi respectfully submits the Data Recovery Plan (**Exhibit A**) and Data Recovery Report (**Exhibit B**) for the Miki Basin Industrial Park Project located at Kamoku Ahupuaʻa, Lāhaina District, Lānaʻi Island TMK: (2) 4-9-002:061 (por.) for the State Historic Preservation Division review per 6E-42, Hawaii Revised Statues (HRS) in connection to the 2nd Draft Environmental Assessment for the State Land Use District Boundary Amendment, Docket No. A19-809.

On July 8, 2020 Pūlama Lānaʻi submitted a final EA report with a cover letter, an HRS 6E Submittal Form, and an archaeologically inventory survey (AIS) report titled *Archaeological Inventory Survey for the Miki Basin 200 Acre Industrial Development* (DiVito et al., May 2018) (Log No. 2020.01586).

On August 4, 2020, SHPD provided a letter to the County of Maui (Log No. 2020.01586, Doc. No.: 2008AM02) accepting the AIS and concurring with the significance assessments and mitigation recommendations for SIHP #s 50-60-98-1980 and 50-40-98-1981, which included a recommendation that a data recovery plan be developed. Additionally, SHPD notified the County of Maui that their division could not make a project effect determination as their office had not received a County permit submittal triggering an HRS 6E-42 review.

HONOLULU OFFICE 733 Bishop Street, Suite 1500, Honolulu, Hawaii 96813 • **TEL** 808.237.2001 • **FAX** 808.566.6927
LĀNAʻI OFFICE 1311 Fraser Avenue, PO Box 630310, Lānaʻi City, Hawaii 96763 • **TEL** 808.565.3000 • **FAX** 808.565.3881

Pūlama Lāna'i has further refined the uses within the Miki Basin Industrial Park Project and has submitted a Second Draft Environmental Assessment for the State Land Use District Boundary Amendment, Docket No. A19-809, published in *The Environmental Notice* on November 23, 2021[1]. It should be noted that the project area has not changed.

The Data Recovery Plan for Sites 50-40-98-1980 and 50-40-98-1981 (**Exhibit A**) was completed on May 9, 2018, and the Data Recovery Report (**Exhibit B**) was completed on February 28, 2019. We sincerely apologize for implementing the Data Recovery Plan before seeking SHPD concurrence. *Figure 1* identifies the location of SIHP sites 50-40-98-1980 and 50-40-98-1981 relative to the Miki Basin Industrial Park Project area.

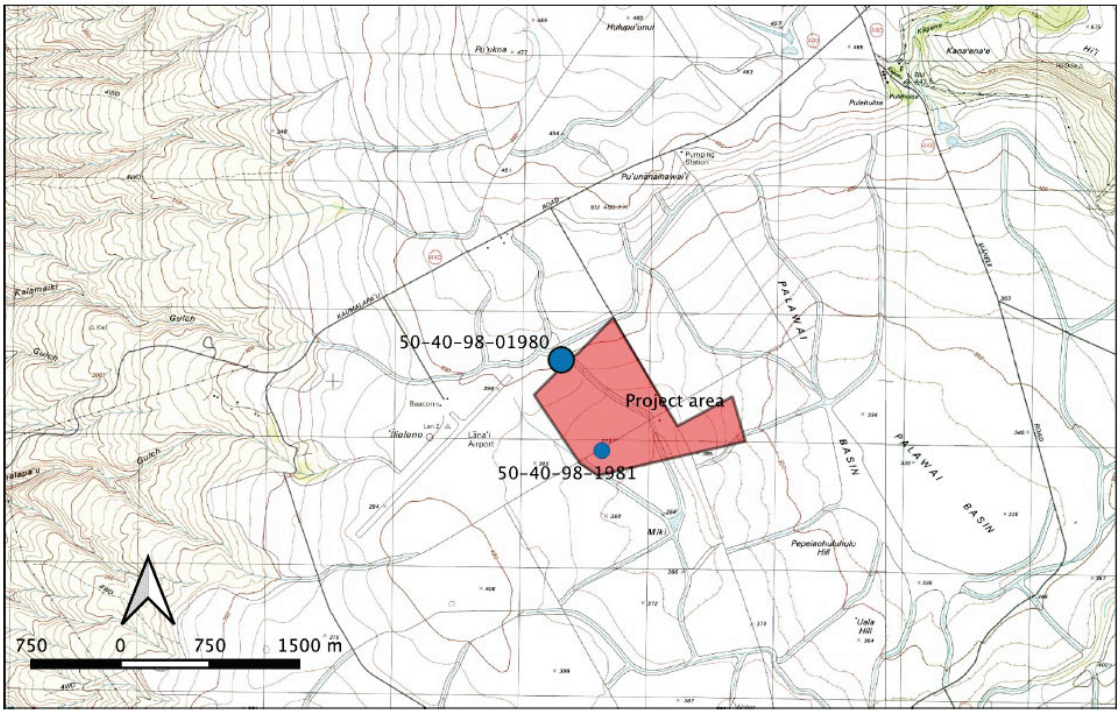

Figure 1. Location of Sites 50-40-98-1980 and 50-40-98-1981 (blue dots) and the Miki Basin Industrial Park Project area (red polygon) on a USGS quadrangle map.

Thank you for your review of the submitted materials.

Mahalo,

Keiki-Pua Dancil
Keiki-Pua Dancil (Jan 6, 2022 16:30 HST)

Keiki-Pua S. Dancil, Ph.D.
Senior Vice President of Government Affairs & Strategic Planning

cc: Trisha Kehaulani Watson, Honua Consulting, watson@honuaconsulting.com

[1] http://oeqc2.doh.hawaii.gov/Doc_Library/2021-11-23-LA-2nd-DEA-Miki-Basin-Industrial-Park.pdf

Exhibit A

Archaeological Data Recovery Plan

T. S. Dye & Colleagues, Archaeologists, Inc.
735 Bishop St., Suite 315, Honolulu, Hawai'i 96813

Archaeological Data Recovery Plan for Sites 50-40-98-1980 and 50-40-98-1981 Within the Miki Basin 200 Acre Industrial Development*

Lands of Kalulu and Kaunolū, Lahaina District, Lāna'i Island, TMK: (2) 4-9-002:061

Thomas S. Dye, PhD

May 9, 2018

Management Summary

At the request of Pulama Lāna'i, and pursuant to Hawaii Administrative Rules §13-278-3, T. S. Dye & Colleagues, Archaeologists has prepared an archaeological data recovery plan for Sites 50-40-98-1980 and 50-40-98-1981, located at Kalulu and Kaunolū, Lahaina District, Lāna'i Island. The data recovery plan follows the recommendations set out in the inventory survey report and proposes to carry out technological analyses of lithic materials collected from Site 50-40-98-1980, and charcoal identification and dating of the *fire-pits* at Sites 50-40-98-1980 and 50-40-98-1981.

Contents

*Prepared for Pulama Lāna'i, 1311 Fraser Avenue, P.O. Box 630310, Lāna'i City, HI 96763

Figures

1 Introduction

At the request of Pulama Lāna'i, T. S. Dye & Colleagues, Archaeologists has prepared an archaeological data recovery plan for Sites 50-40-98-1980 and 50-40-98-1981 located in the lands of Kalulu and Kaunolū, Lahaina District, Lāna'i Island (fig. 1). Sites 50-40-98-1980 and 50-40-98-1981 are located in the land parcel identified on tax maps as TMK: (2) 4-9-002:061.

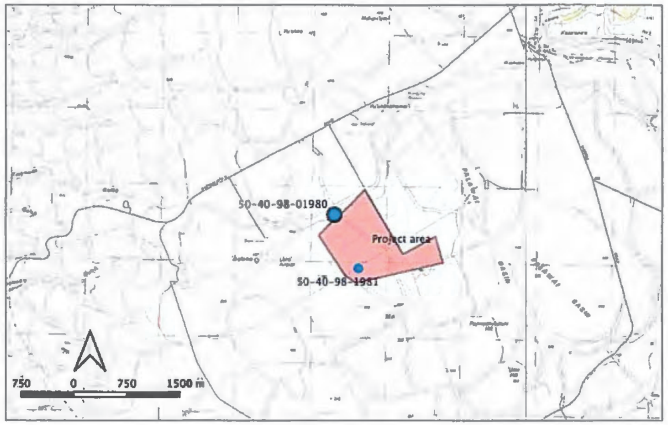

Figure 1: Location of Sites 50-40-98-1980 and 50-40-98-1981 and the Miki Basin 200 Acre Industrial Development on a USGS quadrangle map.

2 Sites 50-40-98-1980 and 50-40-98-1981

Site 50-40-98-1980 is located in the northernmost portion of the *project* area in a highly eroded area along the fence line boundary with the Lāna'i Airport (fig. 1). The site comprises two components, a lithic scatter and an eroded and exposed fire-pit.

The lithic scatter is located on the crest of a slope and extends south along a drainage cut. The scatter covered an area of approximately 30 × 120 m (meter) and, at the time of survey, contained 30 or more pieces of flaked basalt. All of the artifacts that were observed and collected from the scatter came from within or adjacent to the existing drainage in areas that lacked vegetation. A cowry shell fragment and several pieces of branch coral were observed within the scatter. Three adze rejects, a hammerstone, a waterworn pebble *manuport*, and a piece of branch coral were collected from the scatter (fig. 2). No artifacts were observed or collected in the vegetated areas around the drainage. This suggests that the artifacts have either moved downslope from a higher location as a result of water erosion or that the site has eroded and deflated over time. In either case, the artifacts would have been secondarily deposited from their original position.

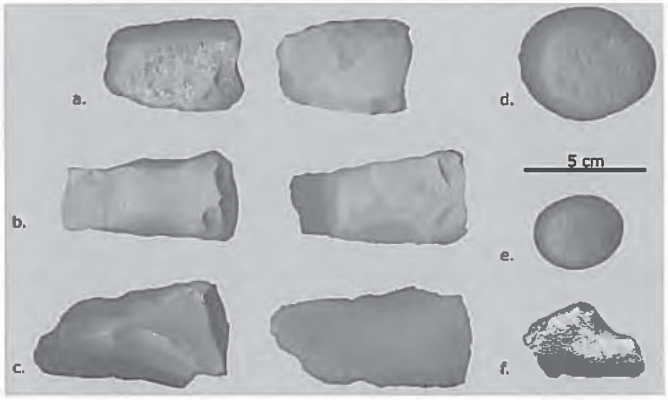

Figure 2: Artifacts collected from the Context 18 lithic scatter, part of Site 50-40-98-1980: *a*, dorsal and ventral views of an adze reject, distal portion; *b*, dorsal and ventral views of an adze reject, proximal portion; *c*, dorsal and ventral views of an adze reject, distal portion; *d*, waterworn cobble hammerstone; *e*, waterworn pebble manuport; *f*, branch coral. The three adze rejects are depicted with the dorsal side to the left and the ventral side to the right.

The second component of Site 50-40-98-1980 was an exposed fire-pit remnant located within the lithic scatter on the crest of the slope in a heavily eroded area. The *fire*-pit remnant was observed over an approximately 75 cm (centimeter) diameter area and had exposed charcoal and a few small cobble-size fire-affected rocks on the surface and eroding downslope. No black plastic or tubing was observed in or around the fire-pit because the plow zone in this location had completely eroded away. It is likely that the fire-pit had originally been truncated by plows when the pineapple field was cultivated. Following documentation of the fire-pit remnant, the fire-pit was bisected twice to determine its size and stratigraphic position (fig. 3).

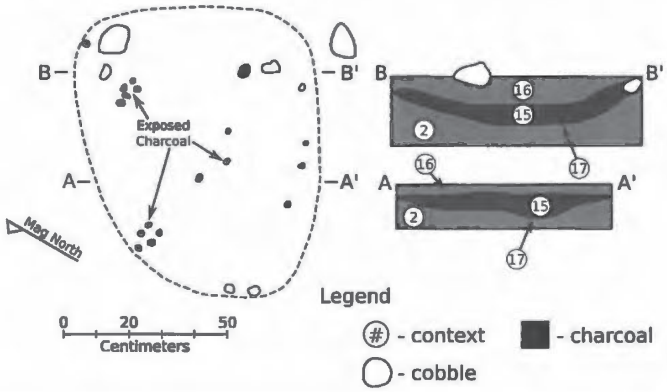

Figure 3: Sketch map and cross section drawing of a subsurface fire-pit recorded at Site 50-40-98-1980.

The first bisection point, A to A', cut the fire-pit in half to expose the stratigraphic section. Following bisection, a 15 cm deep profile was exposed. Context 16, a loose red silty *clay* loam sediment, was present from the current ground surface to a depth of 3 cm. It appears that the sediment has been deposited over the fire-pit due to water erosion along the drainage. The fire-pit, Context 15, is a band of charcoal that extends from 3 cm below surface to a depth of 12 cm. The fire-pit at this location is approximately 60 cm wide and is basin shaped. The interface between the Context 15 fire-pit and the material it had been dug into, the Context 2 dark reddish brown silty clay loam hard pan soil, was recorded as Context 17. The Context 2 soil was present to the base of excavation at 15 cm below surface.

The second bisection point, B to B', was cut just in front of the two rocks that were exposed on the surface. Following bisection, a 20 cm deep profile was exposed. Context 16, a loose red silty clay loam sediment, was present from the current ground surface to a depth of 6 cm. The sediment has been deposited over the fire-pit due to water erosion along the drainage. The fire-pit, Context 15, is a curved band of charcoal that extends from 6 cm below surface to a maximum depth of 15 cm. The fire-pit at this location is approximately 75 cm wide and is basin shaped. The interface between the Context 15 fire-pit and the material it had been dug into, the Context 2 dark reddish brown silty clay loam hard pan soil, was recorded as Context 17. The Context 2 soil was present to the base of excavation at 20 cm below surface. A charcoal sample was collected from each profile after bisection for wood taxa identification and ^{14}C analysis.

A subsurface cultural deposit recorded as Site 50-40-98-1981 was identified in a backhoe trench (see fig. 1, p. 2). The deposit was a truncated fire-pit remnant exposed in the southern profile of the backhoe trench (fig. 4). The fire-pit was truncated by the plow zone layer, Context 1, present to a depth of 35 cm below surface. The upper portion of the fire-pit appears to have been destroyed by a plow moving east to west; charcoal from the fire-pit is scattered an additional 65 cm to the west within the plow zone. The fire-pit remnant is approximately 65 cm in width, approximately 10 cm thick, basin shaped, and is present between 35 and 45 cm below surface. A single rounded volcanic cobble was observed within the feature. The fire-pit had been excavated into Context 2, a dark reddish brown silty clay hardpan soil present to a depth of 100 cm below surface. The interface between the fire-pit and the Context 2 soil it had been excavated into was recorded as Context 13. Context 2 overlay Context 9, a dark brown silty clay loam present to the base of excavation at 150 cm below surface. A charcoal sample was collected from the Context 12 fire-pit for wood taxa and ^{14}C analysis.

Sites 50-40-98-1980 and 50-40-98-1981 were evaluated as significant for the important information on Hawaiian history and prehistory that they have yielded.

3 Research Objectives

The inventory survey report recommended that a data recovery plan be developed and implemented prior to construction activities at the Miki Basin 200 Acre Industrial Development. It was further recommended that the data recovery plan develop research questions that can be addressed with data yielded by the following laboratory tasks:

Site 50-40-98-1980 Analysis of the wood charcoal collected from the Context 15 fire-pit for taxa identification and ^{14}C dating. Analysis of artifacts collected from the Context 18 lithic scatter to further investigate the tool-making reduction sequence utilized on the island [12].

Site 50-40-98-1981 Analysis of the wood charcoal collected from the Context 12 fire-pit for taxa identification and ^{14}C dating.

The research objectives of the proposed data recovery investigations include gathering data on the history of vegetation change on Lāna'i in an effort to date two periods of change, one during the traditional Hawaiian period and the other in the mid nineteenth

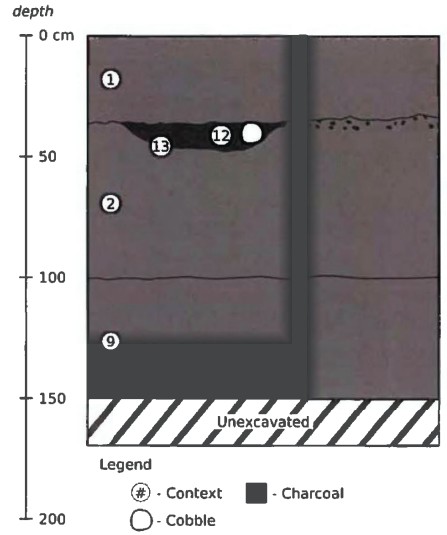

Figure 4: Stratigraphic profile of the south face of the backhoe trench showing the fire-pit, Site 50-40-98-1981, as contexts 12 and 13. Note that the fire-pit has been truncated by the plow zone, Context 1.

century when sheep and goats were raised on the island [7], and to complete paired technological and geochemical sourcing analyses of the lithic artifacts to determine the reduction sequences for the flaked stone implements, and to determine likely source locations for the fine-grained, tool-grade basalt items in the collection.

The first period of vegetation change that will be investigated involves a process identified as landscape transport [2; 8], whereby the Polynesian settlers of Hawai'i established about 28 species of plants brought to the islands from a homeland in the southern hemisphere [13:321 ff.]. This process has been dated to the mid-fifteenth century on O'ahu Island [6], but thus far has proved elusive on Lāna'i, where native plants dominate firewood throughout the traditional Hawaiian sequence. For example, wood charcoal from five taxa introduced by Polynesians, including cf. *kou*, *ipu*, *kukui*, *'ulu*, and *'ōhi'a 'ai* was recovered in small amounts (generally less than 1% by weight) in all of the charcoal collections from two sites at the coastal settlement in Kaunolū [1]. Based on the available dating evidence, the charcoal collections at Kaunolū date to late in the traditional Hawaiian sequence and to the early historic period. The lowland native forest at Kaunolū appears to have persisted into the early historic period. Similarly, several collections of firewood charcoal from Hulopo'e insecurely dated to the period AD 1300–1850 were composed

primarily of native woods, with trace occurrences of *'ulu* and *kō* [10]. Two fire-pits dated to around the early historic period on the coast at Mānele [5] were fueled almost entirely with native species, and a somewhat earlier fire-pit located inland near Lāna'i City [4] also yielded predominantly native firewood.

The second period of vegetation change in the mid-nineteenth century involves the nearly complete collapse of the native lowland dry forest with the introduction of grazing herbivores [7]. To date, fire-pits from this recent period have not been identified and investigated on Lāna'i.

The research objective for the stone artifacts is to characterize the chaîne opératoire for the tools fashioned from fine-grained basalt. An attempt will be made to identify the source of the rock with non-destructive geochemical analysis, describe the reduction sequence along the lines set out by Weisler [12], and classify tools according to function [11], as far as possible given the fragmentary materials.

4 Data Needs, Methods, and Curation

The data needed to address the research objectives were collected during the inventory survey and comprise the contents of the two fire-pits and the secondarily deposited stone artifacts collected at Site 50-40-98-1980.

Field methods are not required to acquire and analyze the data because exhaustive field collections were made during the archaeological inventory survey.

The laboratory work needed to carry out the data recovery investigation includes charcoal identification at the Wood Identification Laboratory of International Archaeological Research Institute, accelerator mass spectrometry (AMS) dating of one specimen of short-lived wood charcoal from each of the fire-pits, and calibration of the laboratory results with the BCal software package [3]. Non-destructive geochemical characterization with EDXRF will be carried out at the University of Hawai'i at Hilo [9].

The procedure for depositing collections after the conclusion of the proposed data recovery project involves returning them to Lāna'i Island, where they will be redeposited at the Lāna'i Culture and Heritage Center, where they are currently stored.

The plan does not call for additional fieldwork. Thus, we do not anticipate that human burials will be disinterred.

Sites 50-40-98-1980 and 50-40-98-1981 were not determined significant under criterion "e," which pertains to sites that have "an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts-these associations being important to the group's history and cultural identity" (§13-275-6(b)(5)). Thus, there is no requirement that consultation with members of the relevant ethnic group be undertaken during preparation of this plan.

Glossary

clay Fine earth particles less than 0.002 mm.
cobble Rock fragment ranging from 76 mm to less than 250 mm.
fire-pit A pit of varying depth, often bowl shaped at the base, usually identified by a concentration of charcoal and/or burned material in the fill, especially at the feature interface.
manuport A natural object found in an unnatural position, having been carried there by man.
project The archaeological investigation, including laboratory analyses and report preparation.

Hawaiian Terms

ipu The gourd, *Lagenaria siceraria*.
kō Sugarcane, *Saccharum officinarum*, was introduced to Hawai'i by Polynesian settlers, who cultivated it widely. The stalk was chewed between meals for its sweetness, brought on long journeys to ease hunger, and eaten in times of famine; juice from the stalk was fed to nursing babies, and used as a sweetening agent in medicinal herbal concoctions; the leaves were used as thatching for houses; the leaf midrib was used for plaiting braids that were made into hats; the stem of the flower was used to make darts for a child's game.
kou A native tree, *Cordia subcordata*, with a wood prized for its grain and ease of carving. It was used for carving a wide variety of objects from platters to images of gods; the leaves were made into dye and the flowers were also used in *lei* making.
kukui The candlenut tree, *Aleurites moluccana*, introduced to Hawai'i by Polynesian settlers. The outer husk of the fruit or nut was used to make a black dye for tapa and tattooing; sap from the fruit was used as medicine to treat thrush, and used as a purgative; the hard shell of the nut was used in *lei* making; the kernel of the nut was the source of an oil that was burned for illumination and also used as a wood varnish for surfboards and canoes; the kernel was also chewed and spit on rough seas to calm the ocean and baked kernels were mixed with salt and chili pepper to make a relish (*'inamona*); the trunk was used to make canoes and floats for fishing nets; a reddish dye was made from the bark and/or root; a gum exuded from wounded bark was used to treat tapa; the flower was mixed with sweet potato to treat thrush; the leaves were used in a poultice for swelling and infection.
'ōhi'a 'ai The mountain apple, *Syzygium malaccensis*, a forest tree growing up to 50 ft. high. Traditionally the trunk of the tree was used for house posts and rafters, enclosures for temples, and to carve idols. The fruit was eaten raw or dried. The bark was made into an infusion to remedy sore throats and a dye was also made from the bark.
'ulu 1. Discoidal, smooth stone as used in *'ulu maika* game; 2. Breadfruit, *Artocarpus altilis*.

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Exhibit B
Archaeological Data Recovery Report

T. S. Dye & Colleagues, Archaeologists, Inc.
735 Bishop St., Suite 315, Honolulu, Hawai'i 96813

Archaeological Data Recovery Report for Sites 50–40–98–1980 and 50–40–98–1981 Within the Miki Basin 200 Acre Industrial Development*

Lands of Kalulu and Kaunolū, Lahaina District, Lāna'i Island, TMK: (2) 4–9–002:061

Thomas S. Dye, PhD

February 28, 2019

Management Summary

At the request of Pulama Lāna'i, and pursuant to Hawaii Administrative Rules §13–278–4, T. S. Dye & Colleagues, Archaeologists has prepared an archaeological data recovery report for Sites 50–40–98–1980 and 50–40–98–1981, located at Kalulu and Kaunolū, Lahaina District, Lāna'i Island. It reports on technological analyses set out in a data recovery plan, including EDXRF analysis of lithic materials collected from Site 50–40–98–1980, and charcoal identification and dating of the *fire-pits* at Sites 50–40–98–1980 and 50–40–98–1981. The lithic analysis indicates the secondarily deposited adze rejects collected from the surface of the Miki Basin 200 Acre Industrial Development project were flake blanks likely derived from outcrops on Lāna'i Island and that rock from sources on Maui and Hawai'i Islands is absent from the collection. The wood charcoal and dating analyses from the two fire-pits at Sites 50–40–98–1980 and 50–40–98–1981 further strengthen the conclusion based on earlier analyses that native forests on Lāna'i persisted into the nineteenth century, with little evidence for cultivation of canoe plants brought to the islands by Polynesian settlers. The persistence of native forest plants on Lāna'i contrasts with the Waimānalo Plain on O'ahu Island, where by the mid-fifteenth century AD canoe plants were typical sources of firewood.

*Prepared for Pulama Lāna'i, 1311 Fraser Avenue, P.O. Box 630310, Lāna'i City, HI 96763.

Contents

Figures

1 Introduction

At the request of Pulama Lāna'i, T. S. Dye & Colleagues, Archaeologists has prepared an archaeological data recovery report for Sites 50–40–98–1980 and 50–40–98–1981 located in the lands of Kalulu and Kaunolū, Lahaina District, Lāna'i Island (fig. 1). Sites 50–40–98–1980 and 50–40–98–1981 were identified and inventoried by DiVito et al. [10]. A data recovery plan was drawn up a few years later [12] that followed recommendations set out in the inventory survey report [10]. The data recovery plan proposed to carry out technological analyses of lithic materials collected from Site 50–40–98–1980, and charcoal identification and dating of the fire-pits at Sites 50–40–98–1980 and 50–40–98–1981. This document presents the results of these technological analyses and interprets them in the context of research questions having to do with the tempo of vegetation change on Lāna'i following discovery and settlement by Polynesians, and characteristics of lithic technology to determine reduction sequences for certain tools and likely source locations for the fine-grained, tool-grade basalt used to fashion the tools.

2 Data Recovery Plan

The data recovery plan for the project is summarized in the following sections.

2.1 Sites 50–40–98–1980 and 50–40–98–1981

Sites 50–40–98–1980 and 50–40–98–1981 are located in the land parcel identified on tax maps as TMK: (2) 4–9–002:061.

Site 50–40–98–1980 is located in the northernmost portion of the *project* area in a highly eroded area along the fence line boundary with the Lāna'i Airport (fig. 1). The site comprises two components, a lithic scatter and an eroded and exposed fire-pit.

The lithic scatter is located on the crest of a slope and extends south along a drainage cut. The scatter covered an area of approximately 30 × 120 m (meter) and, at the time of survey, contained 30 or more pieces of flaked basalt. All of the artifacts that were observed and collected from the scatter came from within or adjacent to the existing drainage in areas that lacked vegetation. A cowry shell fragment and several pieces of branch coral were observed within the scatter. Three adze rejects, a hammerstone, a waterworn pebble *manuport*, and a piece of branch coral were collected from the scatter (fig. 2). No artifacts were observed or collected in the vegetated areas around the drainage. This suggests that the artifacts have either moved downslope from a higher location as a result of water erosion or that the site has eroded and deflated over time. In either case, the artifacts would have been secondarily deposited from their original position.

The second component of Site 50–40–98–1980 was an exposed fire-pit remnant located within the lithic scatter on the crest of the slope in a heavily eroded area. The fire-pit remnant was observed over an approximately 75 cm (centimeter) diameter area and had exposed charcoal and a few small cobble-size fire-affected rocks on the surface and eroding downslope (fig. 3). No black plastic or tubing was observed in or around the fire-pit because the plow zone in this location had completely eroded away. It is likely

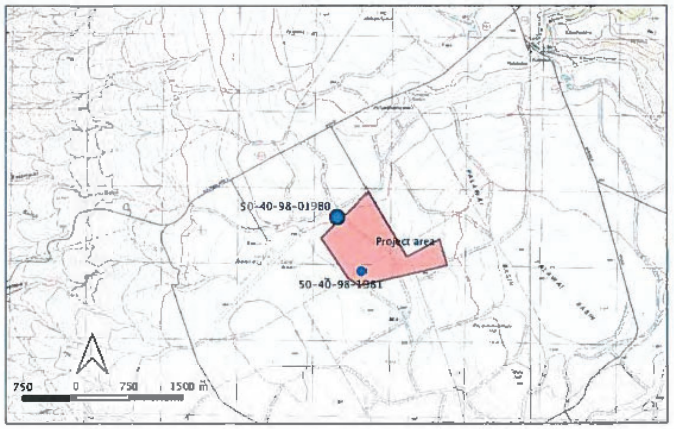

Figure 1: Location of Sites 50–40–98–1980 and 50–40–98–1981 and the Miki Basin 200 Acre Industrial Development on a USGS quadrangle map.

that the fire-pit had originally been truncated by plows when the pineapple field was cultivated. Following documentation of the fire-pit remnant, the fire-pit was bisected twice to determine its size and stratigraphic position (fig. 4).

The first bisection point, A to A', cut the fire-pit in half to expose the stratigraphic section. Following bisection, a 15 cm deep profile was exposed. Context 16, a loose red silty *clay* loam sediment, was present from the current ground surface to a depth of 3 cm. It appears that the sediment has been deposited over the fire-pit due to water erosion along the drainage. The fire-pit, Context 15, is a band of charcoal that extends from 3 cm below surface to a depth of 12 cm. The fire-pit at this location is approximately 60 cm wide and is basin shaped. The interface between the Context 15 fire-pit and the material it had been dug into, the Context 2 dark reddish brown silty clay loam hard pan soil, was recorded as Context 17. The Context 2 soil was present to the base of excavation at 15 cm below surface.

The second bisection point, B to B', was cut just in front of the two rocks that were exposed on the surface. Following bisection, a 20 cm deep profile was exposed. Context 16, a loose red silty clay loam sediment, was present from the current ground surface to a depth of 6 cm. The sediment has been deposited over the fire-pit due to water erosion along the drainage. The fire-pit, Context 15, is a curved band of charcoal that extends from 6 cm below surface to a maximum depth of 15 cm. The fire-pit at this location is

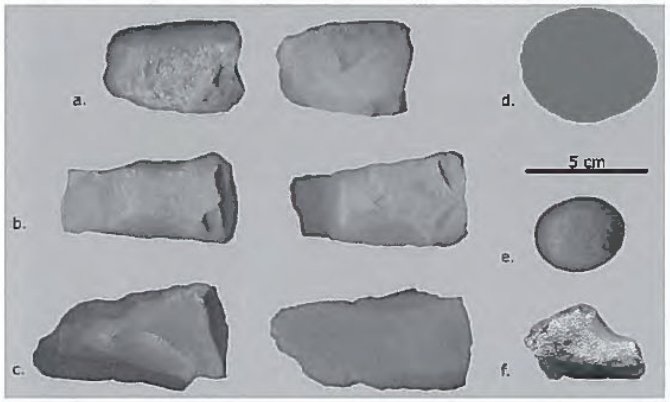

Figure 2: Artifacts collected from the Context 18 lithic scatter, part of Site 50–40–98–1980: *a*, dorsal and ventral views of an adze reject, distal portion; *b*, dorsal and ventral views of an adze reject, proximal portion; *c*, dorsal and ventral views of an adze reject, distal portion; *d*, waterworn cobble hammerstone; *e*, waterworn pebble manuport; *f*, branch coral. The three adze rejects are depicted with the dorsal side to the left and the ventral side to the right.

approximately 75 cm wide and is basin shaped. The interface between the Context 15 fire-pit and the material it had been dug into, the Context 2 dark reddish brown silty clay loam hard pan soil, was recorded as Context 17. The Context 2 soil was present to the base of excavation at 20 cm below surface. A charcoal sample was collected from each profile after bisection for wood taxa identification and ^{14}C analysis.

A subsurface cultural deposit recorded as Site 50–40–98–1981 was identified in a backhoe trench (see fig. 1, p. 4). The deposit was a truncated fire-pit remnant exposed in the southern profile of the backhoe trench (fig. 6). The fire-pit was truncated by the plow zone layer, Context 1, present to a depth of 35 cm below surface. The upper portion of the fire-pit appears to have been destroyed by a plow moving east to west; charcoal from the fire-pit is scattered an additional 65 cm to the west within the plow zone. The fire-pit remnant is approximately 65 cm in width, approximately 10 cm thick, basin shaped, and is present between 35 and 45 cm below surface. A single rounded volcanic cobble was observed within the feature. The fire-pit had been excavated into Context 2, a dark reddish brown silty clay hardpan soil present to a depth of 100 cm below surface. The interface between the fire-pit and the Context 2 soil it had been excavated into was

Figure 3: Exposed charcoal and fire-affected cobbles indicating the location of the fire-pit at Site 50–40–98–1980. The scale is marked in 10 cm increments.

recorded as Context 13. Context 2 overlay Context 9, a dark brown silty clay loam present to the base of excavation at 150 cm below surface. A charcoal sample was collected from the Context 12 fire-pit for wood taxa and ^{14}C analysis.

Sites 50–40–98–1980 and 50–40–98–1981 were evaluated as significant for the important information on Hawaiian history and prehistory that they have yielded [10:96].

2.2 Research Objectives

The inventory survey report recommended that a data recovery plan be developed and implemented prior to construction activities at the Miki Basin 200 Acre Industrial Development. It was further recommended that the data recovery plan develop research questions that can be addressed with data yielded by the following laboratory tasks:

Site 50–40–98–1980 Analysis of the wood charcoal collected from the Context 15 fire-pit for taxa identification and ^{14}C dating. Analysis of artifacts collected from the Context 18 lithic scatter to further investigate the tool-making reduction sequence utilized on the island [28].

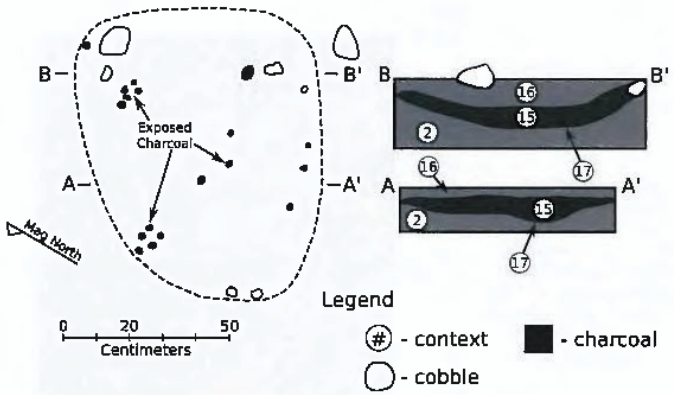

Figure 4: Sketch map and cross section drawing of a subsurface fire-pit recorded at Site 50–40–98–1980.

Figure 5: Stratigraphic profile of the bisected fire-pit at Site 50–40–98–1980. The scale is marked in 10 cm increments.

Site 50–40–98–1981 Analysis of the wood charcoal collected from the Context 12 fire-pit for taxa identification and ^{14}C dating.

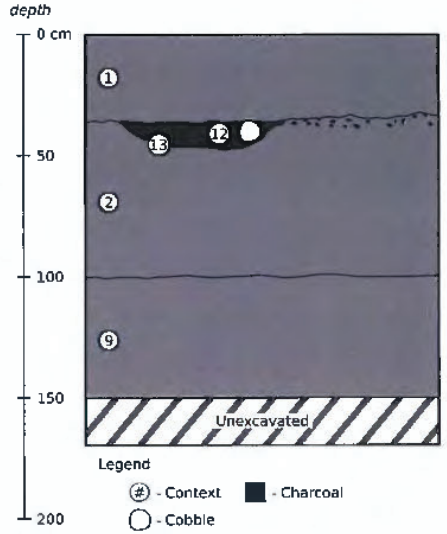

Figure 6: Stratigraphic profile of the south face of the backhoe trench showing the fire-pit, Site 50–40–98–1981, as contexts 12 and 13. Note that the fire-pit has been truncated by the plow zone, Context 1.

The research objectives of the proposed data recovery investigations include gathering data on the history of vegetation change on Lāna'i in an effort to date two periods of change, one during the traditional Hawaiian period and the other in the mid nineteenth century when sheep and goats were raised on the island [19], and to complete paired technological and geochemical sourcing analyses of the lithic artifacts to determine the reduction sequences for the flaked stone implements, and to determine likely source locations for the fine-grained, tool-grade basalt items in the collection.

The first period of vegetation change that will be investigated involves a process identified as landscape transport [3; 20], whereby the Polynesian settlers of Hawai'i established about 28 species of plants brought to the islands from a homeland in the southern hemisphere [29:321 ff.]. This process has been dated to the mid-fifteenth century on O'ahu Island [16], but thus far has proved elusive on Lāna'i, where native plants dominate firewood throughout the traditional Hawaiian sequence. For example, wood charcoal from five taxa introduced by Polynesians, including cf. *kou*, *ipu*, *kukui*, *'ulu*, and *'āhi'a 'ai* was recovered in small amounts (generally less than 1% by weight) in all of the charcoal collections from two sites at the coastal settlement in Kaunolū [2]. Based on the available dating evidence, the charcoal collections at Kaunolū date to late in the

Figure 7: Stratigraphic profile of truncated fire-pit at Site 50–40–98–1981. Note the black plastic mulch in the deposit above the fire-pit. The scale is marked in 10 cm increments.

traditional Hawaiian sequence and to the early historic period. The lowland native forest at Kaunolū appears to have persisted into the early historic period. Similarly, several collections of firewood charcoal from Hulopo'e insecurely dated to the period AD 1300–1850 were composed primarily of native woods, with trace occurrences of *'ulu* and *kō* [25]. Two fire-pits dated to around the early historic period on the coast at Mānele [15] were fueled almost entirely with native species, and a somewhat earlier fire-pit located inland near Lāna'i City [14] also yielded predominantly native firewood.

The second period of vegetation change in the mid-nineteenth century involves the nearly complete collapse of the native lowland dry forest with the introduction of grazing herbivores [19]. To date, fire-pits from this recent period have not been identified and investigated on Lāna'i.

The research objective for the stone artifacts is to characterize the chaîne opératoire for the tools fashioned from fine-grained basalt. An attempt will be made to identify the source of the rock with non-destructive geochemical analysis, describe the reduction

sequence along the lines set out by Weisler [28], and classify tools according to function [26], as far as possible given the fragmentary materials.

2.3 Data Needs, Methods, and Curation

The data needed to address the research objectives were collected during the inventory survey and comprise the contents of the two fire-pits and the secondarily deposited stone artifacts collected at Site 50–40–98–1980.

Field methods are not required to acquire and analyze the data because exhaustive field collections were made during the archaeological inventory survey, when both fire-pits were fully excavated and diagnostic materials were collected from the secondary deposit of stone artifacts at Site 50–40–98–1980.

The laboratory work needed to carry out the data recovery investigation includes: i) identification of charcoal from the fire-pits at Sites 50–40–98–1980 and 50–40–98–1981 at the Wood Identification Laboratory of International Archaeological Research Institute (WIDL); ii) accelerator mass spectrometry (AMS) dating of a single specimen of identified, short-lived, wood charcoal from each of the fire-pits; iii) calibration of the AMS dating results with the BCal software package [6] to estimate calendar dates for construction and use of the fire-pits; iv) non-destructive geochemical characterization of the lithic materials collected from Site 50–40–98–1980 with the EDXRF facility at the University of Hawai'i at Hilo [22]; and v) observation of the adze rejects collected from Site 50–40–98–1980 to determine the primary reduction technique used in their manufacture.

The procedure for depositing collections after the conclusion of the data recovery project returned them to the Lāna'i Culture and Heritage Center, where they were previously stored.

The plan does not call for additional fieldwork. Thus, we do not anticipate that human burials will be disinterred.

Sites 50–40–98–1980 and 50–40–98–1981 were determined significant under criterion "d" for the important information on Hawaiian history and prehistory they have yielded [10;96]. Sites 50–40–98–1980 and 50–40–98–1981 were not determined significant for criterion "e," which pertains to sites that have "an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts–these associations being important to the group's history and cultural identity" (§13–275–6(b)(5)). Thus, there is no requirement that consultation with members of a relevant ethnic group be undertaken during preparation of this plan.

3 Laboratory Results

This section presents the laboratory results for the wood charcoal identification and dating, the EDXRF geochemical sourcing analysis, and observations on the reduction sequence for six adze rejects.

3.1 Wood Charcoal Identification and Dating

Wood charcoal collected from the fire-pits at Site 50–40–98–1980 and 50–40–98–1981 was submitted to the Wood Identification Laboratory at International Archaeological Research Institute for identification. Excerpts from the report filed by Jen Huebert follow.

> The freshly fractured transverse, tangential, and radial facets of selected charcoal fragments were examined with an epi-illuminated microscope at magnifications of 50–500×. Taxonomic identifications were made by comparing observed anatomical characteristics with those of woods in the IARII reference collection. Vouchers associated with this collection have been verified and archived at the Department of Botany, University of Hawai'i at Mānoa. Other published references, including books, journal articles, technical documents, and wood atlases, were also consulted.
>
> Samples were first reviewed under low-power magnification to assess the quality of the material and determine the range of plant parts present. For the most part, the charcoal in these samples is firm and somewhat hard. A selection of 40 fragments of various sizes and shapes were selected from each sample for taxonomic identification. These samples were not taxonomically diverse and consist mainly of various shapes and size classes of *'āweoweo* and *'ākoko* (tables 1 and 2). All are genera that include native Hawaiian hardwood species.

Table 1: Taxa identified from charcoal

Family	Taxon	Name	Habit	Origin
Chenopodiaceae	*Chenopodium oahuense*	*'āheahea*	shrub-tree	native
Euphorbiaceae	*Euphorbia* sp.	*'ākoko*	shrub-tree	native
Fabaceae	*Senna* sp.	*kolomona*	tree	?
Malvaceae	*Sida* cf. *fallax*	*'ilima*	shrub	native

Table 2: Charcoal identifications

Taxon	Part	Count	Weight (g)
Site 50–40–98–1981, Context 12			
Chenopodium oahuense	twig	33	16.6
Sida cf. *fallax*	twig	4	1.84
Euphorbia sp.	twig	1	0.27
Site 50–40–98–1980, Context 15			
Euphorbia sp.	twig	37	3.5
Senna sp.	wood	3	0.61

It should be noted that while the native plant *S. fallax* is fairly common in archaeological assemblages there are several post-Contact *Sida*, including *S. rhombifolia* or Cuba jute, which was introduced in the 1830's [23:Table 2], and

other species that are naturalized throughout the islands. In a brief review of several new wood specimens, I noted the wood anatomy of these taxa might not be diagnostic to species pending further investigation. *Senna* and *Euphorbia* also have naturalized species that are present today on Lāna'i and should be considered similarly.

Please note the following:

- Indeterminate material was too fragile or warped for taxonomic identification, or derives from small woody herb or fern stems which are rarely diagnostic. I have noted whether material was wood, herbaceous stems, grass stems, etc., whenever possible.
- It is best to choose one fragment of material for radiocarbon dating to eliminate the chance of dating more than one event [4].

Descriptions of the wood anatomy observed in the samples follow.

***Euphorbia* sp.** Smaller diameter vessels, most under 50 μm, round, often chained radially 2–4 (sometimes up to 8–10); fibers medium thickness, fine pits noted on fiber walls; rays uniseriate and sometimes up to 3–4 seriate with occasional radial canals, cells square or upright; intervessel pits oval, alternate, medium-sized.

Sida* cf. *fallax Vessels small, under 40 μm diameter, solitary or by 2–3(4); surrounded by thin sleeve of axial parenchyma; fiber walls very thick; rays narrow, bi-seriate, extremely tall in TLS; intervessel pits alternate, 3-4 μm.

***Senna* sp.** Vessels approximately 100 μm diameter, solitary or in groups or chains of 2–3; fibers medium-thick; axial parenchyma wavy, surrounds vessels and intergrades with fibers; rays uniseriate occasionally widening to 2 cells, a few rays are 2-3 cells wide, short to medium heights, mostly of square and some upright cells; intervessel pits 4-5 μm and also wider, alternate; vessel-ray pits similar.

Two pieces of wood charcoal were selected for ^{14}C dating. A piece of *'ilima* charcoal from the fire-pit at Site 50–40–98–1981and a piece of *'ākoko* charcoal from the fire-pit at Site 50–40–98–1980 were submitted to Beta-Analytic for AMS dating (appendix A). Beta-Analytic assigned the *'ilima* charcoal to Beta-510703 and reported a conventional radiocarbon age of 140 ± 30 BP. Beta-Analytic assigned the *'ākoko* charcoal to Beta-510704 and reported a conventional radiocarbon age of 170 ± 30 BP. The calibrated age estimates indicate both fire-pits were used near the end of traditional Hawaiian times (fig. 8).

3.2 Reduction Sequence

Compared to island groups elsewhere in Polynesia, Hawaiian adzes are remarkably uniform. An early study that compared Hawaiian adzes with adze collections from the Society Islands, Marquesas, and Easter Island in East Polynesia remarked that "[n]o place in East Polynesian exhibits such a steadfast adherence to one form of adz as Hawaii"

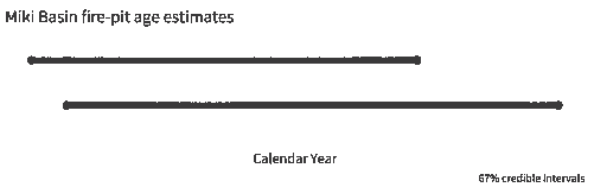

Figure 8: Estimated ages of the Miki Basin fire-pits. Beta-510703 has a 67% credible interval of AD 1681–1862, with a median of AD 1809. Beta-510704 has a 67% credible interval of AD 1668–1810, with a median of AD 1772.

[17:162]. The typical Hawaiian adze was described as "quadrangular (or rectangular) in cross section and, except for some small specimens and a few of medium size, are tanged" [17:162–163]. Adzes with trapezoidal, triangular, lenticular, or plano-convex sections, all common to varying degrees in the other East Polynesian assemblages are either rare or absent from Hawai'i. Hawaiian adzes were manufactured by flaking and grinding, without the pecking technique practiced elsewhere.

Recently, replication experiments have determined reduction sequences for quadrangular adzes from a variety of blank types, including cobbles, flakes, and tabular pieces of rock. The demonstrated

> feasibility of producing adzes from a wide range of blank types means that Hawaiians could have used basalt outcrops and concentrations of subrounded cobbles and boulders, and not simply specialised quarries where large flakes could be obtained. [8:82]

The wide distribution of adze rock in Hawai'i does not mean that adzes were easy to acquire or to produce. In fact, the common Hawaiian quadrangular cross section adze requires great skill to produce.

> Hawaiian quadrangular adzes require precise bidirectional flaking of four right-angled edges, while also creating flat faces on all sides. This is very difficult to achieve on tough basalt using basalt hammer stones. The extremely large and refined examples of prehistoric Hawaiian adzes indicate very high levels of skill and use of hammer stones of different sizes, weights and stone material. [8:71]

It has been estimated that reasonable skill in producing quadrangular section adzes in Hawai'i might have taken "several years of instruction and practice to achieve … [which] may explain the huge numbers of broken and rejected preforms on quarries across the Hawaiian archipelago" [8:82].

An early study of adze-making at the sources along the bench at the east end of the Pālawai Basin observed that "the corners of bowlders have been broken off to furnish the cores" [18:77]. Subsequently, a more detailed study determined that adze blanks at Kapohaku were flakes, rather than cobbles or tabular pieces of rock [28], consistent with Emory's observation. The striking platform of the flake became the poll of the finished adze and the flake termination became the cutting edge. Adzes made from flakes: i) are typically thin relative to width and exhibit a cross section that is rectangular, rather than square [8]; ii) often increase in width toward the cutting edge; and iii) are relatively lightweight. These characteristics identify tools suited for everyday household and gardening tasks, rather than felling large trees in old growth forests.

The six adze rejects collected during the inventory survey (fig. 9) are flakes that can be classified as adze blanks because they each lack the three bi-directionally flaked edges that identify a preform [7]. They appear to have been rejected early in the reduction sequence.

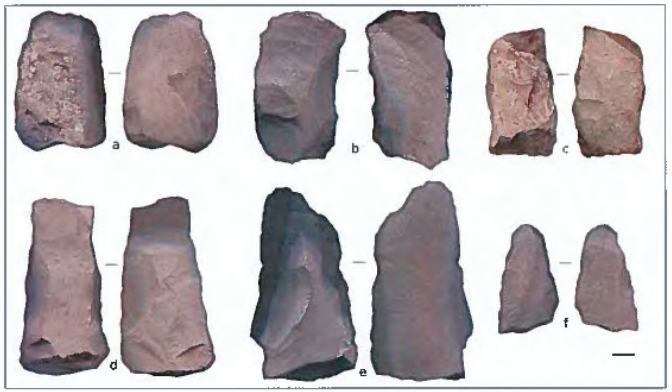

Figure 9: Dorsal (left) and ventral (right) surfaces of secondarily deposited adze rejects included in the EDXRF analysis: *a*, Lāna'i source assignation; *b*, Kīlauea source assignation; *c*, Waiāhole source assignation; *d*, Lāna'i source assignation; *e*, Kīlauea source assignation; *f*, Kīlauea source assignation. The scale bar is 1 cm.

3.3 Lithic Sourcing

Fine-grained rock suitable for adze manufacture is widely distributed around the islands. Exposures of the highest quality adze rock that were heavily exploited have been identified as "quarries" despite their being surface exposures that could be exploited without

the deep excavation typically associated with quarrying [9; 24]. Adze-quality rock was also found outside the "quarries", perhaps most typically as cobbles and small boulders in stream beds, but also as boulder outcrops from which flakes might be removed. The large number of potential sources complicates efforts to identify the rock source of an adze or an adze reject.

Sourcing can be accomplished by a variety of means, including; i) description of thin sections and comparison with a reference collection of source thin sections [9]; ii) destructive analyses that yield high-quality geochemical data that can be compared to published analyses of geologic exposures [24]; and iii) non-destructive EDXRF analyses that yield limited geochemical data that can be compared to EDXRF analyses of source materials [22]. A two-stage characterization process is sometimes employed to maximize the utility of results and minimize the destruction of samples [21]. At the first stage, large numbers of samples are analyzed non-destructively with EDXRF to establish geochemical groups and identify outliers. At the second stage, a few samples are selected for destructive analysis, typically in the hope of identifying the local sources of groups and identifying imports among the outliers. For example, in a study of fine-grained basalt artifacts collected from habitation and ritual structures in the Kahikinui district of Maui, EDXRF analysis of 328 artifacts divided them into 17 groups. The EDXRF results were, in most cases, insufficient to assign groups to particular source locations or quarries. Nevertheless, plausible inferences based on the EDXRF results were followed up by destructive wavelength dispersive X-ray fluorescence (WDXRF) analysis of nine samples. WDXRF analysis typically yields results that can confidently assign samples to particular source locations or quarries based on published geochemical analyses. In the Kahikinui case, WDXRF was designed primarily to firm up the identification of one of the EDXRF groups, Group I, as having originated at the well-known Mauna Kea adze quarry. The adze rock at Mauna Kea is extremely fine-grained and isotropic, two qualities that enhance its value as a raw material for adze manufacture [9]. The WDXRF analysis yielded results that confirmed a Mauna Kea origin for six Group I samples, and this made it possible to assign the other four samples in Group I a Mauna Kea origin based on the EDXRF results [21].

The WDXRF analysis also matched EDXRF group D with a source at Kaunolū. Twenty-five of the Kahikinui artifacts were assigned to Group D, which would make Kaunolū the leading supplier of imported adze rock to the Kahikinui sites. About 8% of the adze rock analyzed from the Kahikinui sites originated on Lāna'i.

Adze rocks collected on Lāna'i have been analyzed with EDXRF at least twice, once for the Miki Basin 200 Acre Industrial Development project, and earlier for an unreported project that focused on artifacts held by the Lāna'i Culture and History Center. The non-destructive EDXRF analysis has obvious benefits for museum specimens with potential for public display, but, as noted above, it yields data that are unlikely to assign artifacts to particular source locations or quarries. As a preliminary stage of analysis, EDXRF can suggest a range of possible source locations or quarries, and it can usefully exclude some potential source locations or quarries. The information provided by EDXRF might point to certain artifacts as potential imports, with geochemical compositions unlikely to be found near the collection location, whose source location might be identified with

additional analysis. At the same time, the EDXRF analysis might also identify artifacts that cannot be sourced to a particular location, but whose geochemical composition is similar to what might be expected from sources near the collection location.

In these circumstances, a statistical framework that can be used to distinguish possible imports from likely local artifacts based on EDXRF information might prove useful. One way to do this is with a statistical technique known as discriminant analysis. Briefly, discriminant analysis uses so-called training data to establish a set of targets and then assigns instances from a set of test data to one or another of the targets. In the present case, the training data are EDXRF analyses of adze-quality rock from potential source locations, and the test data are the EDXRF analyses of the Lāna'i artifacts. In the ideal case, where all of the potential rock sources are included in the training data, and the geochemical analysis is able to distinguish among them confidently, then the discriminant analysis will correctly assign each instance of test data to its source location. In real-world situations that fall short of this ideal, the discriminant analysis assignments are best interpreted more loosely, as indications of a local or non-local source and as guides for future inquiry.

The discriminant model for EDXRF analysis of Lāna'i artifacts falls short of the ideal situation. Caution in the interpretation of results is clearly warranted. EDXRF training data from potential sources lacks information from many known quarry locations. The quarry data for the training set are found on the Geoarchaeology Laboratory, UH Hilo web site and include Kīlauea and Mauna Kea on Hawai'i Island, Nu'u and Haleakalā on Maui Island, and Waiāhole on O'ahu Island. In addition, training data were collected in 2011 by Mills and Lundblad from several locations on Lāna'i (fig. 10). These Lāna'i training data are lumped together in the analysis as a single Lāna'i source.

EDXRF analysis provides abundance estimates for several elements with varying degrees of precision and accuracy. Consequently, analyses of EDXRF results typically focus on a subset of elements chosen either because they are specifically applicable to the question at hand or because the EDXRF method yields relatively precise and/or accurate estimates for them. The present analysis focused on the elements Nickel (Ni), Copper (Cu), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), and Niobium (Nb). These are the elements chosen by the Hilo Geoarchaeology team for a principal components analysis of many of these same training data [21]. Using these seven elements, the discriminant analysis carried out here distinguishes Haleakalā, Nu'u, and Mauna Kea from the other potential sources (fig. 11). Nevertheless, the discriminant analysis based on the EDXRF estimates of the seven elemental abundances does not confidently distinguish the Lāna'i sources from the Kīlauea and Waiāhole sources.

The success of the classification yielded by the discriminant analysis of the training data can be assessed in several ways [5:108–110]. Two common assessments are the hold-out method, which holds out a random subset of the training data and then determines whether instances are correctly assigned to source targets established with the remaining training data, and the leave-out-one cross-validation method, which assesses whether each instance of the training data is correctly assigned to a source target established by the remainder of the training data. In practice, the two methods should provide similar results with a reasonably-sized training data set. The leave-out-one cross-validation

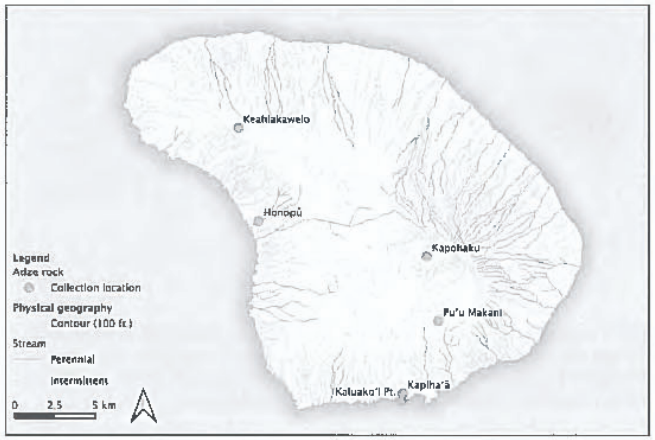

Figure 10: Potential adze rock sources on Lāna'i for which EDXRF training data are available. Note that data are also available for an outcrop in Ka'ā whose location hasn't been fixed.

method implemented by the MASS package of the R statistical software [27] correctly assigns sources to 97% of the samples in the training data set. As expected, all of the Haleakalā, Mauna Kea, and Nu'u instances were assigned to the correct source. The other potential sources fared less well: 97% of the Waiāhole instances were correctly assigned, as were 83% of the Lāna'i debitage instances and 63% of the Kīlauea instances. These results are confirmed by the hold-out method, which correctly classified 98% of a randomly selected hold-out set comprising 20% of the training data. This result indicates that the EDXRF method is sufficiently powerful to distinguish among the six sources included in the training data set. It is no guarantee that the EDXRF data would perform as well if other source locations were added to the training data set. In general, the greater the number of potential sources, the more difficult it is to distinguish among them. The same relationship holds for within-source variability. In the case of geochemical sourcing, as the known range of geochemical compositions from a source grows, the more difficult it is to distinguish that source from other sources that are geochemically similar. Thus, the success of the classification yielded by the discriminant analysis of the training data should be tempered by the understanding that it was likely aided by the formative state of the training data set, which lacks several known sources, and by the likely incomplete catalog of Lāna'i Island sources in the EDXRF database.

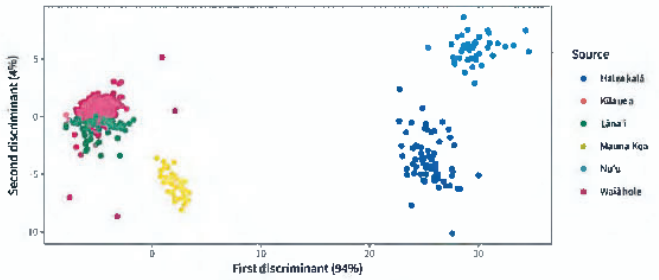

Figure 11: Graphical summary of the discriminant analysis. Note that the Haleakalā, Nu'u, and Mauna Kea sources can be distinguished with the first two discriminants, which together capture 98% of the variability in the full data set. In contrast, the Lāna'i sources are not clearly distinguished from Waiāhole and Kīlauea.

Six secondarily deposited adze rejects collected from the surface during the inventory survey (see fig. 9, p. 14) were analyzed with EDXRF in an effort to determine their source locations (appendix B). Using the training data described earlier, the discriminant analysis assigns two adze rejects to a Lāna'i source, three adze rejects to a Kīlauea source, and one adze reject to a Waiāhole source. As discussed, the discriminant analysis does not distinguish these sources confidently; the results should not be interpreted as indicating imports from Kīlauea and Waiāhole. Rather, these results indicate that there is no strong evidence that any of the adze rejects was made with imported rock. At the same time, the results do offer strong evidence that the adze rejects did not originate at Haleakalā or Nu'u on Maui, or Mauna Kea on Hawai'i Island.

4 Discussion

This section compares the ages and firewood composition of the fire-pits at Sites 50–40–98–1980 and 50–40–98–1981 with the ages and firewood composition of eight other fire-pits on Lāna'i Island. The ages and composition of the Lāna'i Island fire-pits are then compared with 33 fire-pits from coastal Waimānalo, O'ahu to distinguish tempos of vegetation change following Polynesian colonization of the islands.

Ten fire-pits on Lāna'i have been investigated with a combination of wood charcoal identification and controlled radiocarbon dating using single pieces of a short-lived taxon. The combination of wood charcoal identification and controlled radiocarbon dating yields both a roster of the woods used to fuel a fire and a precise estimate of when the firing took place. Assuming that fires were fueled with wood that was available in