

4. DESCRIPTION OF THE HUMAN ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES

This section of the Second Draft EIS describes the existing conditions of the human environment, as well as potential impacts and mitigation measures associated with the Kaloko Makai development project.

4.1. ARCHAEOLOGICAL AND HISTORIC RESOURCES

Archaeological inventory surveys were conducted by Cultural Surveys Hawai'i, Inc. (CSH) between March 2007 and April 2008 for the Kaloko Makai project site. The archaeological inventory report consists of seven volumes. The results are summarized below and an abstract of the study is included as Appendix I. The complete report has been filed with the State Historic Preservation Division (SHPD), State Land Use Commission (LUC), Office of Environmental Quality Control (OEQC), and Office of Hawaiian Affairs (OHA).

4.1.1. Archaeological Background

The following archaeological inventory survey scope of work was developed and implemented to satisfy SHPD requirements. The scope of work for this inventory survey was designed in accordance with SHPD rules governing standards for archaeological inventory surveys and reports (Hawai'i Administrative Rules (HAR), Title 13, Subtitle 13, Chapter 276):

- 1) Appropriate consultation with knowledgeable members of the community, requesting information on historic properties in the project area.
- 2) A complete ground survey of the entire project area for the purpose of historic property identification and documentation. All historic properties would be located, described and mapped with evaluation of function, interrelationships and significance. Documentation is to include photographs and scale drawings of selected historic properties. All historic properties are to be assigned *Inventory of Historic Properties* numbers by the State.
- 3) Subsurface testing to determine if subsurface deposits are located in the project area, and, if so, evaluate their significance. If appropriate samples from these excavations were found, they were analyzed for chronological and/or paleoenvironmental information.
- 4) Research on historic and archaeological background, including search of historic maps, written records and Land Commission Award documents. This research was to focus on the specific area with general background on the ahupua'a land district and was to emphasize settlement patterns.
- 5) Preparation of a survey report to include the following:
 - a. A topographic map of the survey area showing all historic properties;
 - b. Results of consultation with knowledgeable community members about the property and its historical and cultural issues.
 - c. Description of all historic properties with selected photographs, scale drawings and discussions of function;
 - d. Historical and archaeological background sections summarizing prehistoric and historic land use as they relate to the project area's historic properties;

- e. A summary of historic property categories and their significance in an archaeological and historic context;
- f. Recommendations based on all information generated that will specify what steps should be taken to mitigate impact of development on the project area's significant historic properties, such as data recovery (excavation) and preservation of specific areas. These recommendations will be developed in consultation with the client and the State agencies.

This scope of work includes full coordination with the SHPD relating to archaeological matters. This coordination takes place after consent of the landowner or representatives.

Given the large size of the total project area (over 1,100-acres) and the large number of archaeological sites identified (341), the work has been organized within separate studies for each of the four Tax Map Key parcels (TMK: [3] 7-3-009:017, 025, 026 & 028 (includes new parcel 063) as follows¹:

1. *Archaeological Inventory Survey of a 224.43-Acre Parcel within Portions of Kaloko and Kohanaiki Ahupua'a, North Kona District, Hawai'i Island TMK: [3] 7-3-009:017* (Bell, Groza, Shideler, and Hammatt 2008),
2. *Archaeological Inventory Survey of a 360.131-Acre Parcel within Portions of Kohanaiki Ahupua'a and Kaloko Ahupua'a, North Kona District, Hawai'i Island TMK: [3] 7-3-009:025*(Bell, Groza, Simonson, Shideler, and Hammatt 2008),
3. *Archaeological Inventory Survey of a 194.324-Acre Parcel within portions of Kohanaiki Ahupua'a and Kaloko Ahupua'a, North Kona District, Hawai'i Island TMK: [3] 7-3- 009:026* (Bell, Simonson, Esh, Groza, Shideler, and Hammatt 2008), and
4. *Archaeological Inventory Survey of a 363.106-Acre Parcel within Portions of Kaloko Ahupua'a, North Kona District, Hawai'i Island TMK: [3] 7-3-009:028 (includes new parcel 063)* (Esh, Bell, Simonson, Shideler, and Hammatt 2008)

The proposed project was considered for its potential to impose adverse visual, auditory or other environmental impact to any known historic properties, including standing architecture, located outside the project area. Based on available information about the proposed development and the visual gravity of industrial/commercial development flanking the project area to the north and south, and Queen Ka'ahumanu Highway to the west (makai), the proposed project is considered to add to an established urban trend in coastal North Kona.

The archaeological inventory surveys involved consultation with knowledgeable members of the community, a complete ground survey of the entire project area for the purpose of historic property identification and documentation, subsurface testing to determine if subsurface deposits are located in the project area, and research on historic and archaeological background.

Because fieldwork was occasionally conducted simultaneously, certain numerical sequences span all four TMKs. Specifically, burials were reported to SHPD upon their discovery and therefore their

¹ TMK (3)7-3-009: 063 was previously within TMK 7-3-009: 028.

numerical sequence reflects the discovery date for the entire study. These numerical designations are consequently not necessarily sequential within the TMK, but they do reflect the designations as originally reported to SHPD.

Document Review

Background research included a review of previous archaeological studies on file at SHPD of the Department of Land and Natural Resources (DLNR); a review of geology and cultural history documents at Hamilton Library of the University of Hawai'i, the Hawai'i State Archives, the Mission Houses Museum Library, the Hawai'i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai'i State Archives and the Archives of the Bishop Museum; and a study of historic maps at the Survey Office, DLNR and the Land Survey Division, Department of Accounting and General Services (DAGS). Information on Land Commission Awards (LCAs) was accessed through Waihona 'Āina Corporation's Māhele Data Base (www.waihona.com).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected type and location of sub-surface pre-and post-contact historic properties in the project area.

Consultation

A previous cultural impact assessment (Hammatt & Shideler 1996) was conducted for TMK 7-3-09: 17, in 1996. Informants knowledgeable of TMK 7-3-09: 17 and the project area vicinity were interviewed. These consultations focused on identifying traditional cultural practices conducted adjacent to the project area as well as addressed community concerns regarding possible burial sites.

CSH conducted consultation with organizations and the community to identify kūpuna and other individuals with knowledge of the history of the project area and its surroundings.

The results of these interviews are presented in a companion report for this project, titled "Cultural Impact Assessment for a 1,150-Acre Parcel within portions of Kohanaiki and Kaloko Ahupua'a, North Kona District, Hawai'i Island TMK: [3] 7-3-009:017, 025, 026, 028" (Monahan et al. 2008). The Cultural Impact Assessment (CIA) includes consultation for all five parcels (including new parcel 063) within the Kaloko Makai project. The on-going consultation with organizations includes the State SHPD, OHA and the Hawai'i Island Burial Council. The CIA is further discussed in Section 4.2.

Summary of Previous Archaeological Studies

The following is a summary of previous archaeological studies conducted within the current project area, discussed in chronological order (see Figure 4-1). Temporary field numbers were assigned to historic properties during prior field inspections, but no State Inventory of Historic Property numbers were given to any sites within the project area prior to the current study.

Survey work was undertaken in 1970-71 by Renger inland of the highway (see Figure 4-1) - i.e. that middle zone of Kaloko which includes a portion of the present study area. Although the findings of much of this fieldwork within the middle zone were written up in detail (Cordy et al. 1991), the findings from the survey sample conducted specifically within the project area (i.e. that portion of the middle zone situated on the inland side of the Queen Ka'ahumanu Highway) were not included because, "regrettably... it appears that the maps and survey records have been misplaced since the end of the 1971 field season" (Cordy et al. 1991:340). Renger's summary of the findings from that part of the survey indicated that fifteen features were identified:

Very few sites were discovered within the "transitional middle zone" ... between the coastal and upland exploitation zones ...Seven lava tube shelters, four trails (coast-upland); three platforms, two cairns ... two low-walled enclosures and an L-shaped structure were recorded. (cited in Cordy et al. 1991:340)

These sites are presumably the subject of a set of Renger's (1971) "Kaloko Field Notes" that begins "Mauka Excavations" but in the apparent absence of any site location map it is difficult to relate these notes to specific sites in the field.

Lloyd Soehren (1979) conducted a reconnaissance survey of the Kaloko access road corridor, understood as the present alignment of present Hina Lani Street but identified no sites.

In 1985, Barrera, Jr. surveyed an approximately 409-acre area located between Māmalahoa Highway and Queen Ka'ahumanu Highway just below the Kona Heavens Subdivision and just mauka of Kaloko Makai project site. The portion north of Hina Lani Street was later surveyed by Barrera Jr. (1991) and Wolforth et al (2005), as shown in Figure 4-1. Four sites were recorded within the area, including an enclosure (Site 1), a lava tube cave (Site 2), a wall (Site 3), and a platform potentially containing burial sites (Site 4). It is unknown at this time if these sites were assigned SIHP numbers. These sites are located outside of the project site.

In 1987, Paul H. Rosendahl Inc. accomplished an archaeological reconnaissance survey of three one-acre parcels - proposed water tank sites - in Kaloko (TMK: 7-3-09: Por.1, 17) (Rosendahl and Haun 1987), along the south side of the then "main access road between Queen Ka'ahumanu Highway and Kona Heavens Subdivision" - i.e. the present Hina Lani Street. The parcels were located at 350 ft. above mean sea level (amsl.), 630 ft. above mean sea level (amsl) and 910 ft. amsl. The lower two parcels are within the present project area, and the highest is outside of it.

Only one site (State site 10- 28-10887), a historic wall interpreted as a boundary or cattle wall was recorded and that was within the mauka-most parcel. Rosendahl and Walker (1991) carried out an Archaeological Field Inspection for proposed Kaloko Industrial crusher sites just south of Hina Lani Street within the present study area. Their study began with the examination of a 10-acre study area that identified a trail and two associated cairns, passing through the east corner at about 450 ft. amsl. The presence of archaeology lead to a determination to examine an adjacent 10-acre area that proved to be free of archaeological concerns.

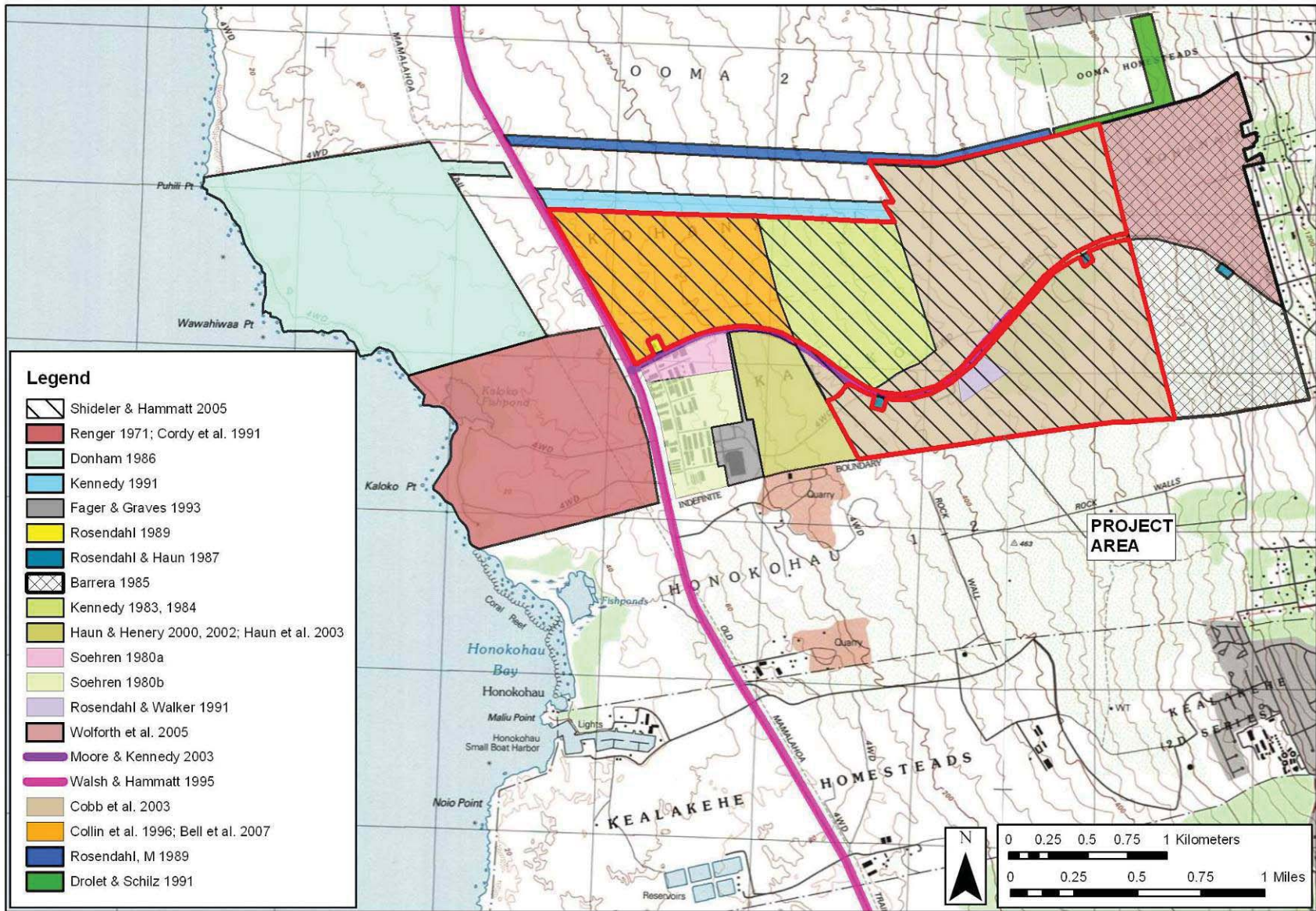


FIGURE 4-1
Previous Archaeological Studies in the Vicinity of the Project Area

Kaloko Makai

In 2003, two studies completed archaeological assessments within the project area. A field inspection by Cobb et al. (2003) gives very brief descriptions of possible historic properties within the current project area as well as in two parcels to the north. Because of the large area covered, the maps are generalized, and this combined with the brief descriptions make it difficult to confidently correlate the sites mentioned with sites identified during the current inventory survey. Haun (2003) also did an archaeological assessment of the current project area, largely via helicopter to cover the a'ā terrain, but also by foot in the thicker vegetation. He identified eight sites, all of which correlate to sites currently presented.

In 2005, CSH completed an archaeological field inspection of a 1200+ acre project area in Kaloko and Kohanaiki [TMKS: (3) 7-3-009:017, 025, 026 and 028]. Numerous pre-Contact sites including habitations, agricultural features, petroglyphs, boundary walls, and burials were observed (Shideler & Hammatt 2005). This field inspection included the present project area.

Regarding Lava Tubes

Lava tubes are ubiquitous within portions of the Kaloko Makai project area, especially on the pāhoehoe, and vary greatly in size and shape. All openings in the bedrock were examined for the presence of cultural modification or cultural material. Any opening that appeared large enough to explore was examined thoroughly. Generally, an average size person can fit through a tube entrance 30 centimeters in diameter or greater, but the shape and geology of lava tubes varies greatly, and occasionally a smaller size opening could be entered; likewise, sometimes a larger than 30 centimeter opening could not be traversed due to jagged edges, etc.

Every effort was made to explore the entirety of all lava tubes to their terminus, within reason as far as tube size and safety (i.e., heavily collapsed tubes were entered with caution). When a tube can no longer be explored due to size or safety, this is considered its cultural terminus, and is denoted as impassable on maps.

The primary purpose for the intensive exploration of lava tubes is to locate any human remains that may be present in remote areas of a lava tube, in addition to locating other cultural material. Lava tubes were traditionally used for concealment of burials, and human remains are often located far from any other cultural modification, sometimes at great distances from tube entrances; these burials may have been placed in the lava tube using an entrance that was then filled and concealed on the surface. Therefore, in an effort to locate all burial locations within the project area, a thorough effort was made to explore all lava tubes and side tubes to their natural or cultural terminus.

Human utilization of lava tubes sometimes involved blockage of entrances and inner side tubes. In order to complete the inventory survey, it was necessary to pass this type of blockage; when possible, this was done by finding another passageway for access behind the blockage or attempting to assess what was behind the blockage (i.e., solid lava tube wall vs. a continuing passageway) without disturbing the blockage. If it was determined that the tube did continue past blockage and there was no other way to access the tube, a photo was taken of the blocked area and then rocks

were carefully removed until an archaeologist could pass through. After inspection of the lava tube, the rocks were replaced as carefully as possible to their original position.

All lava tubes with cultural material present were mapped using a compass for bearing and a laser for distances (Stanley FatMax Tru-laser Distance Measurer; stated accuracy for this device is +/- 6 cm). The laser reflects well off most surfaces in tubes, and is an excellent alternative to the rather impractical method of pulling measuring tapes through cramped areas, or simply estimating distances (it is extremely difficult to accurately estimate distances in lava tubes; see Wolforth et al. 2005:24). The laser method may actually increase the efficiency of mapping tubes, since accurate measurements can be obtained nearly instantaneously; overall this technology seems to produce more accurate maps than simply estimating distances in about the same amount of time. In small tubes, a regular measuring tape was used when practical.

Occasionally lava tubes extend long distances beyond any cultural modification. When this occurs, lava tubes are explored to their natural or cultural terminus. Maps are produced for all areas containing cultural materials, and the rest of the lava tube is described but not necessarily mapped. A distance and bearing from the site tag is given for all burials within lava tubes.

4.1.2. Results of Archaeological Inventory Survey

A total of 341 archaeological sites were identified in the course of the archaeological inventory survey work (59 sites in TMK 017, 121 sites in TMK 025, 120 sites in TMK 026 and 041 sites in TMK 28/63. An overview of the formal feature types, functional categories and significance criteria is presented below, followed by a summary discussion of the finds.

Parcel	Acreage	Number of Sites	Sites/Acre
TMK 017	224.430	59	0.26
TMK 025	360.131	121	0.34
TMK 026	194.324	120	0.62
TMK 028 & 063	363.106	41	0.11
Total	1141.991	341	0.22

Formal Feature Types

Formal feature type designations are descriptive - based on physical characteristics – and commonly refer to structural elements of a site. Fifteen primary feature types were identified within the project area.

The following are brief descriptions of the different feature types encountered during the inventory survey:

Alignment: A single row of stones one course high.

Cairn: A marker of stacked or piled stones. Cairns are frequently referred to as ahu.

Enclosure: A walled structure that completely encloses an area.

Lava blister: A small subterranean lava formation. Unlike lava tubes, however, they tend to be circular and do not extend in any direction for a great length.

Lava tube: Modifications or apparent usage of a subterranean lava formation characteristic of pāhoehoe lava flows.

Modified depression: An area in which stones have been removed to create a depression or to expose a soil area. Two types of modified depressions were encountered, one type (encountered on a lava flow) appears to have functioned as a storage area and the second type in which the only modification consists of the removal of stones to create an area suitable for agriculture either in soil or possibly through mulching.

Modified outcrop: An area within an existing lava flow in which a portion of the flow has been humanly modified by the placement or removal of stones (a modified tumulus differs from a modified outcrop in that a modified tumulus is in a field of exposed outcrop whereas a modified outcrop may be surrounded by soil).

Mound: Linear, circular or amorphous stone pile which typically lacks a vertical face and level surface.

Pavement: A stone-filled floor or surface.

Platform: A raised free-standing stone structure with three or more vertical faces.

Rock art: A carving or inscription on a boulder, cobble or slab.

Terrace: A raised stone construction partially built against, or level to, a ground or outcrop surface. These structures commonly resemble platforms. Unlike platforms, however, they are not totally free-standing.

Trail: A trodden lava surface, pavement or stone alignment set into the ground or outcrop surface.

Wall: A bi-faced and free-standing stone structure which is an isolated segment or defines large boundaries.

Table 4-2 is a summary of occurrences of formal feature types identified.

Function Interpretation

Function interpretation of a site or feature is determined by criteria which included: site construction and complexity; locational context (association with other sites and/or geological

determinates); analysis of cultural remains (surface and subsurface); and external correlations with other archaeological sites in Hawai'i.

Ten primary function categories were identified among the sites within the project area: agriculture; animal husbandry; habitation; human burial, ceremonial; indeterminate; marker; mining (quarrying) and storage (activity areas); rock art, transportation; and water collection (activity area). Findings are summarized in Table 4-3.

The following are brief descriptions of the different function types commonly encountered in this general area:

Activity area: The feature represents the extent of space serving a special function, or the scope of a specific activity; this category may include lithic production, water collection, storage, fishhook manufacture, quarrying or mining, etc.

Agriculture: Primary function is for farming, horticulture or subsistence planting.

Animal husbandry: The feature is associated with the care of livestock.

Burial: Used for the interment of human skeletal remains. This functional category is also used for human remains found out of primary context.

Ceremonial: Used for ritual or religious purposes.

Fireplace: Burn pit or lens of burned material in a limited area.

Habitation: A place for living, which may be either temporary or permanent habitation.

Habitation sites are generally distinguished from shelters by an increased energy investment in modification and formal construction.

Marker: A point visibly marked for the purpose of identifying a point on a line on the surface of the earth such as a boundary or trail.

Rock art: Petroglyphs and pictographs are functionally rock art.

Transportation: The feature was used as a road or trail.

Significance Assessments

Sites were evaluated for significance according to the broad criteria established for the State Register (See Tables 4-4 to 4-8).

The five criteria are:

- A Site reflects major trends or events in the history of the state or nation.
- B Site is associated with the lives of persons significant in our past.

- C Site is an excellent example of a site type.
- D Site may be likely to yield information important in prehistory or history.
- E Site has cultural significance; probable religious structures (shrines, heiau) and/or burials present.

4.1.3. Conclusions

Kohanaiki and Kaloko, based on the present research, had fairly different resources at the elevation of the project area, and varied significantly in the types of resources as elevation increased. Rainfall, eroded pāhoehoe and barren a'ā all created distinct landscapes for these ahupua'a in the project area. Both had numerous lava tubes, a great resource in this arid region. In Kohanaiki the mauka regions had greater potential for agriculture and had very dense lava tubes, attracting habitation to this area.

As a whole, inhabitants of Kohanaiki and Kaloko were fairly spread out, but were more concentrated along the upper half of the project area. In pre-contact times there could have been as many as a dozen households living in this more mauka area. As has been demonstrated elsewhere in Kona, strong preference was given to ridges, small rises and proximity to lava tubes in the case of most of these habitations. This habitation area in the project area was most likely the makai edge of an inland population center that likely extended mauka of the Kohanaiki Homesteads.

In post-contact times, it is likely that many of those who remained resettled near the new government road, at the Kohanaiki Homesteads or in the land claims awarded in this vicinity. Still, findings show that the area continued to be an important resource and habitation area evidenced by a notable number of historic sites including a habitation, platforms, two curb stone trails, a historic habitation and numerous historic burials. In these post-contact times, the mauka project area probably served as an informal extension to the Kohanaiki Homesteads to the makai.

Residents of these areas were industrious and opportunistic use of the natural terrain and natural resources is evident. The lack of readily available freshwater led to a number of adjustments in living practices. Agricultural areas are concentrated higher up the slope where rainfall is more prevalent. Lava tubes were utilized to capture dripping ground water almost without exception, even when the labor required to do so would have been very significant.

Habitation was also somewhat intensive, with dense complexes of structures located further makai than might have been expected by previous work in the area. These areas were interdependent with other portions of the ahupua'a. Presence of significant marine food remains in mauka agricultural areas and habitations reinforce the importance of coastal resources here.

Feature Type	TMK 17		TMK 25		TMK 26		TMK 28		All TMKs	
	No.	%	No.	%	No.	%	No.	%	No.	%
Alignment	1	1	3	1.4	2	0.7	0	0	6	0.9
Cairn	1	1	8	3.6	17	6.1	2	3.3	28	4.3
Cupboard	2	2	0	0	0	0.0	0	0	2	0.3
Enclosure	12	12.1	31	14	19	6.9	2	3.3	64	9.7
Hearth	1	1	0	0	1	0.4	0	0	2	0.3
Lava blister	1	1	5	2.3	2	0.7	0	0	8	1.2
Lava tube	10	10.1	80	36.2	70	25.3	17	27.9	177	26.9
Modified depression	2	2	9	4.1	4	1.4	4	6.6	19	2.9
Modified outcrop	26	26.3	14	6.3	16	5.8	9	14.7	65	9.9
Mound*	3	3	8	3.6	26	9.4	4	6.6	41	6.2
Pavement	7	7.1	6	2.7	5	1.8	0	0	18	2.7
Platform	2	2	8	3.6	44	15.9	5	8.2	59	9.0
Rock art	0	0	2	0.9	4	1.4	0	0	6	0.9
Rock shelter	1	1	0	0	0	0.0	0	0	1	0.2
Terrace	7	7.1	13	5.9	23	8.3	3	4.9	46	7.0
Trail	21	21.2	17	7.7	12	4.3	7	11.5	57	8.7
Wall	2	2	17	7.7	32	11.6	8	13.1	59	9.0
Total # of Features (% of total features)	99 (15%)		221 (34%)		277 (42%)		61 (9%)		658 (100%)	

*There are several pervasive agricultural sites in the project area with widespread clearing and planting mounds. As these individual mounds are considered sub-features of the larger sites, each site/feature counts as one occurrence of the formal feature type.

Function	TMK 17		TMK 25		TMK 26		TMK 28		TOTAL
	No.	%	No.	%	No.	%	No.	%	%
Activity Area	0	0.0	3	2.3	24	17.1	3	7.0	8.0
Agriculture	7	10.6	4	3.1	9	6.4	1	2.3	5.6
Animal husbandry	0	0.0	4	3.1	3	2.1	7	16.3	3.7
Burial (Known)	0	0.0	5	3.9	24	17.9	5	11.6	9.3
Burial (Probable)	3	4.5	1	0.8	2	2.1	2	4.7	2.4
Ceremonial	0	0.0	2	1.6	2	1.4	1	2.3	1.3
Indeterminate	3	4.5	4	3.1	1	0.7	0	0.0	2.1
Marker	1	1.5	5	3.9	8	5.7	2	4.7	4.2
Quarrying	1	1.5	5	3.9	1	0.7	1	2.3	2.1
Storage	3	4.5	0	0.0	1	0.7	0	0.0	1.1
Permanent Habitation	1	1.5	10	7.8	25	17.9	2	4.7	10.1
Temporary Habitation	31	47.0	72	56.3	34	24.3	13	30.2	39.8
Transportation	16	24.2	13	10.2	4	2.9	6	14.0	10.3

*Since some sites have dual primary functions, i.e. habitation and burial, these functions are each counted as one instance each in the table; thus, the total counts for each parcel here are slightly different than the actual total number of sites (341), for this table only.

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
13493	Trail	Transportation	D	Pre-Contact	No Further Work
15324	Trail	Transportation	D, E*	Pre-Contact	No Further Work
15325	Wall, modified depressions, mound	Temporary habitation / Transportation / Storage	D	Pre-Contact	Data Recovery
15329	Modified tumulus	Temporary habitation	D	Pre-Contact	No Further Work
20696	Lava tube	Temporary habitation	D	Pre-Contact	No Further Work
20697	Modified tumulus	Temporary habitation	D	Pre-Contact	Data Recovery
20698	Pavements	Temporary habitation	D	Pre-Contact	Data Recovery
20699	Modified tumulus	Indeterminate	D	Pre-Contact	No Further Work
20700	Modified tumulus, Enclosure	Temporary habitation / Agriculture	D	Pre-Contact	Data Recovery
20701	Modified tumulus	Temporary habitation	D	Pre-Contact	No Further Work
20702	Mod. tumulus/ terrace	Temporary habitation	D	Pre-Contact	Data Recovery
20703	Terrace, Pavement, Mod. tumulus	Temporary habitation / Mining	D	Pre-Contact	Data Recovery
20704	Trails, walls	Temporary habitation / Transportation	D	Pre-Contact	No Further Work
20705	Modified tumulus	Possible burial	D, E*	Pre-Contact	Preservation
20706†	Modified tumulus	Temporary habitation	D	Pre-Contact	No Further Work
20707	Lava tube	Temporary habitation	D	Pre-Contact	No Further Work
20708	Modified tumulus	Temporary habitation	D	Pre-Contact	Data Recovery
20709	Platform, enclosures, modified lava blister	Recurrent habitation / Agriculture / Storage	C, D	Pre-Contact	Preservation

Table 4-4 (continued)					
Archaeological Site Summary for TMK Parcel 17					
SIHP No.	Site Type	Function	Significance	Age	Mitigation
20710	Lava tube, Alignment, Mound, Modified tumulus, Pavement	Temporary habitation	D	Pre-Contact	Data Recovery
20711	Enclosure	Temporary habitation	D	Pre-Contact	Data Recovery
20712	C-shape	Temporary habitation	D	Pre-Contact	No Further Work
20713	Cairn	Marker	D	Pre-Contact	No Further Work
20714	Wall	Temporary habitation	D	Pre-Contact	No Further Work
	Terrace	Temporary habitation	D	Pre-Contact	Data Recovery
20716	Modified tumulus	Possible Burial	D, E*	Pre-Contact	Preservation
20717	Modified tumulus	Temporary habitation	D	Pre-Contact	No Further Work
20718	Modified tumulus	Agriculture	D	Pre-Contact	No Further Work
20719	Rock shelter / Hearth	Temporary habitation	D	Pre-Contact	Data Recovery
20720	Terrace	Possible Burial (destroyed)	D, E*	Pre-Contact	No Further Work
20721	Modified tumulus	Temporary habitation	D	Pre-Contact	Data Recovery
20722	Trail	Transportation	D	Pre-Contact	No Further Work
20724	Trail	Transportation	D	Pre-Contact	No Further Work
20725	Modified tumulus	Temporary habitation	D	Pre-Contact	Data Recovery
20726	Trail	Transportation	D	Pre-Contact	No Further Work
20727	Lava tube	Temporary habitation	D	Pre-Contact	Data Recovery
20728	Enclosure	Temporary habitation	D	Pre-Contact	No Further Work
20729	See -15329	N/A	N/A	N/A	No Further Work
20730	Modified tumulus	Temporary habitation	D	Pre-Contact	Data Recovery

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
20732	Trail	Transportation	D	Pre-Contact	No Further Work
20733	Trail	Transportation	D	Pre-Contact	No Further Work
20734	Modified depression	Agriculture	D	Pre-Contact	No Further Work
20735	See -15325	N/A	N/A	N/A	No Further Work
20736	Trail	Transportation	D	Pre-Contact	No Further Work
20737	Trail	Transportation	D	Pre-Contact	No Further Work
20738	Enclosure	Agriculture	D	Pre-Contact	No Further Work
20739	Enclosure / Trail	Transportation	D	Pre-Contact	No Further Work
20740	Modified tumulus	Agriculture	D	Pre-Contact	No Further Work
20742	Lava tube	Temporary habitation	D	Pre-Contact	No Further Work
20743	Modified tumulus	Indeterminate	D	Pre-Contact	No Further Work
20744	Trail	Transportation	D	Pre-Contact	No Further Work
20745	Trail	Transportation	D	Pre-Contact	No Further Work
20746	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
20747	Trail	Transportation	D	Pre-Contact	No Further Work
20748	Lava tube	Storage	D	Pre-Contact	No Further Work
20749	Lava tube, terrace	Temporary habitation	D	Pre-Contact	Data Recovery
26259	Trail	Transportation	D	Pre-Contact	No Further Work
26260	Lava tube	Temporary habitation	D	Pre-Contact	Data Recovery
26261	Terrace	Temporary habitation	D	Pre-Contact	Data Recovery
26262	C-shape	Temporary habitation	D	Pre-Contact	No Further Work
26263	Lava tube	Temporary habitation	D	Pre-Contact	Data Recovery
26264	Modified tumulus	Agriculture	D	Pre-Contact	No Further Work
10712	Wall	Animal Husbandry	D	Historic	Preservation
20741	Complex	Temporary Habitation	C, D	Pre-Contact	Preservation

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26275	Complex	Ceremonial	C, D, E	Pre-Contact	Preservation
26276	Modified depression	Temporary Habitation	D	Pre-Contact	No Further Work
26277	Complex	Temporary Habitation	D	Pre-Contact	Data recovery
26278	Trail	Transportation	D	Pre-Contact	No Further Work
26279	Modified outcrop	Indeterminate	D	Pre-Contact	No Further Work
26280	Lava blister	Temporary Habitation	D	Pre-Contact	No Further Work
26281	Mounds	Agriculture	D	Pre-Contact	No Further Work
26282	Lava blister	Temporary Habitation	D	Pre-Contact	No Further Work
26283	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26284	Complex	Permanent Habitation	C, D	Pre-Contact	Preservation
26285	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26286	Modified outcrop	Quarry	D	Pre-Contact	No Further Work
26287	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26288	Complex	Temporary Habitation	C, D	Pre-Contact	Preservation
26289	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26290	Lava tube	Burial	D, E*	Pre-Contact	Preservation
26291	Lava tube	Temporary Habitation/ Quarry	D	Pre-Contact	Data Recovery
26292	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26293	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26294	Wall	Indeterminate	D	Pre-Contact/ Historic	No Further Work

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26295	Cairn	Marker	D	Pre-Contact	No Further Work
26296	Enclosure	Permanent Habitation	C, D	Pre-Contact/ Historic	Preservation
26297	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26298	Platform	Temporary Habitation	D	Pre-Contact	No Further Work
26299	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26300	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26301	Terrace	Temporary Habitation	D	Pre-Contact	No Further Work
26302	Cairn	Marker	D	Pre-Contact	No Further Work
26303	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26304	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26305	Modified outcrop	Temporary Habitation	D	Pre-Contact	No Further Work
26306	Modified outcrop	Indeterminate	D	Pre-Contact	No Further Work
26307	Complex	Ceremonial	C, D, E	Pre-Contact	Preservation
26308	Enclosure	Temporary Habitation	D	Historic	No Further Work
26309	Complex	Temporary Habitation	D	Pre-Contact	No Further Work
26310	Lava tube	Temporary Habitation/Burial	D, E*	Pre-Contact	Preservation
26311	Lava tube	Burial	D, E*	Pre-Contact	Preservation
26312	Cairn	Marker	D	Pre-Contact	No Further Work
26313	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26314	Enclosure	Permanent Habitation	D	Pre-Contact	No Further Work
26315	Complex	Temporary Habitation	D	Pre-Contact	Data recovery
26316	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26317	Lava tube	Temporary Habitation/ Quarry	D	Pre-Contact	No Further Work
26318	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26319	Lava tube	Activity Area	D	Pre-Contact	No Further Work
26320	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26321	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26322	Cairn	Marker	D	Pre-Contact	No Further Work
26323	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26324	Lava tube	Temporary Habitation	D, E**	Pre-Contact	Preserve
26325	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26326	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26327	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26328	Platform	Temporary Habitation	D	Pre-Contact	Data recovery
26329	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26330	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26331	Complex	Permanent Habitation	C, D	Pre-Contact	Preserve
26332	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26333	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26334	Complex	Temporary Habitation	D	Pre-Contact	Data recovery
26335	Enclosure	Permanent Habitation	D	Pre-Contact	No Further Work

Table 4-5 (continued)					
Archaeological Site Summary for TMK Parcel 25					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26337	Complex	Temporary Habitation	D	Pre-Contact	Data recovery
26338	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26339	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26340	Trail	Transportation	D	Pre-Contact	No Further Work
26341	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26342	Lava tube	Temporary Habitation	D	Pre-Contact/ Historic	Data recovery
26343	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26344	Complex	Permanent Habitation	D	Pre-Contact	Data recovery
26345	Modified outcrop/ Lava tube	Quarry	D	Pre-Contact	No Further Work
26346	Trail	Transportation	D	Pre-Contact	No Further Work
26347	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26348	Complex	Permanent Habitation	C, D	Pre-Contact	Preserve
26349	Complex	Temporary Habitation	D	Pre-Contact	Data recovery
26350	Complex	Permanent Habitation	C, D	Pre-Contact	Preserve
26351	Lava blister	Temporary Habitation	D	Pre-Contact	No Further Work
26352	Cairn	Marker	D	Historic	No Further Work
26353	Trail	Transportation	D, E	Pre-Contact	Preserve
26354	Complex	Temporary Habitation	D	Pre-Contact	Data recovery

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26355	Trail/Wall	Transportation	D	Pre-Contact/ Historic	No Further Work
26356	Lava blister	Temporary Habitation	D	Pre-Contact	No Further Work
26357	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26358	Unknown/ Bulldozed	Habitation/ Indeterminate	D	Pre-Contact	No Further Work
26359	Trail	Transportation	D	Pre-Contact	No Further Work
26360	Wall	Animal Husbandry	D	Historic	No Further Work
26361	Trail	Transportation	D	Pre-Contact	No Further Work
26362	Lava tube	Burial	D, E*	Pre-Contact	Preserve
26363	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26364	Lava tube	Temporary Habitation	D, E	Pre-Contact	Preserve
26365	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26366	Wall	Animal Husbandry	D	Historic	No Further Work
26367	Enclosure	Animal Husbandry	D	Historic	No Further Work
26368	Trail	Transportation	D	Pre-Contact	No Further Work
26369	Trail	Transportation	D	Pre-Contact	No Further Work
26370	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26371	Trail	Transportation	D	Historic	No Further Work
26372	Trail	Transportation	D	Pre-Contact	No Further Work
26373	Lava tube	Temporary Habitation	D	Pre-Contact/ Historic	Data recovery
26374	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26375	Modified outcrop	Quarry	D	Pre-Contact	No Further Work
26376	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26377	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work

Table 4-5 (continued)					
Archaeological Site Summary for TMK Parcel 25					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26378	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26379	Complex	Temporary Habitation/ Agriculture	D	Pre-Contact	Data recovery
26380	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26381	Enclosure	Permanent Habitation	C, D	Pre-Contact	Preserve
26382	Trail	Transportation	D	Pre-Contact	No Further Work
26383	Enclosure	Temporary Habitation	D	Pre-Contact	No Further Work
26384	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26385	Mounds	Temporary Habitation	D	Pre-Contact	No Further Work
26386	Modified outcrop	Activity Area	D	Pre-Contact	No Further Work
26387	Modified outcrop	Activity Area	D	Pre-Contact	No Further Work
26388	Lava tube	Temporary Habitation	D	Pre-Contact	Data recovery
26389	Enclosure	Permanent Habitation	D	Pre-Contact	Data recovery
26390	Lava Blister	Temporary Habitation	D	Pre-Contact	No Further Work
26391	Lava Tube	Temporary Habitation	D	Pre-Contact	No Further Work
26392	Mound	Agriculture	D	Pre-Contact	No Further Work
26393	Mound	Agriculture	D	Pre-Contact	No Further Work

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
10712	Wall	Animal Husbandry	D	Historic	Preservation
26418	Trail	Transportation	D	Pre-Contact	No Further Work
26475	Lava tube	Shelter	D	Pre-Contact	No Further Work
26476	Mound	Agriculture	D	Historic	No Further Work
26477	Lava tube	Shelter	D	Pre-Contact	No Further Work
26478	Complex	Temporary Habitation & Burial	D, E	Pre-Contact	Preservation & Data Recovery
26479	Enclosure	Permanent Habitation	D	Pre-Contact	No Further Work
26480	Lava tube	Shelter & Burial	D, E	Pre-Contact	Preservation
26481	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26482	Lava tube	Water Collection	D	Pre-Contact	Data Recovery
26483	Lava tube	Water Collection	D	Pre-Contact	Data Recovery
26484	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26485	Lava tube	Permanent Habitation	D	Pre-Contact	Data Recovery

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
5699	Wall	Animal Husbandry	D	Historic	No Further Work
6601	Complex	Agriculture	D	Pre-Contact	Data Recovery
10714	Trail	Transportation	D, E	Pre-Contact/ Historic	Preservation
16103	Lava tube	Permanent Habitation & Burial	D, E	Pre-Contact	Preservation & Data Recovery
26486	Complex	Permanent Habitation	D	Pre-Contact	Preservation
26487	Enclosure	Permanent Habitation	D	Pre-Contact	No Further Work
26488	Lava tube	Burial	D, E	Pre-Contact	Preservation

Table 4-7 (continued)					
Archaeological Site Summary for TMK Parcel 26 (Kailua Quad)					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26489	Complex	Permanent Habitation	D, E	Pre-Contact	Preservation
26490	Lava tube	Shelter	D	Pre-Contact	No Further Work
26491	Platform	Permanent Habitation	D	Pre-Contact	No Further Work
26492	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26493	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26494	Complex	Permanent Habitation	D	Pre-Contact	Preservation
26495	Lava tube	Temporary Habitation	D	Pre-Contact	Preservation & Data Recovery
26496	Complex	Temporary Habitation	D	Pre-Contact	No Further Work
26497	Modified outcrop	Indeterminate	D	Pre-Contact	No Further Work
26498	Lava tube	Temporary Habitation & Burial	D, E	Pre-Contact	Preservation & Data Recovery
26499	Lava tube	Shelter	D	Pre-Contact	Data Recovery
26500	Lava tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26501	Lava tube	Water Collection & Burial	D, E*	Pre-Contact	Preservation
26502	Complex	Permanent Habitation	D	Pre-Contact	Data Recovery
26503	Lava tube	Water Collection & Burial	D, E	Pre-Contact	Preservation
26504	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26505	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26506	Lava tube	Shelter	D	Pre-Contact	No Further Work
26507	Complex	Agriculture	D	Pre-Contact	Data Recovery
26508	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26509	Lava tube	Burial	D, E	Pre-Contact	Preservation
26510	Complex	Water Collection, Burial, & Ceremonial	D, E	Pre-Contact	Preservation & Data Recovery
26511	Lava tube	Shelter	D	Pre-Contact	No Further Work
26512	Lava tube	Shelter	D	Pre-Contact	No Further Work

Table 4-7 (continued)					
Archaeological Site Summary for TMK Parcel 26 (Kailua Quad)					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26513	Complex	Temporary Habitation	D	Pre-Contact	Data Recovery
26514	Complex	Permanent Habitation	D	Pre-Contact	Data Recovery
26515	Platform & Cairns	Burial & Marker	D, E	Pre-Contact	Preservation
26516	Modified outcrop	Storage	D	Pre-Contact	No Further Work
26517	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26518	Enclosure	Permanent Habitation	D	Pre-Contact	No Further Work
26519	Complex	Permanent Habitation	C, D, E	Pre-Contact	Preservation
26520	Lava tube	Burial, Ceremonial, & Animal Husbandry	D, E	Pre-Contact/ Historic	Preservation & Data Recovery
26521	Lava tube	Shelter	D	Pre-Contact	Data Recovery
26522	Lava tube	Burial & Water Collection	D, E	Pre-Contact/ Historic	Preservation & Data Recovery
26523	Platform	Temporary Habitation	D	Pre-Contact	No Further Work
26524	Lava tube	Shelter	D	Pre-Contact	No Further Work
26525	Lava tube	Shelter	D	Pre-Contact	No Further Work
26526	Cairn	Marker	D	Pre-Contact	No Further Work
26527	Lava tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26528	Lava tube	Water Collection	D	Pre-Contact	Data Recovery
26529	Lava tube	Water Collection & Burial	D, E	Pre-Contact	Preservation
26530	Platform	Temporary Habitation	D	Pre-Contact	No Further Work
26531	Enclosure	Agriculture	D	Pre-Contact	No Further Work
26532	Lava tube	Temporary Habitation & Burial	D, E	Pre-Contact	Preservation
26533	Platform	Agriculture	D	Pre-Contact	No Further Work
26534	Complex	Permanent Habitation	C, D	Historic	Preservation

Table 4-7 (continued)					
Archaeological Site Summary for TMK Parcel 26 (Kailua Quad)					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26535	Platform	Permanent Habitation	D	Pre-Contact	No Further Work
26536	Wall	Animal Husbandry	D	Historic	No Further Work
26537	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26538	Lava tube	Temporary Habitation & Burial	D, E	Pre-Contact	Preservation & Data Recovery
26539	Complex	Temporary Habitation	D	Pre-Contact	No Further Work
26540	Cairn	Marker	D	Pre-Contact	No Further Work
26541	Cairn	Marker	D	Pre-Contact	No Further Work
26542	Platform	Temporary Habitation	D	Pre-Contact	No Further Work
26543	Wall	Marker	D	Pre-Contact	No Further Work
26544	Enclosure	Permanent Habitation	C, D	Pre-Contact	Preservation
26545	Lava tube	Activity Area	D	Pre-Contact	Data Recovery
26546	Lava tube	Water Collection	D	Pre-Contact	Data Recovery
26547	Lava tube	Burial	D, E	Pre-Contact	Preservation
26548	Lava tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26549	Terrace	Agriculture	D	Pre-Contact	No Further Work
26550	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26551	Modified outcrop	Quarrying	D	Pre-Contact	No Further Work
26552	Complex	Permanent Habitation	D	Pre-Contact	Data Recovery
26553	Lava tube	Temporary Habitation	D	Pre-Contact	No Further Work
26554	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26555	Lava tube	Shelter	D	Pre-Contact	No Further Work
26556	Platform	Burial	D, E	Pre-Contact	Preservation
26557	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26558	Platform	Permanent Habitation	D	Pre-Contact	Data Recovery
26559	Platform	Burial	D, E	Pre-Contact	Preservation
26560	Trail	Transportation	D, E	Pre-Contact	No Further Work

Table 4-7 (continued)					
Archaeological Site Summary for TMK Parcel 26 (Kailua Quad)					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26561	Cairn	Marker	D	Pre-Contact	No Further Work
26562	Complex	Permanent Habitation & Burial	D, E	Pre-Contact	Preservation
26563	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26564	Lava tube	Burial	D, E	Pre-Contact	Preservation
26565	Complex	Permanent Habitation	D	Pre-Contact	Data Recovery
26566	Lava tube	Water Collection	D	Pre-Contact	Data Recovery
26567	Mound	Agriculture	D	Pre-Contact	No Further Work
26568	Lava tube	Water Collection & Burial	D, E	Pre-Contact	Preservation
26569	Lava tube	Water Collection & Burial	D, E	Pre-Contact	Preservation
26570	Lava tube	Water Collection & Burial	D, E	Pre-Contact/ Historic	Preservation
26571	Cairn	Marker	D	Pre-Contact	No Further Work
26572	Complex	Agriculture	D, E	Pre-Contact	No Further Work
26573	Lava tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26574	Complex	Permanent Habitation	D, E	Pre-Contact	Preservation
26575	Lava tube	Water Collection	D	Pre-Contact	No Further Work
26576	Lava tube	Burial & Shelter	D, E	Pre-Contact	Preservation
26577	Mound	Permanent Habitation	D	Pre-Contact	Data Recovery
26578	Lava tube	Shelter	D	Pre-Contact	Data Recovery
26579	Cairn	Marker	D	Pre-Contact	No Further Work
26580	Enclosure	Permanent Habitation	D	Pre-Contact	Preservation
26581	Lava tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26582	Lava tube	Burial	D, E	Pre-Contact	Preservation
26583	Complex	Permanent Habitation & Ceremonial	C, D, E	Pre-Contact	Preservation
26584	Complex	Transportation	D	Pre-Contact	No Further Work
26585	Complex	Agriculture & Temporary Habitation	D	Pre-Contact	No Further Work

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26586	Cairn	Marker	D	Pre-Contact	No Further Work
26587	Platform	Agriculture	D	Pre-Contact	No Further Work
26588	Enclosure	Permanent Habitation	C, D	Pre-Contact	Preservation

* Site is a probable burial

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26371	Trail	Transportation	D	Historic	Preserve
26414	Wall	Animal Husbandry	D	Historic	Preserve
26415	Trail	Transportation	D	Pre-Contact	No Further Work
26416	Lava Tube	Burial	D, E	Pre-Contact	Preserve
26417	Mounds/Modified Depressions	Agriculture	D	Pre-Contact	No Further Work
26418	Trail	Transportation	C, D	Pre-Contact	Preserve
26419	Trail	Transportation	D	Pre-Contact	No Further Work
26420	Lava Tube	Activity Area	D	Pre-Contact	No Further Work
26421	Lava Tube	Temporary Habitation	D	Pre-Contact	No Further Work
26422	Trail	Transportation	D	Pre-Contact	No Further Work
26423	Lava Tube/Modified Tumulus	Burial	D, E	Pre-Contact	Preserve
26424	Enclosure	Ceremonial	C, D, E	Pre-Contact	Preserve
26425	Lava Tube/Modified Tumulus	Temporary Habitation/Burial	D, E	Pre-Contact	Preserve & Data Recovery
26426	Modified Tumulus	Marker	D	Historic	No Further Work
26427	Lava Tube	Burial	D, E	Pre-Contact	Preserve
26428	Platform	Permanent Habitation	D	Pre-Contact	Data Recovery
26429	Modified Tumulus	Activity Area	D	Pre-Contact	No Further Work

Table 4-8 (continued)					
Archaeological Site Summary for TMK Parcel 28 (Keahole Pt. Quad)					
SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26430	Modified Tumulus/ Platform/ Terrace	Temporary Habitation	D	Pre-Contact	Data Recovery
26431	Lava Tube	Activity Area	D	Pre-Contact	Data Recovery
26432	Wall	Animal Husbandry	D	Historic	No Further Work
26433	Trail	Transportation	D	Pre-Contact	No Further Work
26434	Lava Tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26435	Wall	Animal Husbandry	D	Historic	No Further Work
26436	Wall/Cairn	Animal Husbandry	D	Historic	No Further Work
26437	Cairn	Marker/Animal Husbandry	D	Historic	No Further Work
26438	Lava Tube	Temporary Habitation/Burial	D, E	Pre-Contact	Preserve & Data Recovery
26439	Lava Tube	Temp. Habitation	D	Pre-Contact	Data Recovery
26440	Lava Tube	Temporary Habitation/ Burial*	D, E	Pre-Contact	Preserve
26441	Lava Tube	Activity Area	D	Pre-Contact	No Further Work
26442	Wall	Animal Husbandry	D	Historic	No Further Work
26443	Enclosure	Permanent Habitation	D	Pre-Contact	Preserve
26444	Wall	Animal Husbandry	D	Historic	No Further Work
26445	Modified Tumulus	Temporary Habitation	D	Pre-Contact	Data Recovery
26446	Lava Tube	Temporary Habitation	D	Pre-Contact	Data Recovery
26447	Lava Tube	Temporary Habitation	D	Pre-Contact	No Further Work
26448	Modified Tumulus	Temporary Habitation	D	Pre-Contact	No Further Work
26449	Lava Tube	Temporary Habitation	D	Pre-Contact	Data Recovery

SIHP No. 50-10-27-	Site Type	Function	Significance	Age	Mitigation
26450	Wall	Animal Husbandry	D	Historic	No Further Work
26451	Modified Tumulus	Temporary Habitation	D	Pre-Contact	No Further Work
26452	Lava Tube	Activity Area**	D, E	Pre-Contact	Preserve & Data Recovery
26453	Platform	Burial*	D, E	Pre-Contact	Preserve

* Site is a probable burial

** Site contains burials located outside of the project area

The makai project area was probably frequently traversed on mauka-makai trails, which were identified to some degree in the project area and have been identified in Kaloko-Honokōhau National Historic Park to the west. Interestingly, evidence was found that Kaloko and Kohanaiki may have been interdependent upon each other at these elevations, perhaps more than with other neighboring ahupua'a. Dense clusters of trails crossing a'a flows in both the makai project area (TMK 17) and the middle project area (the center of TMK 25) virtually straddle the presently known ahupua'a boundary.

Also, historic maps show that the major mauka-makai trail, Site -10714, crossed from Kohanaiki into Kaloko in the middle project area, though this was not definitively confirmed with archaeological findings. At least one possible crossing preserved as a gap in the post-contact ahupua'a wall was also located near the mauka end of the project area.

Until the construction of Queen Ka'ahumanu Highway, the use of some of these local trails likely continued for access to the coast. Other historic use, in particular ranching, played a major role in a continually evolving landscape. Hu'ehu'e Ranch provided jobs for paniolo who continued to utilize the area. Introduced fodder flora have overtaken much of the landscape, and grazing and mechanical clearing have likely negatively impacted many sites. Modern use has continued to affect the area and disturbance in the form of bulldozing, dumping and camp sites along Hina Lani Street have had the greatest impact.

Nevertheless, these numerous stages of land use have had a large area to share, and much of the evidence of earliest land use in pre-contact times is still in good condition. Further research on these cultural resources through a comprehensive data recovery program will add considerably to this knowledge. Preservation will also be a major consideration, especially in the northeast project area with emphasis on trails, burials and sites of high interpretive value.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project will affect historic properties recommended eligible to the Hawai'i Register. CSH's project specific effect recommendation is "effect, with agreed upon mitigation measures."

Historic properties outside of the project area do have the potential to be affected by the current development. The proximity of the project area to Kaloko-Honokōhau National Historical Park to the east is the primary concern. Historic properties north and south of the project area are of less concern due to the extensive industrial/commercial developments separating the project area from the potential sites there. Also of some concern are the remaining Kohanaiki Homesteads in the next parcel east of the project area. Three of these homesteads were recommended for preservation by previous archaeological work there (Wolforth 2005) and if not directly affected by development of that parcel, their view plane has the potential to be affected by development of the project area.

Overall, the project area contains a large number of significant sites that are recommended for preservation and/or data recovery. It is recommended that of the 341 sites in the project area, a total of eighty (80) sites be subjected to a program of data recovery to address scientific and informational concerns, and a total of seventy-two (72) sites be preserved (see Table 4-9 and Figure 4-2).

Recommendation	TMK 17		TMK 25		TMK 26		TMK 28		All TMKs	
	No.	%	No.	%	No.	%	No.	%	No.	%
Preservation	3	5.1	18	14.9	38	30.8	13	31.7	72	21
Data Recovery	19	32.2	29	24.0	23	19.2	8	19.5	80	23
No Further Work	37	62.7	74	61.2	60	50.0	20	48.8	189	56
Total (total %)	59	(17%)	121	(36%)	120	(35%)	41	(12%)	341	(100%)

Preservation sites should be considered for some amount of data recovery effort as part of the preservation plan, to include further documentation, dating, etc. as appropriate. It is believed that continued documentation in some cases could help mitigate possible vandalism or looting of preserve areas.

The remaining 189 sites are not recommended to undergo further research, as the documentation and plotting of location during the current study has addressed the limited information available at these sites. These sites are classified under Criterion D significance only and are generally characterized as sites in poor structural condition, or sites such as minimally modified lava tubes, trail remnants, agricultural features or animal husbandry walls that lack excavation potential.

Mitigation for impact on historic properties outside the project area is best addressed by architectural and landscaping measures to minimize visual impact on the environment in Kaloko-Honokōhau National Historical Park. Based on previous development of the vicinity, tall buildings directly adjacent to the highway, bright or light colored paint, heavy use of corrugated metal and landscaping using non-native plants would have the greatest visual impact on those properties in

the park. Use of low-rise architecture, local stone, muted colors and native plants would be preferable from a mitigation perspective and would minimize the urban feel of the land most immediately visible from, and historically tied to, that preserved in the park.

There are a total of seventy-two (72) sites in the project area that are recommended for preservation in whole or in part. A large percentage of these sites are recommended for preservation based on the presence of a burial (confirmed or probable) and/or association with a burial.

Burials are especially common in lava tubes within the project area and special consideration will need to be given to the preservation in place of burials, especially when remains are located far from the lava tube entrances. Thus, the preservation plan will need to address the logistics of preservation boundaries in terms of accurate locational information as well as how to preserve/seal entrances associated with burials.

Several of the non-burial preserve sites are major intact trail systems that run for several hundred meters, and two sites are ahupua'a walls that are recommended for preservation with breaches allowed. Other preserve sites include ceremonial enclosures and platforms (possible heiau), excellent examples of habitation complexes (some of which utilize both surface and sub-surface areas), and a few petroglyph panels.

All of the confirmed and suspected burials will be preserved pursuant to a burial treatment plan prepared in consultation with recognized descendants and the Hawai'i Island Burial Council. The other preservation sites will be treated in accordance with a preservation plan submitted to and approved by SHPD prior to final subdivision approval. It is recommended that considerations for the preservation of these sites be detailed in a burial treatment plan and preservation plan to be approved by the SHPD.

The complete collection of artifacts associated with this archaeological inventory survey was collected from private lands; accordingly, this material belongs to the landowner. While a relatively small number of artifacts were collected given the size of the project, some items were retrieved during the inventory survey due to concern over possible looting. Some artifacts and midden were collected as part of the test excavations conducted. The artifacts associated with this archaeological inventory survey will be temporarily housed at a CSH storage facility. CSH will make arrangements with the landowner regarding the disposition of the project's collection. Should the landowner request archiving of material, then the archive location will be determined in consultation with SHPD.

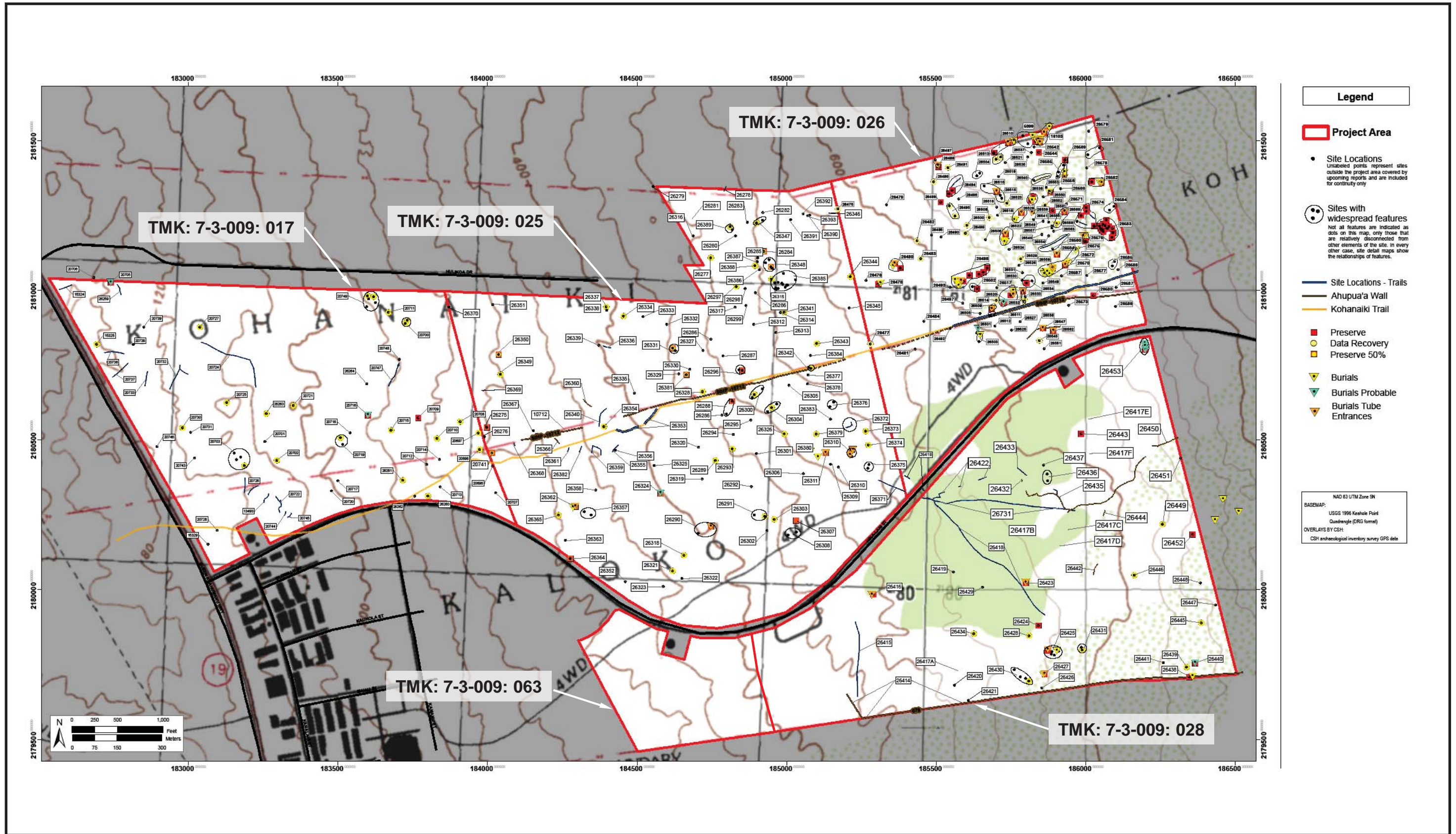


FIGURE 4-2
Archaeological Sites
Kaloko Makai

4.2. CULTURAL RESOURCES

Cultural Surveys Hawai'i, Inc. (CSH) conducted a Cultural Impact Assessment (CIA) of a 1,150-acre parcel within portions of Kaloko Ahupua'a and Kohanaiki Ahupua'a, North Kona District, Hawai'i Island, TMK: (3) 7-3-009: 017, 025, 026, 028 and new parcel 063 (May 2008). The results are summarized below and the study is included as Appendix J.

The purpose of the CIA is to consider the effects that the proposed project may have on the culture of Hawai'i, and traditional and customary rights. The Hawai'i State Constitution, Article XII, Section 7 protects "all rights" of native Hawaiians that are "customarily and traditionally exercised for subsistence, cultural and religious purposes." Act 50 (SLH 2000) was passed as an attempt to balance the scale between traditional lifestyles and development and economic growth. Act 50 provides that environmental impact statements: (1) Include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and (2) Amend the definition of "significant effect" to include adverse effects on cultural practices.

The CIA has been designed and prepared to fulfill the mandate to the Land Use Commission from the Hawai'i State Supreme Court in its ruling, *Ka Pa'akai O Ka 'Aina v. Land use Commission, State of Hawai'i*. 94 Haw. 31 (2000). The specific section of the ruling that served to guide the development and preparation of the CIA is as follows:

In order for the rights of native Hawaiians to be enforceable, an appropriate analytical framework for enforcement is needed. Such an analytical framework must endeavor to accommodate the competing interests of protecting native Hawaiian culture and rights on the one hand, and economic development and security, on the other.

Likewise, the scope of work was designed to meet the *Guidelines For Assessing Cultural Impacts* as adopted by the OEQC (1997), as well as the requirement of any other State and County agencies involved in the review process for the proposed project. The "Guidelines for Assessing Cultural Impacts" issued by the OEQC discuss the types of cultural resources, practices and beliefs that might be assessed. The Guidelines state:

The type of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The assessment also considers cultural resources, practices and beliefs within the broader context of Kaloko Ahupua'a and Kohanaiki Ahupua'a that are relevant to assessing the role of the project area.

4.2.1. Previous Cultural Impact Assessment (CIA)

A CIA (Hammatt and Shideler 1996) was conducted for a portion of the project area in 1996 as a companion study to the Collin et al. (1996) study of TMK 7-3-009:017. Informants knowledgeable of the project area were interviewed. These consultations focused on identifying traditional cultural practices conducted within the project area, as well as addressing community concerns regarding probable burial sites.

This summary of the CIA focuses on the probable burial sites located within that portion of the project area. The reader is referred to the CIA (Hammatt and Shideler 1996) for a detailed discussion and analysis of the traditional cultural practices documented within the project area.

On March 16, 1996, CSH staff interviewed the Reverend Norman Keanaaina, a kama'āina (native-born, one born in a place) of Kohanaiki since the 1940s. Reverend Keanaaina stated his belief that there were indeed burials within the TMK parcel 17 portion of the project area. He stated that interment within the TMK parcel 17 portion of the project area continued into the 1930s or 1940s, when his "grandmother's husband," the Kapaa family, was buried.

Reverend Norman Keanaaina made a site visit with CSH personnel and was taken to three sites (SIHP No. -20702, -20717 and -20720) in the south-central portion of TMK parcel 17, which had been previously identified by CSH as probable burials. The Reverend agreed that the filled-in cracks at these sites were probable burials. He stated that the common practice was to wrap the body in a mat or a horse blanket, then inter it in a sufficiently large crack which would subsequently be filled with stones.

In 1996, eight possible burial sites (SIHP Nos. -20702, -20705, -20716, -20717, -20720, -20731, -20743, and -20749) had not been tested to determine the presence or absence of human skeletal remains, and testing was deferred to data recovery. Because the CSH archaeological inventory survey sought to re-evaluate and improve records for all of these sites, many of these sites were tested. The focus of this effort was to improve decision-making that now depends more heavily on findings of the archaeological inventory survey. The result of this testing was a reduction of eight possible burial sites to two probable burial sites. A third possible burial site (SIHP No. -20720) was determined to have been destroyed and is therefore no longer a current possible burial site.

4.2.2. Environmental Setting

The project area comprises approximately 1,139 acres in the ahupua'a of Kaloko and Kohanaiki. The lands are located on the leeward coast of Hawai'i Island within the district of North Kona on the lower west slope of Hualālai Volcano.

4.2.2.1. Natural Environment

The project area is bounded by Queen Ka'ahumanu Highway to the west, Hina Lani Street to the south, TMK [3] 7-3-009:032 to the east, and 'O'oma 2nd Ahupua'a to the north. Elevation within the project area ranges from 80 ft. above annual mean sea level AMSL at the western boundary to 760 ft. amsl. along the eastern boundary.

Kona weather is typified by afternoon showers brought on by warm air that has been moved inland by light sea breezes. The humid air gradually condenses over higher altitudes throughout the day. At night, the land cools resulting in breezes which send warm air back out to sea. Rainfall in the project area averages 10 inches per year (Cordy et al. 1991). There are no natural springs or perennial streams within the project area, but dozens of subterranean water-collection lava tubes have been identified during the archaeological survey by CSH.

The land surface is comprised of a large 'a'ā flow running mauka/makai through the project area with several smaller flows to the northeast and a large flow in the northwest portion of the area. The surface of the 'a'ā lava ranges from roughly level expanses to rough fractured ridges.

Pāhoehoe lava covers the west-central and north-central sections of the project area. The surface ranges from level expanses to highly fractured tumultuous areas and is characterized by numerous tumuli and pressure ridges with depressions or undulations in the pāhoehoe containing thin soil pockets. Collapsed portions of lava tubes also contribute to the uneven surface of the pāhoehoe flows.

4.2.2.2. Built Environment

Although much of the land around the project area remains rural, the built environment is distinct on the north and west sides of the parcel. The built environment is distinct near the Queen Ka'ahumanu Highway, makai of the project area. To the north of the project area is a light industrial area bordering Huliko'a Drive built after the Colin et al. (1996) study. This area is marked by the Matsuyama Market and Pine Tree Cafe near the intersection of Huliko'a Drive and the highway. The area is marked by a stone sign "Kohanaiki."

Hina Lani Street, a major coastal/inland (makai/mauka) connector road, runs through the center of the project lands. Two 1-million-gallon water tanks and a fairly large base yard have been developed along Hina Lani Street and are convenient points of reference. South of the makai (west) portion of the project area is a large industrial area often referred to as "Kaloko Industrial" or "New Industrial" (in contrast to an older industrial area near the old Kona airport). This area features numerous large warehouses, light industrial and commercial buildings (Home Depot and Costco, among others).

The project lands themselves are generally undeveloped, and appear not to have been dramatically impacted by modern activity other than bulldozing. Some modern cattle ranching has apparently taken place intermittently within the project area, with some barbed-wire fencing and a wooden trough present; the historic ahupua'a wall that runs through portions of the project area is also a good indication that historic animal husbandry occurred in the area.

Portions of the 'a'ā and pāhoehoe flows throughout the project area have been bulldozed, and bulldozer roads and intermittent bulldozing activity are present. A large portion of the bulldozing on pāhoehoe areas is probably related to the ranching activities. There are additional swaths of bulldozing on the 'a'ā around the water tanks located on Hina Lani Street and at the large base yard off of Hina Lani Street. Most bulldozer activity tends to be concentrated either near Hina Lani

Street, near the southern ahupua'a wall, or near barbed-wire fences within the central portion of the project area. There are a few distinct bulldozer roads in the project area, but less distinct signs such as bulldozer tread scars on bedrock were also noted in various locations.

A jeep road present since mid-century runs more or less mauka/makai just north of Hina Lani Street and is visible on the aerial view. A bulldozer road, also visible on the aerial view, extends from Hina Lani Street north to the end of Huliko'a Drive.

4.2.3. Traditional and Historic Background

4.2.3.1. Mythological and Traditional Accounts

4.2.3.1.1. Kekaha

The ahupua'a of Kohanaiki and Kaloko lie at the southern end of Kekaha, the portion of North Kona extending from Honokōhau to 'Anaeho'omalū. The character of the region of Kekaha - as it had been established in the Hawaiian consciousness - is represented in a traditional saying recorded by Mary Kawena Pukui and in a brief description by John Papa 'Ī'ī. The saying, "*Kekaha wai 'ole na Kona*", translates to "waterless Kekaha of the Kona district." Pukui states that "Kekaha in Kona, Hawai'i, is known for its scarcity of water but is dearly loved by its inhabitants" (Pukui 1983:184).

Pukui (1983:271) also relates the importance of fishing in the following:

Ola aku la ka aina kaha, ua pua ka lehua l kai.

Life has come to the *kaha* lands for the *lehua* blooms are seen at sea.

Pukui (1983:271) further explains this saying: "Kaha lands refers to Kekaha. When the season for deep-sea fishing arrived, expert fishermen and their canoes headed for the ocean."

Kohanaiki means "small barrenness" (Pukui et al. 1974:115).

'Ī'ī describes the winds of Kekaha:

...a cold wind from Kekaha, the Hoolua. Because of the calm of that land, people often slept outside of [sic] the tapa drying sites at night. It is said to be a land that grows cold with a dew-laden breeze, but perhaps not so cold as in Hilo when the Alahonua blows. ('Ī'ī 1959:122)

These passages suggest that Kekaha was firmly identified with its austere physical environment. A legend told in Maguire (1966) reveals the importance of water resources in this general area (see also Wolforth 2005:8-9). The story takes place at the Cave of Mākālei, which is located outside of the current project area near 'Akahipu'u (a nearby mountain). The story focuses on a man named Ko'amokumokuhe'eia, who moved to this area and was told by the current residents that water was very scarce.

Water, he was told, could be obtained in “celebrated” caves, but these caves were *kapu* (forbidden), and if caught, trespassers would be killed by the owner of the cave. However, Ko‘amokumokuohe‘eia discovered a very small cave entrance that no else knew about. The cave had water dripping from its roof (Maguire 1966:30). Ko‘amokumokuohe‘eia and his father used carved ‘ōhi‘a and wiliwili trees to capture the dripping water, and his family was thus able to survive during dry spells. This legend clearly demonstrates the importance of water as a resource that is difficult to procure, and it highlights the importance of water collection caves.

Kekaha was, however, “valued by ruling chiefs, inhabited by attendant chiefs, and upon occasion abused by warring chiefs” (Kamakau 1979:31). Describing the apportioning of land by the ali‘i (royalty) before the ascendancy of Kamehameha, Kamakau records this information about the lands of Kekaha:

Waimea [he is referring in this case to Waimea, O‘ahu] was given to the Pa‘ao kahuna class in perpetuity and was held by them up to the time of Kamehameha III when titles had to be obtained. But there was one land title held by the kahuna class for many years and that was Puuepa in Kohala. In the same way the land of Kekaha was held by the kahuna class of Ka-uahi and Nahulu. (Kamakau 1961:231)

Kamakau further records that during the 1770s, “Kekaha and the lands of that section” were held by descendants of the Nahulu line, the Ka-me‘e-ia-moku and Ka-manawa, the twin half brothers of Ke‘e-au-moku, the Hawai‘i island chief (Kamakau 1961:310). The Great Seal of the State of Hawai‘i depicts Kame‘eiamoku and Kamanawa (Springer 1989:23).

Intensive archaeological investigation during recent decades has clarified the picture of pre-Contact Hawaiian life within Kekaha and the two ahupua‘a under study. An especially detailed study of Kaloko has resulted in the following analysis of the development of pre-Contact settlement throughout the ahupua‘a:

Throughout its span of occupation Kaloko was but part of a larger society. Kaloko was apparently a unified community after A.D. 1200-1300. When initially occupied (A.D. 1000-1500), it may have been an outlier of another community. Nevertheless, from its initial occupation, Kaloko had 1 or more internal local residence groups containing constituent households. By A.D. 1200-1300 at least 2 residential groups were present in the community, and by contact (circa A.D. 1778) at least 4 residential groups had dwelled in the area. Each residential group performed religious functions as well as being a leisure unit. Members of the group held use rights to adjacent farm lands and probably to areas where forest and marine resources were located. Within each residential group, 1 household seems to have been dominant, being the spatial focus for its group’s religious activities. It is suggested that such dominance was a function of consanguineal seniority and/or wealth. (Cordy et al. 1993:45)

While exact population figures for Kaloko were not possible, the study suggested that the “community seems to have gradually grown in size but could never have been larger than 118 and most likely was about 60-100 in size” (Cordy et al. 1993:45). The general pattern of land use and

settlement suggested for Kaloko may also have existed within the similar environment of neighboring Kohanaiki.

4.2.3.1.2. The Legend of Ka-Miki

Kepā Maly (1993) translated the “Kaaō Hooniua Puuwai no Ka-Miki” (The Heart stirring Story of Ka-Miki) that appeared in the newspaper *Ka Hoku o Hawai‘i* between 1914 and 1917. The legend provides details about life and the environment of Kekaha as well as for the entire island of Hawai‘i. Ka-Miki, the quick or adept one, and his brother Maka‘iole, rat or squinting eyes, traveled around the island to participate in competitions circa the thirteenth century when Pili-a-Ka‘aiea was the chief of Kona. The boy’s parents were Pōhaku-o-Kāne (male) and Kapa‘ihilani (female), the *ali‘i* of Kaloko and Kohanaiki. The legend relates that the supernatural brothers “were empowered by their ancestress Ka-uluhe-nui-hihi-kolo-i-uka (the great entangled growth of *uluhe* fern which spreads across the uplands), a reincarnate form of the earth-mother goddess, creative force of nature Haumea (also called Papa) who dwelt at Kalama‘ula on Hualālai, in the uplands of Kohana-iki, Kona” (Maly 1993:21-22). The twins were raised by Ka-uluhe, who taught them how to use their supernatural powers.

Several of the stories identify heiau of Kaloko and Kohanaiki. The first appeared between April 16 and 30, 1914.

The ocean at ‘Ohiki was named Kauahia or Kai o Kauahia. After an ‘awa ceremony with Ka-uluhe ma, Ka-Miki went to the shore of ‘Ohiki to fish, in the pond waters of the chief Ahauhale. ‘Ohiki was the name given for several places, including: a heiau; a cove; and an ‘ili of Kaloko. The ‘ili land parcel came to be known as Ki‘ikahala after the punishment of the dual formed priest-shark Kalua‘olapauila.

On the night of Kāne the priests, chiefs, and people were observing the kapu of silence and all was being made ready to dedicate the royal compound of Ka‘aipu‘aat Kohanaiki. Ka-Miki and Maka‘iole descended to the coastal region of Kaloko and Kohanaiki from Kalam‘ula and beat the drums in the heiau of Pohakea, ‘Ohiki, Kaukeano, ‘O‘unui, Honu‘iwa, Pu‘uho‘olelelupe, Kauki‘eki‘e, and Hale-o-Lono. The sound of the pahu heiau (temple drums) greatly startled the people, and caused the priests and chiefs of Kaloko to grumble amongst themselves. The sequence of events which followed, led to the naming of Hi‘iakanoholae.

A spring in the land parcel was also named ‘Ohiki. The ocean of this area was named Kauahia before ‘Ohiki came about, and following the death of the shark-priest Kalua‘olapauila, the land section and temple of ‘Ohiki came to be called Ki‘ikahala.

Details about why this area of Kohanaiki became important appeared between January 8 and May 28, 1914 and December 6, 1917.

Ka-uluhe-nui-hihi-kolo-i-uka a reincarnate form of Haumea (also called Papa) lived at Kalama‘ula in the uplands of Kohana-iki, below Hainoa. Ka-uluhe was the wife of

Kumua, and the hill site at which Kumua dwelt is also called Kumua; it is below Kalama'ula, a little above the hidden spring of Kapa'ihī. The reason that Kumua lived at this hill was because it allowed him clear view of the coastal lands of Kohana-iki, which is where his children and grand children lived. One of the children of Kumua ma was Pipipi'apo'o and she was married to Hale-o-Lono (an agriculturalist and temple type, coastal Kohana-iki) who was an exceptional farmer. Hale-o-Lono excelled in his trade, and the place upon which he farmed was called Nanawale, and because he marked the area with many cairns, it came to be called Nahiahu, also called Nawaiahu, the place of cairns.

Nawahi ahu appears on Emerson's RM 1449 and RM 1512, dating to 1888 and 1889 respectively. A discussion of the maps and roads that appear on the maps is presented in the "Mid- to late -1800s" section below.

A more recent translation of the legend of Ka-Miki by Maly and Maly (2003:15) includes the following additional information about Nāwahiahu.

Pipipi'apo'o was another daughter of Kūmua and Ka-uluhe-nui-hihi-kolo-i-uka. She married Haleolono, one who cultivated sweet potatoes upon the 'ilima covered flat lands of Nānāwale, also called Nāhiahu (Nāwahiahu), as it has been called from before and up to the present time. Cultivating the land was the skill of this youth Haleolono, and because he was so good at it, he was able to marry the beauty, Pipipi'apo'o. Pipipi'apo'o skill was that of weaving pandanus mats, and there grow there many pandanus trees to this day. The grove of pandanus trees and a nearby cave, is called Pipipivapo'o...

Maly (1993:28) notes that Hale-o-Lono, Kī'ikahala, and 'Ohiki are associated with sites and/or place names that are shared by Kaloko and Kohanaiki.

Ka-Miki completed his journey around the Big Island and

...became the foremost champion of Pili (7/26/1917). It was at this time that Ka-Miki learned about the sacred palama chiefess Paehala of Honokohau; lands also called Na-Hono-i-na-Hau-'Elua (the bays of the two dews). Pili gave Ka-Miki permission to wed Paehala if she and her family agreed, and Paehala was the foremost beauty of Kona.

When the chiefess agreed to marry Ka-Miki, Pili told Ka-Miki, that he would also, "oversee the chiefs' sacred fishponds [at Kaloko and Pa'aiea]; the schools of kala, uhu, and palani; and all the lands of Kekaha from Hikuhi which is above Napu'u u (also called Napu'upo'alu); and lands between Keahualono at Kaniku to the plain of Kanoenoe, marked by the hill of Pu'uokalua at Keahuolu" (10/18/1917). (Maly 1993:22)

Maly (1993:29) explains that traditional accounts of Kaloko and Kohanaiki describe a lush environment that differs from its current state due to several factors. The Hualālai lava flow in 1801 covered the former agricultural and forested lands, residential areas and fishponds. The loss of

forests began the decrease in rainfall that was exacerbated by the introduction of livestock and ranching. Goats and cattle stripped the vegetation from the lands causing water resources to dry up. Thus, over the last 150 years, the environment has been significantly altered.

4.2.4. Early Historic Period

Kamakau (1961) reports that during the war between Alapa'inui of Hawai'i and Kekaulike of Maui, Kekaulike "abused the country people of Kekaha" by destroying all the coconut groves and slaughtering "the country people." The destruction of these valuable trees was devastating.

Kekaha lands were set aside for the priestly class:

Waimea [O'ahu] was given to the Paoa Kahuna class in perpetuity and was held by them up to the time of Kamehameha II when titles had to be obtained. But there was one land title held by the kahuna class of Paoa for many years and that was Puuepa in Kohala. In the same way the land of Kekaha was held by the kahuna class of Ka-uahi and Nahulu. (Kamakau 1961:231)

During the last decades of the eighteenth century, following western contact, Kohanaiki and Kaloko - as elements of the larger Kekaha area - remained under the control of Ka-me'e-ia-moku, who resided to the north at Ka'upūlēhu (Kamakau 1961:147). Ka-me'e-ia-moku's son, Ulumaheihei Hoapili, "belonged to the priesthood of Nahulu and was an expert in priestly knowledge. He had been taught astronomy and all the ancient lore" (Kamakau 1961:354).

Archibald Menzies, the first foreigner to record his visit to Kekaha, accompanied Captain Vancouver in 1792. He described the land as "barren and rugged with volcanic dregs and fragments of black lava...in consequence of which the inhabitants were obliged to have recourse to fishing for their sustenance" (Menzies 1920:99).

Kamakau recorded that Kaloko is the site where Kamehameha's bones were cached by Hoapili after the king's death in 1819:

Kamehameha had...entrusted his bones to Ulu-maheihei Hoa-pili with instructions to put them in a place which would never be pointed out to anyone. At midnight, therefore, when black darkness had fallen and no one was likely to be on the road and the rough lava plains of Pu'ukaloa lay hushed, Hoa-pili sent his man, Ho'olulu, to bring the container of wicker work in which the bones of Kamehameha were kept to Kaloko in Kekaha...The next morning Hoa-pili and Ke-opu-lani took canoe to Kaloko where Hoa-pili met the man who had charge of the secret cave and together they placed the bones there. (Kamakau 1961:215)

Kelly (1971:25) notes a February 16, 1887 letter to a person named Kapalu as the "overseer and keeper of the Royal Burial Ground at Kaloko, Kailua." The Interior Department of the Hawaiian Kingdom provided Kapalu with a \$20 a month stipend, for seven months. A second letter reappoints Kapalu as a caretaker although there is no payment for his services. Kelly also relates that an informant's grandfather had disclosed the location of the burial cave, and he would move the

remains to protect them. Another informant stated that women are not buried at Kaloko, only men of high rank. Other informants revealed that the burial caves were inland and not in the vicinity of Kaloko Pond (Kelly 1971:25).

Kamakau's account regarding the caching of Kamehameha's remains suggests that Kaloko's population, toward the end of the nineteenth century's second decade, had diminished to such an extent that the ahupua'a could provide the necessary isolation and secrecy for the burial.

By the early nineteenth century, the inhabitants of Kaloko and Kohanaiki had long experienced the social pressures and consequences of western contact. "As early as 1788, Hawaiians began enlisting as seamen on the foreign ships that stopped at Island ports, and their number increased rapidly with the growth of whaling in the Pacific" (Schmitt 1973:16). As harbor facilities were developed at Kailua and Kealahou during the early 1800s, these ports became population centers drawn from increasingly isolated (economically and socially) areas like Kaloko and Kohanaiki. Newly-introduced diseases cut the population severely.

Missionary censuses of the 1830s chart the diminishing population of Kekaha and North Kona. In 1834, the total population of Kekaha is recorded as 1,244, comprising 21% of the total North Kona population of 5,957 (Schmitt 1973:31). The North Kona figure represents a population loss of 692 since the previous census of 1831 (during which no figure specific to Kekaha was noted), which recorded 6,649 persons in the district (Schmitt 1973:9). One factor - inter-island migration - which led to the diminishing population of Kona was specifically noted by missionaries in 1832: "We have been sensible for some time that the number of inhabitants in this island is on the decrease. There is an almost constant moving of the people to the leeward islands, especially since the removal of the governor (Kuakini) to Oahu. Some leave by order of the chiefs, and others go on their own responsibility" (cited in Schmitt 1973:16).

Land Commission documents of the 1840s and 1850s record the disposition of population and land use within Kohanaiki and Kaloko ahupua'a that had evolved since western contact. At the Māhele of 1848, Kaloko was claimed by and awarded [Land Commission Award (LCA) 7715] to Lot Kamehameha (who would become Kamehameha V). Kohanaiki was classified as Government Land. Subsequently, 18 kuleana claims - by commoners claiming to occupy and/or cultivate land parcels - were made in Kaloko. Twelve of these claims were awarded. All claims were for mauka lands - between 1200 and 1700 ft. elevation - adjacent to or just makai of the Government Road.

Parcels within Kohanaiki, having become Government Land, were subject to sale - designated grants - by the Hawaiian Kingdom government. Land sales began in the 1850s with Grant 2030 to Kaiakoili in 1856, awarding 102 acres adjacent to and makai of the Government Road. Also beginning in the 1850s, the first taxpayer rolls for Kohanaiki and Kaloko were documented: they indicate, within Kohanaiki, eight, 13 and 12 taxpayers during the years 1857, 1859 and 1860, respectively; within Kaloko, during the same years, 19, 21 and 23 taxpayers were recorded. Just past the middle of the nineteenth century, the populations of Kaloko and Kohanaiki had been drawn beyond the original subsistence-based economy into the western commercial paradigm.

As Cordy notes about Kaloko: "The historical documents suggest that by the 1840s-1850s, the Coastal Zone had been abandoned as a residential area, except probably for a house used by the

fishpond's caretaker. This pattern would have been a stunning change from prehistoric and early historic times, when many coastal residences were present" (Cordy et al. 1991:288). This pattern likely also held for Kohanaiki.

4.2.4.1. Historic Cultivation

Oral histories of the area, ethnographic evidence, and archaeological evidence documents that upland Kaloko and neighboring areas were, in the past utilized for agricultural purposes. Various crops were traditionally cultivated in the "Kona Field System" within the Kekaha region and other parts of the Kona Coast. Sweet potato is likely to have been the most abundantly grown crop because of its adaptability to stony, dry environments. It was commonly planted in mounds and in pāhoehoe excavations.

During the mid 1800s, Captain Charles Wilkes of the American Exploring Team comments on the agricultural use of pāhoehoe excavations (similar to the modification of pāhoehoe outcrop in the project) which he observed specifically in the Kona region:

Cultivation is carried on in many places where it would be deemed almost impracticable in any other country. The natives, during the rainy season, also plant, in excavations among the lava rocks, sweet potatoes, melons, and pine-apples, all of which produce a crop. (Wilkes 1845:91)

Sweet potatoes were also cultivated within walled fields or depressions in the walls themselves. E.S. Craighill Handy and Elizabeth Green Handy discuss this method from an account that appeared in the Hawaiian newspaper *Ka Nupepa Ku'oko'a* (March 24, 1922):

Rocky lands in the olden days were walled up all around with the big and small stones of the patch until there was a wall (*kuaiwi*) about 2 feet high and in the enclosure were put weeds of every kind, 'ama'u tree ferns and so on, and then topped well with soil taken from the patch itself, to enrich ti, or in other words to rot the rubbish and weeds to make soil.

After several months, the rotted weeds were converted into soil of the best grade. The farmer waited for the time when he knew that the rains would fall, then he made the patch ready for planting. If for sweet potatoes, he made mounds for them and for taro too, on some places on Hawai'i. (Handy and Handy 1972:131)

4.2.4.2. Historic Ranching

Ranching has its roots in this early historic period with the introduction of goats, cattle, and horses by sea captains who sought to develop these resources to replenish their ship holds during long journeys. Captain George Vancouver gave Ke'eaumoku, an ali'i, a pair of goats in 1792, and the following year, he brought Ke'eaumoku four sheep. Vancouver also brought the first cattle, California longhorns, to Kamehameha I in 1793.

Kamehameha issued a kapu (in this case, a prohibition) that carried the death penalty to anyone harming cows or cattle thus ensuring that the first herds would proliferate. The kapu was enforced for 10 years. Due to the kapu, families constructed walls to protect their sweet potato and taro lands from the cattle. Kamehameha ordered the construction of a wall, mauka of the project area, that ran from north to south Kona, to prevent cattle from destroying populated areas (Bergen 2004:22-23). Historical research suggests that both goat and cattle grazing took place within the project area.

In 1803, horses were introduced, and they also ran free although no *kapu* protected them. Horses had difficulties acclimating to local grasses, and herds of feral horses were rare until the 1830s. At that time, Kamehameha III had California *vaqueros*, cowboys of Native Californian, Spanish, and Mexican descent, brought to Hawai'i to herd the cattle and teach Hawaiians to ride horses and tend the cattle. The paniolo, as they were called, were expert horsemen and able to chase down the wild cattle on horseback and capture them with a lasso. The hide and tallow trade proved to be successful and cattle were shipped from Kailua Bay to slaughterhouses on O'ahu. In 1851, it was estimated that Hawai'i Island had 8,000 head of tame cattle and 12,000 head of wild cattle (Kelly 1983:79; Bergen 2004:23, 97).

Historic documents related to the Government Homestead Program of the late 1880s indicate officials determined that goats were the only animals that were adept at grazing within arid, rocky Kaloko and Kohanaiki (Maly and Maly 2003:76, 79). Goats were present in the area prior to the late 1880s and may have been present within the project area. Limited cattle ranching was practiced at the same time, although by 1900, cattle ranching had for the most part replaced the goats (Maly and Maly 2003:75).

4.2.5. Mid- to Late -1800s

The division of Kohanaiki - through sales of Government lands -continued throughout the remainder of the nineteenth and into the twentieth century. Grant 2942 in 1864 awarded to Huliko'a 929.75 acres which included the width of the ahupua'a, extending makai from Kaiakoili's grant. In 1871, Grant 3086 awarded 154 acres to Kapena; this parcel extended makai from Huliko'a's grant to the shoreline.

At the time of the Māhele, Huliko'a was a resident of Kohanaiki (Maly and Maly 2003:4). Although Maly and Maly (2003:60) reviewed all Māhele claims, no additional references to Huliko'a were found. However, based on traditional patterns of residency in the region, it is "likely they had primary residences in the uplands, near sheltered māla 'ai (agricultural fields), and kept near shore residences for seasonal fishing, collection of salt, access to water in dry periods, and for access to other resources of the coastal zone" (Maly and Maly 2003:60).

Maly and Maly (2003:66) also note that during their research "the original notes of survey and map accompanying Grants 2030 and 2942, are missing from the state collection, so the corresponding maps and surveys, and their relationship to Kapena's parcel could not be compared with the original records." These survey documents were also not found during the current study.

Kaloko is documented during the 1870s in testimonies by Hawaiians before the government's Boundary Commission. Testifying on August 12, 1873, Nahuina (who had earlier received LCA 10327 in Kaloko) describes himself as "born at Kaloko North Kona Hawai'i at the time of Keikepuipui, the building of the heiau at Kailua, and have always lived there" and states that the boundaries of Kaloko were shown to him by his father, the former konohiki of the ahupua'a.

Nahuina adds that Kaloko has "ancient fishing rights extending out to sea." Testifying on the same date, Hoohia, who "moved to Honokohauiki when quite small and reside[s] there now", adds details that suggest the mauka Kaloko-Honokōhau boundary was defined by different vegetation that also reflected former traditional gathering rights: "Honokohaunui ends at Ohiawela, a *pali*. Kaloko takes the *koa*, and Honokohaunui, the *ohia*...The *olona* grows on Honokohaunui and Kealakehe and the *koa* on Kaloko."

During the 1880s, Kona lands - including Kaloko and Kohanaiki - were surveyed by J.S. Emerson for the Hawaiian government. A portion of his Registered Map (RM) 1449, Akapipu'u Section shows a trail through the project area; the trail actually ran from the Kohanaiki Homesteads to the Kaloko fishpond.

Emerson produced three maps corresponding to the project area during this time period: Registered Map (RM) 1280, RM 1449 and RM 1512. Emerson's assistant, J. Perryman also produced sketches of the west slopes of Hualālai. Although other surveyors and historians have produced maps for the area, these maps are the most comprehensive.

RM 1280 is cited and reproduced with the most frequency. It is often dated to 1888, but the map does not indicate an original date; rather, the date the map was traced by another surveyor in 1952 for reproduction purposes. RM 1449 and RM 1512, dating to 1888 and 1889 respectively, are essentially maps of the same series. RM 1449 is a broad overview map ranging from Kaloko to Kūki'ō in the north, and RM 1512 is a detail of the land grants around the government road.

A composite of RM 1449 and RM 1512 shows an alternative view of both the country side and the detail in the area of the Kohanaiki Homesteads. Most visible are family claims in the Kohanaiki Homesteads and Kohanaiki Road running directly makai from the homesteads. The road ends abruptly on RM 1449, although it appears to come close to joining the prominent "Lower Government Road." The indication of the "Lower Government Road" also ends shortly into Kaloko.

Oral history interviews (Maly and Maly 2002) relate that in the mid-1800s only a few residences were on the coastal lands, in the uplands above 900 ft. elevation, and in the vicinity of Māmalahoa Highway (east of the project area). The land between 900 ft. and the coast was cattle, donkey and goat pasturage. Mauka/makai trails through Kohanaiki, Kaloko, Kalaoa and Honokōhau were utilized by upland families to access the coast to fish, and gather water during upland droughts.

Kaloko and most of Kohanaiki continued to be held by the ali'i throughout the remainder of the nineteenth century, passing, after the death of Lot Kamehameha, successively to Bernice Pauahi Bishop, Kalākaua and Kapi'olani.

4.2.6. 1900s

During the twentieth century, major developments focused on Kaloko Ahupua'a, with continuing commercial use of the fishpond and increasing animal husbandry. The Kohanaiki Homesteads were apparently in decline during the early part of the century (Maly and Maly 2003), and are mentioned only in passing in H.W. Kinney's 1913 guide to the Big Island, which notes that it is an "inland settlement without much interest."

Ranching steadily increased. Once John Maguire purchased the former chiefly lands of Kaloko in 1906 after the deaths of Kalākaua and Kapi'olani (Kelly 1971:29), the ahupua'a uplands were developed into the Hu'ehu'e Ranch. Maly and Maly (2003) discuss the acquisition of these lands and the types of ranching that were common:

In 1899, John A. Maguire, founder of Hu'ehu'e Ranch applied for a Patent Grant on... lots in 'O'oma 2nd, but he only secured Grant No. 4536 Maguire's Hu'ehu'e Ranch did secure General Lease No.'s 1001 and 590 for grazing purposes on the remaining government lands in the Kohanaiki and 'O'oma vicinity. Thus, by the turn of the century, Hu'ehu'e Ranch, utilized both the upper forest lands and lower kula lands to the shore for ranching purposes. Oral history interviews with elder former ranch hands record that this use extended across the Kapena and Huliko'a grant lands of Kohanaiki, from the fee and leasehold lands of Kaloko and 'O'oma. Nineteenth century goat drives gave way to formalized cattle drives and round ups on these lands. (Maly and Maly 2003:78)

4.2.6.1. Hu'ehu'e Ranch

John Avery Maguire was the son of Charles and Hiilawe Maguire. He was born in Hamakua, Hawai'i in 1848 and began his ranching career as a foreman for the Pu'uhue Ranch. Maguire later became the ranch manager and then purchased Hu'ehu'e Ranch in 1888. His biography indicates that he did not live at the ranch until 1897, but this is contradicted by other sources, as is the date of purchase. He also bought Kahuā Ranch Company in 1890 and sold it in 1898 to J.F. Woods (Siddall 1917).

Likely due to its location north of the most populated area on the Big Island, Hu'ehu'e Ranch received many guests over the years including Queen Lili'uokalani, Prince Jonah Kuhio Kalaniana'ole, Sanford Dole, first president of the Republic of Hawai'i, and Jack and Charmian London (HawaiiHistory.org 2008).

John A. Maguire's lands extended well beyond the current project area to the north into Waipi'o Valley according to research conducted by Lebo et al. (1999). Maguire, his wife Eliza and his son Charles, conducted multiple land transactions within Waipi'o Valley between 1898 and 1915.

By the time J.A. Maguire died in 1919, Hu'ehu'e consisted of 40,000 acres of land, most of which was leased from the Bishop Estate. He owned 2,500 head of cattle and 500 sheep. His son, Charles, and daughter-in-law Mary Kiha-lani-nui, pre-deceased him, and their only child Aileen Ruth Kiha-lani Maguire lived with her grandfather and inherited Hu'ehu'e Ranch.

Aileen married Arthur Joseph Stillman at the St. John the Baptist Chapel in Kohanaiki on December 27, 1917. Stillman became the ranch's general manager following the death of his father-in-law in 1919.

The Maguire/Stillman family held thousands of acres of property on Hawai'i including lands outside of the project area that are part of Hu'ehu'e Ranch. Maguire initially leased lands from the Bishop Estate and inherited lands from his first wife, as mentioned above; he later added acreage acquired from Kapi'olani at Kaloko.

Only 12,000 acres were suitable for grazing, since large areas were covered with lava flows, and dense vegetation including lantana and ferns. Hu'ehu'e Ranch contained some 2,000 grade Herefords, 20 purebred Hereford bulls, and 20 purebred cows. Annually, approximately 330 to 400 head of cattle was sold, loaded on steamers in Kailua-Kona and shipped to Honolulu (University of Hawai'i 1927:28).

The Maguire/Stillman family held Hu'ehu'e Ranch until they sold it on July 8, 1966. At that time, the Kona Coast Company, a partnership between the Kaloko Land Corporation, Mauna Loa Cattle Corporation (which later was separately held by members of the Karl B. Rodi family), and Foothill Land Corporation (which was later succeeded by the David Pacific Corporation and Davis family members) was established. The company owned and operated the ranch that was managed by Roger T. Williams.

Kona Historical Society records indicate that cattle ranching continued on Hu'ehu'e Ranch although game bird hunting and residential and resort development of properties became more important business aspects.

4.2.6.2. Modern Land Use

The boundary between Kohanaiki and Kaloko was until fairly recently only approximate. Kelly (1971:48) notes that when Emory and Soehren conducted their 1961 archaeological survey, the boundary was south of its current location. Additionally, one of her informants remembered that Kaloko Pond and the coast were within the ahupua'a of Kohanaiki, and Kaloko was "farther over, toward Huliko'a" (Kelly 1971:48). Kelly cites Beckley's (1887:256) statement that, "These fish ponds are sometimes owned, by the proprietors of two adjoining lands, the people of one owning the right to fish during the rise of the tide and the other during the ebb."

Until the construction of the Queen Ka'ahumanu Highway in the 1970s, access to the "kula kai (shoreward plains)" (Maly and Maly 2003:101) was limited to local residents. The 1924 USGS map shows the mauka/makai road connecting the Kohanaiki Homesteads with the Kaloko fishpond, and crossing the project area at the ahupua'a boundary between Kohanaiki and Kaloko. In the first half of the twentieth century, the primary method of travel was "by foot or on horse or donkey, and those who traveled the land, were almost always native residents of Kalaoa, 'O'oma, Kohanaiki, Kaloko and Honokohau" (Maly and Maly 2003:99).

Hu'ehu'e Ranch bulldozed a jeep road to the shore around 1955 during the construction of the Kailua pier, and this was used primarily by the ranch employees for duties or for going fishing along the coast.

The Kaloko fishpond - leased from the Hu'ehu'e ranch - continued as a commercial fishing operation until the 1950s. During the 1970s, the pond was incorporated into the newly-established Kaloko-Honokōhau National Historic Park.

While the present project area is largely undeveloped, surrounding areas have seen increasing modern use. The Hu'ehu'e Ranch jeep road and other signs of animal husbandry activity can be seen on the 1959 USGS map.

In 1985, the Land Use Commission approved a boundary amendment of 190-acres of land for an 18-hole golf course and appurtenant facilities. These include a clubhouse, maintenance building, driving range, practice greens and parking. The proposed golf course was not intended to be a part of, nor associated with any type of resort development. The golf course was proposed to primarily serve the resident population and is oriented for public use (LUC FOF, COL and D&O A84-566-TSA).

More recent nearby development is largely industrial, and the Kaloko Industrial Area is just southwest of the project area, including large stores such as Home Depot and Costco. Huliko'a Road is also heavily developed, primarily as an industrial area, along a portion of the north border of the project area. Hina Lani Street runs along the south border of the project area, and leads mauka to a residential area (Kona Heavens) before the Palani junction (at Māmalahoa Highway), as well as leading makai to the modern Queen Ka'ahumanu Highway.

4.2.7. Community Consultation Effort

Throughout the course of the CIA, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies and individuals who might have knowledge of and/or concerns about cultural resources and practices specifically related to the project area. A number of attempts were made to contact individuals, organizations, and agencies apposite to the CIA for Kohanaiki. This effort was made by letter, e-mail, telephone and in person contact.

A total of twenty-five people were contacted for the purposes of the CIA; 18 people responded; and 12 kūpuna and/or kama'āina were interviewed for more in-depth contributions. A total of nine of these individuals have consented to have their testimonies included in the report. Efforts at obtaining permission to include the testimonies of the remaining three individuals who were interviewed for this CIA are ongoing.

4.2.7.1. Community Responses

Kama'āina and kūpuna with knowledge of Kohanaiki and Kaloko Ahupua'a and the proposed project area were contacted for participation in this assessment. The approach of CSH to cultural impact studies affords these community contacts an opportunity to review transcriptions and/or interview notes and to make any corrections, deletions or additions to the substance of their testimony.

4.2.8. Traditional Practices and Properties

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the overall region and the project area are presented below. This section examines resources and practices identified within the project area in the broader context of the encompassing Kohanaiki and Kaloko Ahupua'a landscape.

4.2.8.1. Hawaiian Habitation

According to the CSH archaeological inventory surveys of the project area (Bell et. al 2008a, b, c; Esh et al. 2008), of the total fifteen (15) habitation sites in the project area, thirteen (13) sites fit the characteristics of temporary habitation and two (2) are categorized as permanent habitation.

The majority of the temporary habitation sites within the project area are located on the pāhoehoe flow on the east and southeast side of the project area. Both permanent habitation sites are located on or near the edge of the large 'a'ā flow that dominates the project area. In terms of elevation, all of the habitation sites are located above approximately 500 ft. amsl., and generally the sites are scattered across the eastern portion of the project area. It is notable that nearly all non-lava tube habitation features are located on a naturally elevated area (either tumuli, outcrops, or 'a'ā edge).

4.2.8.2. Gathering of Plant Resources

In ancient Hawai'i, upland forest regions provided various woods needed for canoes, tools and more, as well as cordage, food and herbs (Abbott 1992). Several of the plants within the project area have past and present ethnobotanical uses for native Hawaiians (e.g., as medicinal, building, weaving). Many of these plants are (possible) Polynesian introductions such as kukui (*Aleurites moluccana*), kī or tī (*Cordyline fruticosa*), and noni (*Morinda citrifolia*). Some of these Hawaiian canoe plants (plants brought by the early Polynesians in their canoes) are indicators of former Hawaiian habitation. For example, kī was often planted around heiau (temples), and considered a sacred plant in parts of Polynesia. Kī was also planted around taro lo'i (pondfields) (<http://www.canoplants.com>).

A contributor to the cultural assessment mentioned past or ongoing plant gathering of the ko'oko'olau (*Bidens* spp.). As discussed in Section 3.6 Flora, ko'oko'olau (*Bidens micrantha ctenophylla*) a candidate species was observed on the project site. In addition, 'aiea (*Nothocestrum breviflorum*), hala pepe (*Pleomele hawaiiensis*), uhiuhi (*Caesalpinia kavaiensis*), ma'aloa (*Neraudia ovata*), were observed and are located within the Dryland Forest and/or immediately north of Hina Lani Street.

Other plants present in the project area include the native pili grass (*Heteropogon contortus*), 'ōhi'a trees (*Metrosideros polymorpha*), laua'e ferns (*Phymatosorus scolopendria*), 'ohe trees (*Reynoldsia sandwicensis*), alahe'e (*Psydrax odorata*), and halapepe (*Pleomele* spp.). Native plants observed at higher elevations within the project site include: naio (*Myoporum sandwicense*), 'a'ali'i (*Dodonaea* sp.) and 'ulei (*Osteomeles anthyllidifolia*).

According to one of the interviewees, during the 1930s to 1940s, alahe'e, mango, banana, uhi or yam (*Dioscorea alata*), and pia, a Polynesian arrowroot (*Tacca leontopetaloides*) were widely distributed in the project area and throughout the Kona Field System. These plants were used as medicine and food by Hawaiians.

4.2.8.3. Marine and Freshwater Resources

Like the integrated system of Hawaiian culture where an individual is linked to the surrounding environment, there is often a connection between marine resources and the agricultural plants found in the project area. One of the interviewees recalled the presence of alahe'e trees in the project area and cited a proverb that when the alahe'e tree blooms, the he'e (squid, octopus) are momona (fattened, fertile) and ready to harvest. Another saying involves the lākana (Lantana camara); when this plant blossoms, the hā'uke'uke (*Colobocentrotus atratus*), an edible variety of sea urchin, are also momona.

Although outside the project area, the Kaloko-Honokōhau fishponds provided Hawaiians with a rich resource for fish and shellfish. The ingenious design of the fishponds allowed fresh water in but prevented large fish from getting out. Besides the extensive aquaculture and tidepools available for shellfish and several types of limu, the ocean near the project area abounds with all kinds of fish.

There are no springs or ponds located in the project area; however, there are dozens of water collection lava tubes identified during the archaeological inventory survey. As described in more detail in the archaeological reports (see Bell et al. 2008a, b, c; Esh et al. 2008), most of these subterranean water sources are relatively small and require intensive and careful methods of collection, including building of small rock structures to hold ipu (gourds) in place for days in order to fill them.

4.2.8.4. Burials

There have been at least 65 burials found at about two dozen sites within the current project area. Most of the community participants were aware of the presence of burials throughout the project area. It was a common practice to use lava caves as burial sites in addition to other uses like water collection and habitation. Interviewees confirmed the traditional practice of burying loved ones in the caves after wrapping their bodies with tapa cloth. All participants who mentioned the presence of burials in the project area were adamant at preserving the iwi kūpuna in place.

4.2.8.5. Trails

There were seven trails or trail segments observed during the archaeological inventory survey (Bell et al. 2008a, b, c; Esh et al. 2008). Trails are a common site type within the Kekaha region in general. Although some of the trails in the project area were little more than remnants, several run many hundreds of meters and are in good-to-excellent condition. The intersection of three of the trails is especially of interest, as it appears to represent trail use during subsequent periods of time. The construction type also is indicative of changing needs in transportation, specifically the creation of trails more amenable to travel by horse or other pack animal.

The trails indicate a local network of transportation corridors that focus on transportation over the large 'a'ā flow that dominates the project area, with mauka/makai and cross slope-oriented trails. The network of trails thus provides fairly direct coast-to-uplands routes via the project area and access to activity areas within the project area. The activity areas include: agricultural pursuits, a ceremonial site, and temporary and recurrent habitation sites, as well as an animal husbandry area. Overall the trails suggest a high level of energy investment in constructing paths for traversing the 'a'ā flow, both in pre-Contact times as well as historically.

OHA's response letter to CSH's request for consultation (see Appendix J) highlights the importance of the "Road to Sea" trail, also known as the Kohanaiki Trail that has been a subject of some controversy in past archaeological projects, given the uneven nature of its preservation and integrity as a historic property. OHA strongly advocates for a relatively broad interpretation of this particular trail's importance and significance to the wider Kona community, rather than a more narrow scientific view that some or much of the trail has been altered beyond its "traditional" design or intent. According to the CIA, many older people from this area used this "Road to the Sea" trail during the early twentieth century for subsistence purposes.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Background research conducted for this project yields the following results:

- The project area is part of the traditional region known as Kekaha, extending from Honokōhau to 'Anaeho'omalu in North Kona. Mary Kawena Pukui notes that Kekaha, within which Kaloko and Kohanaiki Ahupua'a are located, is known "for its scarcity of water but is dearly loved by its inhabitants" (Pukui 1983:185). Despite being a dry place, the project area contains many unique resources—including dozens of subterranean lava tubes and caverns used to collect water; the project area included an extensive pre-Contact Hawaiian settlement that continued to support a subsistence-based lifestyle into the early historic era.
- Archaeological research shows the project area contains hundreds of culturally and historically significant sites. Sites in the project area include permanent and temporary habitation structures—many of which incorporate natural features of subterranean lava tubes into their design, agricultural features (including extensive rock mounds used to plant sweet potatoes), at least 65 burials located in approximately two dozen burial sites, ahu (stone markers), trails, petroglyphs, ahupua'a boundary walls, papamū (traditional gaming site), and others.
- Radiocarbon dating from nearby sites definitively shows the general area has been utilized by humans for at least 1,000 years.
- The project area is likely to contain substantial additional subsurface deposits—as yet undiscovered and undocumented—associated with lava tubes and subterranean chambers, including burials and other highly sacred materials.
- The project area is also associated with the unique history of Hawaiian-style ranching and paniolo ("Hawaiian cowboys"), including the well-documented Hu'ehu'e Ranch.
- Because of its association with Kaloko and Kohanaiki Ahupua'a and the Kekaha region, the project area is associated with specific mo'olelo (oral history) about

- the sixteenth or seventeenth century ruler of Hawai'i Island Lonoikamakahiki (Lono-i-ka-makahiki), who was involved in several famous battles with the chiefs of Maui (including Kama-lala-walu) and other parts of Hawai'i
- Kamehameha I, whose remains were reportedly interred near Kaloko Fishpond (*makai* of the project area)
- 'Umi-a-Liloa, who frequented the famous fisheries of Kaloko and Kohanaiki, and the Nahulu chiefs (including Ka-me'e-ia-moku and Ka-manawa)
- The project area is also associated with more legendary references to Ka-Miki, various mo'o (water spirits) that resided at fishponds at and near the seashore, and Hualālai; and more general references to water-collection lava tubes and the unique environmental conditions of the region.

Community consultation conducted for this project yields the following results:

- Several participants voiced negative feelings and opinions about the overall cumulative impacts of ongoing and future developments in Kona District and the project area environs pointing out such factors as a diminished quality of life for locals, dwindling resources, prices beyond the reach of most kama'āina and overtaxed infrastructure as contributing to a loss of what is authentic and traditional about Kona.
- Several participants talked about subsistence resources that were previously available to, and enjoyed by, locals—such as various limu (seaweeds), crabs and fish—but that are no longer available or easily accessed due to the cumulative impacts of development in Kona.
- Most participants talked about the presence of burials and iwi kūpuna (ancestral remains) throughout the project area. It is clear from some of the interviews that there are many lineal and/or cultural descendents to some of these burials that should be consulted during the proposed development, since some historic-era family burial sites, in particular, may be impacted by the subject project.
- A few participants talked specifically about changing patterns of vegetation and plant life, highlighting the loss of native and Polynesian-introduced species as well as useful historic introductions such as mango trees. In particular, there is a remnant area of lowland forest in the project area containing several endangered and threatened native species, including ko'oko'olau (*Bidens* spp.). It is important to understand that such natural resources are significant cultural and historical resources to many native Hawaiians. Plants were integral to Hawaiians not only for their use as food and medicine, but also for their connection to other aspects of life.
- A few participants talked about drinking from water collection caves in historic times, as they moved around the landscape (e.g., as ranchers), and of brackish pools used by their animals (e.g., cattle and horses).
- Several individuals discussed trails in the project area, including a historic trail running from the ocean to the mountains (this is the so-called "Road to the Sea") along the ahupua'a boundary between Kaloko and Kohanaiki, that were used in the recent memories of some participants to gather resources from the sea and the uplands. Given many changes and modern developments, the trails in the project area have not been used by many people for several decades.

As discussed in Section 4.1, the project area contains a large number of significant sites that are recommended for preservation and/or data recovery. It is recommended that of the 341 sites in the project area, a total of eighty (80) sites be subjected to a program of data recovery to address scientific and informational concerns, and a total of seventy-two (72) sites be preserved (see Table 4-9 and Figure 4-2).

The remaining 189 sites are not recommended to undergo further research, as the documentation and plotting of location during the current study has addressed the limited information available at these sites. These sites are classified under Criterion D significance only and are generally characterized as sites in poor structural condition, or sites such as minimally modified lava tubes, trail remnants, agricultural features or animal husbandry walls that lack excavation potential.

Use of low-rise architecture, local stone, muted colors and native plants would be preferable from a mitigation perspective and would minimize the urban feel of the land most immediately visible from, and historically tied to, that preserved in the park.

There are a total of seventy-two (72) sites in the project area that are recommended for preservation in whole or in part. A large percentage of these sites are recommended for preservation based on the presence of a burial (confirmed or probable) and/or association with a burial. Burials are especially common in lava tubes within the project area and special consideration will need to be given to the preservation in place of burials, especially when remains are located far from the lava tube entrances. Thus, the preservation plan will need to address the logistics of preservation boundaries in terms of accurate locational information as well as how to preserve/seal entrances associated with burials.

Several of the non-burial preserve sites are major intact trail systems that run for several hundred meters, and two sites are ahupua'a walls that are recommended for preservation with breaches allowed. Other preserve sites include ceremonial enclosures and platforms (possible heiau), excellent examples of habitation complexes (some of which utilize both surface and sub-surface areas), and a few petroglyph panels.

All of the confirmed and suspected burials will be preserved pursuant to a burial treatment plan prepared in consultation with recognized descendants and the Hawai'i Island Burial Council. The other preservation sites will be treated in accordance with a preservation plan submitted to and approved by SHPD prior to final subdivision approval. It is recommended that considerations for the preservation of these sites be detailed in a burial treatment plan and preservation plan to be approved by the SHPD.

The complete collection of artifacts associated with this archaeological inventory survey was collected from private lands; accordingly, this material belongs to the landowner. While a relatively small number of artifacts were collected given the size of the project, some items were retrieved during the inventory survey due to concern over possible looting. Some artifacts and midden were collected as part of the test excavations conducted. The artifacts associated with this archaeological inventory survey will be temporarily housed at a CSH storage facility. CSH will make arrangements with the landowner regarding the disposition of the project's collection. Should the landowner

request archiving of material, then the archive location will be determined in consultation with SHPD.

As discussed in Section 3.6 Flora, none of the listed endangered plants will be “taken” in the development and construction of the Kaloko Makai project.

Three individual endangered plants (two hala pepe and one ‘aiea) found outside the Dryland Forest Preserve will be buffered by setbacks and enclosures (fence/wall). Kaloko Makai will develop a 50-ft. radius buffer around the two hala pepe and one ‘aiea and any structure. The plants will be incorporated into landscaping within the 50-ft. buffers.

As part of the project proposal, 150-acres will be set aside as the Kaloko Makai Dryland Forest Preserve, in Phase 1 of the project. Through the establishment of this preserve, a variety of species will have continued permanent protection and their habitat set aside, in perpetuity.

To promote and encourage traditional and customary cultural practices, the harvesting of native woods (such as alahee, elama, iliahi, and ulei, as well as other exotics like mango) or trees during grubbing work, will be allowed by cultural practitioners.

As the project moves forward the Appliant will continue to consult with OHA, community groups / individuals responsible for the long-term care of Kohanaiki and Kaloko Ahupua‘a, and cultural practitioners.

4.3. TRAIL ACCESS

A mauka-makai historic trail (Kohanaiki Trail or “Road to Sea” trail) runs through the entire length of the Kaloko Makai project. Kaloko Makai will incorporate the Kohanaiki Trail as an integral component of the project.

4.3.1. Kohanaiki Trail

Kohanaiki Trail is a long mauka/makai running trail originating mauka of Kaloko Makai in the Kohanaiki Homesteads. Generally, the trail parallels the nearby Kaloko/Kohanaiki ahupua‘a wall.

The trail entirely traverses pāhoehoe and is generally well defined throughout the eastern portion of the parcel, except near the makai parcel boundary where bulldozing and grading has nearly destroyed the ahupua‘a wall and eliminated any definitive sign of the trail.

The trail is very consistent with the route identified on Emerson’s mapping in 1888 and 1889. The present archaeological review for the Kaloko Makai project suggests that the specific route shown on an earlier map, Emerson’s RM 1280, is highly schematic.

Cultural Surveys Hawaii (Kaloko Makai’s Archaeologists), representatives of Na Ala Hele (State of Hawai‘i Trail and Access System) and representatives of the Ala Kahakai National Historic Trail identified what they believe is the trail alignment by walking the trail alignment, , looking at detailed historic maps (including Emerson), archaeological data created by others makai (Donham (1986),

Renger (1971), and Cordy et. al (1991)) of the Queen Ka'ahumanu Highway (and in consideration of modern aerial photographs) and community comments.

The upper portion of the trail through Kaloko Makai will be preserved. Where the Trail intersects with Hina Lani Street, Kaloko Makai will realign the remaining lower portion of the Trail from that point to run parallel with and adjoining the Hina Lani right-of-way down to Queen Ka'ahumanu Highway.

Since the integrity of the historic trail is lost at that point, due to Hina Lani road construction, the adjoining industrial subdivision and the water tank, Kaloko Makai will realign the trail and have it run down the southern boundary of the property (fronting Hina Lani,) from the point of intersection with Hina Lani down to Queen Ka'ahumanu Highway. This alignment gives the users of the trail easy access to cross Queen Ka'ahumanu or Hina Lani at the bottom, as there are crosswalks with crossing signals at that intersection.

Kaloko Makai will incorporate the Kohanaiki Trail as an integral component of the project. Two school sites and multiple parks are proposed near the trail. Likewise, Kaloko Makai will incorporate two trails that run through the Dryland Forest (one also connects to another school site and park in the mauka TND - these will connect through the project to the Kohanaiki Trail).

POTENTIAL IMPACTS AND MITIGATION MEASURES

Kaloko Makai will incorporate the Kohanaiki Trail as an integral component of the project, as shown in Figure 2-11. The original trail surface and other cultural resources located within the trail corridor, including, but not limited to, existing native trees will be retained. Kaloko Makai has located two school sites and multiple parks near the trail. Likewise, Kaloko makai will also be incorporating two trails that run through the Dryland Forest (one also connects to another school site and park – these will connect through the project to the Kohanaiki Trail), as shown in Figure 2-11.

The Kohanaiki Trail extends beyond the Kaloko Makai property. Immediately mauka of Kaloko Makai, the Kohanaiki Trail runs through the adjoining Kaloko Heights project. In November of 2006, a community consensus on the incorporation and preservation of those portions of the Kohanaiki Trail located within the Kaloko Heights project was reached. Kaloko Makai will provide treatment measures to the Kohanaiki Trail as it runs through Kaloko Makai consistent with the consensus treatment measures that were reached between the community and Kaloko Heights, as listed below.

1. The mauka-makai alignment ("footprint") of the Trail shall be open for public use and retained in perpetuity across Kaloko Makai (note the realignment of the lower portion noted in #11 below.).
2. The Trail will be at least 10-feet wide and will be bordered by perpetual open space buffers of at least 10-feet wide on each side. These buffers are intended to be sloped and otherwise modified as necessary to make grade adjustments. In combination with the buffers, the total width of this perpetual public right of way will be at least 30-feet throughout its length across Kaloko Makai.

3. In direct consideration of federal, state and county rules, regulations and law relating to land use, subdivisions, streets and accessibility, and to further ensure a safer walking surface for the Trail user, vertical changes (that is, cutting and filling in comparison to the surrounding development) in the original Trail elevation may be necessary and will be allowed, as long as the horizontal alignment is kept the same. Such changes are to be kept to the minimum and, wherever possible and practical, the original Trail surface and other cultural resources located within the trail corridor, including but not limited to, existing native trees, rocks will be retained.
4. Wherever vertical changes are not required, the original Trail surface and other cultural resources located within the Trail, including, but not limited to, existing native trees, will be retained.
5. Whenever possible, cultural features found along the existing Trail (such as papamu/konane board) shall be retained and incorporated into the cultural landscape, in living celebration of and consistent with their cultural heritage and significance. Likewise, to the extent it is feasible and appropriate, significant cultural resources located outside the designated right of way and adjacent to the Trail may be relocated within the right of way.
6. In further consideration of existing governmental rules and regulations pertaining to land use and requisite street and sidewalk requirements, it is understood that it will be necessary to cross the existing Trail alignment at specific and limited points. At this early stage of the planning process for Kaloko Makai it is premature for SCD to propose the number and location of specific Trail crossings. Therefore, throughout the land use planning process for Kaloko Makai, SCD will consult on the proposed number and location of the Trail crossings.
7. Subject to the approval of the applicable governmental agencies responsible for approving the easements and construction plans for roadways that cross the Trail, pāhoehoe will be embedded in the roadway paving as the means to mark where the original Trail footprint is located. To the extent practical, pāhoehoe retrieved from other areas within Kaloko Makai shall be used in the paving.
8. Whenever existing rock walls must be removed, the rocks from these walls will be set aside and reused in the construction of new screen, buffer and retaining walls built within Kaloko Makai. Whenever feasible, rocks from Kaloko Makai will be used for such walls (minimize importation of rock from offsite).
9. To promote and encourage traditional and customary cultural practices, the harvesting of native woods (such as alahee, elama, manele, iliahi and ulei, as well as other exotics like mango), from trees downed during the grubbing work or ones that must be removed during permitted land grading, will be allowed by cultural practitioners. If requested and where possible and practical, SCD, or its designated representative(s), will cooperate with cultural practitioners in the gathering and temporary storage of such woods. Harvesting activities will be coordinated in advance with SCD personnel.
10. SCD will consult with cultural practitioners in understanding and compiling oral histories related to Kaloko Makai and the surrounding area, so that these histories can be used within Kaloko Makai (such as for neighborhood identities, street names and the like).
11. Where the Trail intersects with Hina Lani Street, SCD will realign the remaining lower portion of the Trail from that point to run parallel with and adjoining the Hina Lani right-of-way down to Queen Ka'ahumanu Highway.
12. With the vision of perpetuating the life of the land in that which is pono (righteous), and to promote better understanding and aloha among SCD and the larger community, SCD will

continue to meet, consult and cooperate with cultural practitioners regarding the protection and incorporation of Hawaiian cultural perspectives, traditions and practices in appropriate areas and segments of Kaloko Makai.

With respect to number #11 above, Kaloko Makai representatives discussed this with Na Ala Hele staff in 2008 and with the Na Ala Hele Big Island advisory group after that. Since the integrity of the historic trail is lost at that point, due to Hina Lani road construction, the adjoining industrial subdivision and the water tank, Kaloko Makai will realign the trail and have it run down the southern boundary of the property (fronting Hina Lani,) from the point of intersection with Hina Lani down to Queen Ka'ahumanu Highway. This alignment gives the users of the trail easy access to cross Queen Ka'ahumanu or Hina Lani at the bottom, as there are crosswalks with crossing signals at that point.

4.4. ROADWAYS AND TRAFFIC

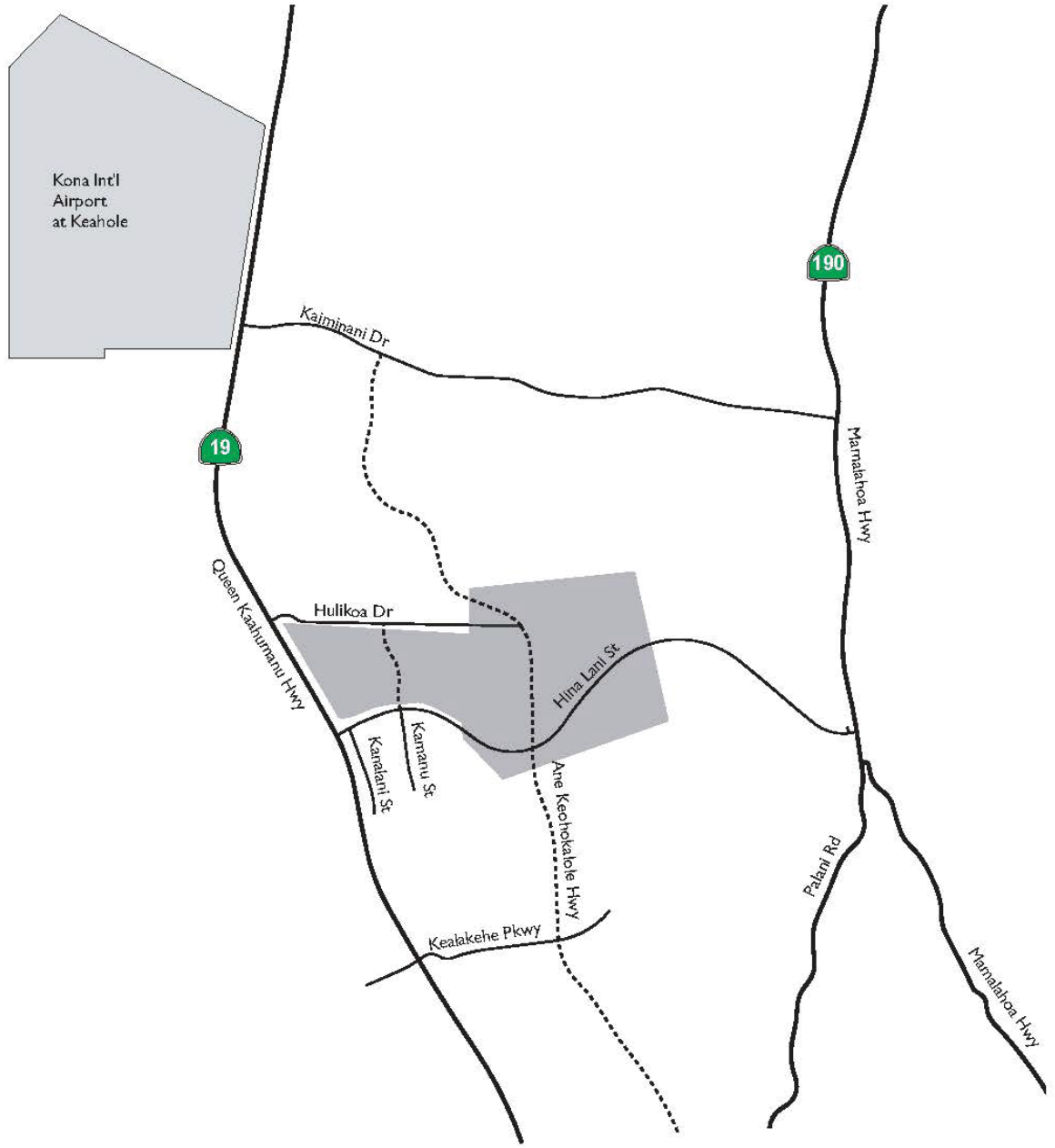
A Traffic Impact Assessment Report (TIAR) was prepared by KOA Corporation to analyze the potential traffic-related effects of the proposed project. Traffic conditions were evaluated for the following conditions:

- Existing Condition
- 2025 without Project Condition
- 2035 without Project Condition
- 2045 without Project Condition
- 2025 with Project Phase 1 Condition
- 2035 with Project Phase 2 Condition
- 2045 with Project Phase 3 Condition

The results are summarized below and included in Appendix K. The TIAR assumes full build out and occupancy at the start of the horizon year in order to provide a conservative analysis of traffic impacts. This contrasts with the market assessment which conservatively assesses market absorption by end of each study period.

The study area consists of the following eight intersections (see Figure 4-3):

1. Queen Ka'ahumanu Highway at Ka'iminani Drive
2. Queen Ka'ahumanu Highway at Huliko'a Drive
3. Queen Ka'ahumanu Highway at Hina Lani Street
4. Kanalani Street at Hina Lani Street
5. Kamanu Street at Hina Lani Street
6. Ane Keohokālole Highway at Hina Lani Street
7. Māmalahoa Highway at Hina Lani Street
8. Queen Ka'ahumanu Highway at Kealakehe Parkway



LEGEND

- Site
- X Analysis Intersection
- Future Roadways

NOT TO SCALE
 Source: Traffic Impact Study for Kaloko Makai, KOA Corp.
 September 2012



FIGURE 4-3
TIAR Study Area
Kaloko Makai

Koa Corporation utilizes a level of service system to identify, evaluate, and describe street system operation conditions. Level of service is a report-card scale used to indicate the quality of traffic flow on roadway segments and at intersections. Level of service range from Level A (free flow, little congestion) to Level F (forced flow, extreme congestion). Level of Service D or better are considered as acceptable.

4.4.1. Existing Conditions

4.4.1.1. Existing Roadways

Several existing and planned regional roads serve the Kaloko Makai project. Queen Ka'ahumanu Highway adjoins the project on its makai side. Hina Lani Street adjoins the makai side of the project on the south side of the property and then cuts through the project site as it goes mauka. Ane Keohokālole Highway is proposed to cut through the middle of the project in a north-south direction.

Queen Ka'ahumanu, which runs parallel to the coast, is the main arterial roadway between North Kona and South Kohala. The highway is a two-lane, two-way highway with shoulders. The existing highway right-of-way ranges from 80-feet (from Palani Road to the Honokōhau Boat Harbor) to 300-feet (from the Harbor to Kona International Airport.)

Present improvement projects are expanding Queen Ka'ahumanu from Henry Street to the Kona International Airport to a four-lane (two lanes in each direction) divided highway. Very long-range DOT plans note that Queen Ka'ahumanu could be expanded to 6 or more lanes and revert back to limited access status. Long range plans call for the present signalized intersection at Hina Lani Street to be realigned as a grade separated interchange (no specific plans or budgets are in place, or anticipated in the foreseeable future for this subsequent expansion on the highway).

Phase I of the Queen Ka'ahumanu Highway widening from Henry Street to Kealakehe Parkway has been completed. The next phase of the improvement project, from Kealakehe Parkway to the Kona International Airport has been awarded.

Supporting this project is a new north-south road, Ane Keohokālole Highway. Ane Keohokālole Highway will be constructed in phases; the initial phases consist of a two-lane roadway. In the future as the traffic volume increases, the roadway would be widened to four lanes.

Ane Keohokālole Highway from Palani Road to Ka'iminani will serve as a north-south highway through the Kona Urban Area. It will be the central corridor for multi-modal transportation for future regional development in this region of North Kona. Phase 1 includes two vehicle lanes between Palani Road and Kealakehe Parkway. Phase 2 is the next section of road between Kealakehe Parkway and Hina Lani Street. Phases 1 and 2 have been completed. Future sections of Ane Keohokālole Highway, ultimately to Ka'iminani Drive, will be constructed as funds become available. Kona CDP Policy LU-2.6: TOD/Traditional Neighborhood Design (TND) Public Infrastructure and Facilities, states: To encourage the development of TODs and TNDs, public financing sources shall pay 100% for: Major proposed trunk transit route (i.e. Ane Keohokālole.)

Ane Keohokālole Highway, the trunk transit line in the Kona Urban Core, will run through the Kaloko Makai property. In addition, a transit station will be incorporated into the TOD village near the central part of the property.

Hina Lani Street is a two-lane, two-way mauka-makai residential collector roadway that connects Queen Kaʻahumanu Highway to Māmalahoa Highway (mauka of the Kaloko Makai project.) There are signalized intersections where Hina Lani Street intersects with these two highways.

Kamanu Street serves the Kaloko Industrial Park across the street from Kaloko Makai. Several area planning documents (K-to-K Plan and Kona CDP) call for "Main Street" in this area, with an extension of the existing Kamanu Street (to be renamed Main Street) through Kaloko Makai and its adjoining properties as it heads north.

4.4.2. Existing Transit Service

The County of Hawaiʻi Mass Transit Agency provides an island-wide public bus transit system called Hele-On Bus. The Hele-On Bus currently provides bus service along Queen Kaʻahumanu Highway.

4.4.3. Kona CDP

The North Kona area is appropriately seeing urban infill development and proposals, consistent with the 2008 Kona CDP and its accompanying Kona Village Design Guidelines.

Kaloko Makai is strategically located along the major regional traffic corridor of Queen Kaʻahumanu Highway, between the town of Kailua-Kona and the Airport. The Kaloko Makai project layout and road system takes into consideration DOT's plans for a grade-separated interchange for a realigned Hina Lani Street at Queen Kaʻahumanu Highway. Kaloko Makai will use this makai area on an interim basis and when DOT is ready to construct the interchange, arrangements for the land transfer to DOT can be made at that time.

Kaloko Makai is centrally located on Ane Keohokālole Highway, which will run through the development; this is the major transit corridor called for in the Kona CDP.

The Kaloko Makai project was conceived, planned and designed to be consistent with the Hawaiʻi County *General Plan*, the K-to-K Plan and the Kona CDP. It serves to implement these planning documents.

Kaloko Makai is a compact, mixed-use, master-planned community offering a wide range of housing types and affordability, and a variety of businesses and employment opportunities, focused around a TOD corridor along the extension of Ane Keohokalole Highway through the project, with land available (at no cost) for a new Kona regional hospital and the Kona Judiciary Complex.

Kaloko Makai has been designated as a Neighborhood TOD in the Official Kona Land Use Map of the Kona CDP. Kaloko Makai also supports many of the Guiding Principles of the Kona CDP, which was adopted by County ordinance on September 25, 2008. Kaloko Makai:

- **Directs future growth patterns toward compact centers** – Kaloko Makai is planned around a compact urban center within the Kona Urban Area.
- **Provides connectivity and transportation choices** – Kaloko Makai will be transit-ready and is located along key alignments for regional transportation. Developer SCD will also contribute to the development of Ane Keohokālole Highway. The Project itself is planned to offer walking and biking trails in addition to vehicular roads.
- **Provides housing choices** – Kaloko Makai will offer a broad range of housing types including affordable as well as “market-priced” housing units. Offerings will range from traditional single-family homes to mid- and higher-density multifamily homes, and may include live-work and mixed use developments.
- **Provides recreation opportunities** – Kaloko Makai features an approximately 150-acre Dryland Forest Preserve, as well as numerous community parks, a district-scale park and trails.
- **Provides infrastructure and essential facilities concurrent with growth** – In addition to the recreational and transportation contributions noted above, Kaloko Makai is planned to include a Hospital and medical complex, Lodge and Business Center, two Elementary Schools and a Middle School.

In addition, Kona CDP Policy LU-2.6: TOD/Traditional Neighborhood Design (TND) Public Infrastructure and Facilities, states: To encourage the development of TODs and TNDs, public financing sources shall pay 100% for:

- Major proposed trunk transit route,
- A transit station (or transit station component if the transit station is part of a private mixed-use project) within the urban core,
- A major park or plaza within the urban core.

Likewise, the Kona CDP states: “Public Financing of Infrastructure. In recognition of the regional benefits of major roads and transit stations, these types of improvements within TODs shall be funded with general revenue funding sources.” (Kona CDP, Page 4-34)

4.4.4. Levels of Service Analysis of Existing Condition

Table 4-10 shows the existing intersection Level of Service (LOS) for both AM and PM peak hours. The study area intersections currently operate at LOS D or better during AM and PM peak hours.

No.	Intersection	Peak Hour	Existing		
			Delay (Sec)	V/C	LOS
1	Queen Ka'ahumanu Hwy at Ka'iminani Drive	AM	16.9	0.85	B
		PM	8.6	0.65	A
2	Queen Ka'ahumanu Hwy at Huliko'a Drive ^[1]	AM	25.2	0.50	C
		PM	52.1	0.85	C
3	Queen Ka'ahumanu Hwy at Hina Lani Street	AM	11.1	0.65	B
		PM	15.7	0.82	C
4	Kanalani Street at Hina Lani Street ^[1]	AM	19.2	0.36	B
		PM	22.8	0.58	C
5	Kamanu Street at Hina Lani Street ^[1]	AM	10.7	0.25	B
		PM	14.1	0.40	B
6	Ane Keohokālole Hwy at Hina Lani Street ^[2]	AM	--	--	--
		PM	--	--	--
7	Māmalahoa Hwy at Hina Lani Street	AM	44.8	1.01	B
		PM	22.2	0.55	A
8	Queen Ka'ahumanu Hwy at Kealakehe Pkwy	AM	15.7	0.79	B
		PM	26.5	0.92	C

[1] Non-signalized. The delay is for the most constrained stop-controlled approach.
[2] Intersection does not currently exist.

4.4.5. Planned Roadway Improvements

KOA Corporation's TIAR includes a comprehensive analysis of traffic scenarios that account for present and future conditions with and absent the development of Kaloko Makai. KOA Corporation's projections utilize regressive analysis of regional traffic count data over a three year period from 2007 to 2010 to model projected future figures compounded with existing traffic volumes and modeled project trip distribution patterns derived from surrounding land uses and geographic conditions.

The following methodologies and assumptions were used to forecast the future traffic volumes for the project area:

- Existing traffic count data: Turning movement counts at existing eight study area intersections on September 21 and 22, 2010. The AM and PM peak hour counts were conducted from 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM, respectively.
- Trip generation rates: This study used nationally recognized trip rates, published by the Institute of Traffic Engineers (ITE), 8th Edition to determine the site-only traffic volumes generated by the proposed Kaloko Makai project,
- Pass-by-trip reduction: Pass-by-trip is a portion of traffic generated by retail uses already on the road stopping at a secondary destination on its way to an ultimate destination.
- Internal trip capture: Internal trip capture is a portion of traffic that visits multiple uses within the project boundary on a single trip.

- Transit trip discount: Transit trip discount is a portion of traffic that utilizes public transportation or vanpool opportunities instead of driving alone in person vehicles to their destinations.
- Project traffic generation: The proposed project is anticipated to generate 5,023 AM peak hour trips and 5,834 PM peak hour trips, with pass-by, internal capture and transit trip discount adjustments (see Table 3 in Appendix K for details).
- Project trip distribution patterns: Trip distribution is the process of identifying the probable destination, direction or traffic routes that will be utilized by project traffic. The potential interaction between the proposed land use and surrounding regional access routes are considered when identifying the route where the project traffic will distribute. Refer to Tables 4-6 in Appendix K for project-only traffic volumes.
- Other cumulative development traffic: Future traffic increases consider additional traffic that are generated by other cumulative developments that either is under construction, approved, planned, or proposed for development near the project area. This study included five other cumulative developments in the vicinity of Kaloko Makai: Kaloko Heights, Kula Nei, West Hawai'i Business Park, Kohaniki Business Park, and Kaloko Industrial Park, Phases 3 and 4.
- Ambient background growth: In addition to cumulative development traffic, other unidentified projects and general population growth contribute to ambient background traffic growth. Based on available data and other traffic studies in the surrounding area, it appears the annual growth rate is 1.74%. Therefore, the study utilizes a 1.74% ambient growth rate to assess future traffic conditions. The total ambient growth for the three analysis horizon years are as follows:
 - Phase 1 (2015): 29.6%
 - Phase 2 (2025): 54.0%
 - Phase 3 (2035): 83.1%
- Future traffic volumes: Based on the traffic forecast methodologies discussed above, the following future traffic volumes for the study area intersections were assessed (see Tables 8-11 in Appendix K):
 - 2025 Without Project Traffic
 - 2025 With Project Phase 1 Traffic
 - 2035 Without Project Traffic
 - 2035 With Project Phase 2 Traffic
 - 2045 With Project Traffic
 - 2045 With Project Phase 3 Traffic

Table 4-11 summarizes the recommended intersection improvements in a tabular format. The recommended intersection improvements for each analysis scenario are described in the following sub-sections.

2025 Without Project Conditions

For 2025 Without Project Conditions, there are some planned improvements that will implemented in the future which include the widening of Queen Ka'ahumanu Highway and the new construction of a Ane Keohokālole Highway that will run in a north-south direction between Queen Ka'ahumanu Highway and Māmalahoa Highway.

Table 4-11 Intersection Mitigation Summary					
Intersection	Recommended Intersection Improvements				
	2025 & 2035 Without Project	2045 Without Project	Year 2025 Project Phase 1	Year 2035 Project Phase 2	Year 2045 Project Phase 3
1 Queen Ka'ahumanu Hwy. at Ka'imianani Dr.	<ul style="list-style-type: none"> • Add a 2nd NB Thru Lane • Add a 2nd SB Thru Lane 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • Add a 3rd NB Thru Lane • Add a 2nd SB Left-Turn Lane • Add a 3rd SB Thru Lane • Add a 2nd WB Left-Turn Lane • Provide WB Right-Turn Overlap Signal Phasing
2 Queen Ka'ahumanu Hwy. at Huliko'a Dr.	<ul style="list-style-type: none"> • Add a 2nd NB Thru Lane • Add a 2nd SB Thru Lane • Retain WB Free Right-Turn Lane • Restrict SB and WB Left-Turn Movements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • Add a 3rd SB Thru Lane
3 Queen Ka'ahumanu Hwy. at Hina Lani St.	<ul style="list-style-type: none"> • Add a 2nd NB Thru Lane • Add a 2nd SB Thru Lane • Add a 2nd SB Left-Turn Lane • Add a 2nd WB Left-Turn Lane 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • Add a 3rd NB Thru Lane • Add a 2nd NB Right-Turn Lane • Add a 3rd SB Thru Lane 	<ul style="list-style-type: none"> • Construct a Grade Separation Interchange (See Appendix K for conceptual layout)
4 Kantalani St. at Hina Lani St.	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • Restrict NB Left-Turn Movement 	<ul style="list-style-type: none"> • Add a 2nd EB Thru Lane 	<ul style="list-style-type: none"> • Add a WB Left-Turn Lane
5 Kamanu St. at Hina Lani St.	<ul style="list-style-type: none"> • Install a New Traffic Signal • Add a 2nd NB Left-Turn Lane 	<ul style="list-style-type: none"> • No additional improvements 	<ul style="list-style-type: none"> • Add a NB Thru Lane • Add SB Left-Turn, Thru, and Right-Turn Lanes • Add an EB Left-Turn Lane • Add a 2nd WB Thru Lane 	<ul style="list-style-type: none"> • Add a SB Free-Right Turn Lane • Add a 2nd EB Left-Turn Lane • Add a WB Right-Turn Lane 	<ul style="list-style-type: none"> • No additional improvements

Table 4-11 (continued)					
Intersection Mitigation Summary					
Intersection	Recommended Intersection Improvements				
	2025 & 2035 Without Project	2045 Without Project	Year 2025 Project Phase 1	Year 2035 Project Phase 2	Year 2045 Project Phase 3
6 Ane Keohokālole Hwy. at Hina Lani St.	<ul style="list-style-type: none"> Provide Left-Turn, Thru, and Right-Turn for all approaches Install a new traffic signal 	<ul style="list-style-type: none"> No additional improvements 	<ul style="list-style-type: none"> No additional improvements 	<ul style="list-style-type: none"> Add a NB Free-Right Turn Lane Add a 2nd EB Thru Lane Add a 2nd WB Thru Lane Add a 2nd WB Left-Turn Lane 	<ul style="list-style-type: none"> Add a 2nd EB Left-Turn Lane Provide EB Right-Turn Overlap Signal Phasing Provide WB Right-Turn Overlap Signal Phasing
7 Māmalahoa Hwy. at Hina Lani St.	<ul style="list-style-type: none"> No additional improvements 	<ul style="list-style-type: none"> No additional improvements 	<ul style="list-style-type: none"> Add a 2nd NB Left-Turn Lane Provide SB Right-Turn Overlap Signal Phasing Add a 2nd EB Left-Turn Lane Provide EB Right-Turn Overlap Signal Phasing 	<ul style="list-style-type: none"> No additional improvements 	<ul style="list-style-type: none"> Add a SB Free Right-Turn Lane
8 Queen Ka’ahumanu Hwy. at Kealakehe Pkwy.	<ul style="list-style-type: none"> Add a 2nd NB Thru Lane Convert SB Right-Turn Lane to a shared (2nd) Thru/Right-Turn Lane 	<ul style="list-style-type: none"> Add a 2nd WB Left-Turn Lane 	<ul style="list-style-type: none"> Add a 2nd WB Left-Turn Lane 	<ul style="list-style-type: none"> Add a 3rd NB Thru Lane Provide NB Right-Turn Overlap Signal Phasing Add a 3rd SB Thru Lane 	<ul style="list-style-type: none"> No additional improvements

Queen Ka’ahumanu Highway is currently a two-lane roadway, and it is anticipated to be widening to a four-lane roadway prior to Year 2025. The planned roadway widening along Queen Ka’ahumanu Highway will provide additional northbound and southbound travel lane improvements to the following study area intersections:

Queen Ka’ahumanu Highway at Ka’iminani Drive (#1)

- Add a Second Northbound Through Lane
- Add a Second Southbound Through Lane

Queen Ka'ahumanu Highway at Huliko'a Drive (#2)

- Add a Second Northbound Through Lane
- Add a Second Southbound Through Lane
- Restrict southbound and westbound left turn movements – this intersection is anticipated to remain unsignalized

Queen Ka'ahumanu Highway at Hina Lani Street (#3)

- Add a Second Northbound Through Lane
- Add a Second Southbound Through Lane
- Add a Second Southbound Left-Turn Lane
- Add a second Westbound Left-Turn Lane

Queen Ka'ahumanu Highway at Kealakehe Parkway (#8)

- Add a Second Northbound Through Lane
- Convert Southbound Right-Turn Lane to a shared (Second) Through/Right-Turn Lane

The future Ane Keohokālole Highway will be a two-lane mid-level road that is planned to be constructed in a north-south direction between Queen Ka'ahumanu Highway and Māmalahoa Highway. By the first horizon year of this traffic study (Year 2025), Ane Keohokālole Highway is anticipated to be completed between Huliko'a Drive and Palani Road to the south. Ane Keohokālole Highway has been completed between Palani Road and Hina Lani Street. The northerly extension of Ane Keohokālole Highway to Ka'iminani Drive is anticipated to be completed by 2028 (or near the beginning of Project Phase 2). The completion of Ane Keohokālole Highway will serve as a parallel corridor to relief traffic congestion on Queen Ka'ahumanu Highway and Māmalahoa Highway. The planned Ane Keohokālole Highway will provide lane improvements to the following study area intersection:

Ane Keohokālole Highway at Hina Lani Street (#6)

- Ane Keohokālole Highway will be constructed as a new mid-level road, and it will run in a generally north-south direction through the project site.
- Construct new intersection: Provide Left-Turn, Through, and Right-Turn for all approaches
- Install a new traffic signal

As previously mentioned, the Kona CDP Policy LU-2.6: TOD/Traditional Neighborhood Design (TND) Public Infrastructure and Facilities, states: To encourage the development of TODs and TNDs, public financing sources shall pay 100% for: Major proposed trunk transit route (i.e. Ane Keohokālole.)

By 2025, there are additional planned improvements to the study area intersections that will be implemented by other surrounding developments to accommodate the overall traffic growth due to background ambient growth and new cumulative developments. The following planned intersection improvements are anticipated:

Kamanu Street at Hina Lani Street (#5)

- Install a New Traffic Signal
- Add a Second Northbound Left-Turn Lane

Table 4-12 summarizes the result of the 2025 Without Project Conditions intersection LOS analysis. As shown in Table 4-12, the intersection of Queen Ka’ahumanu Highway and Huliko’a Drive is projected to operate at Level of Service “E” or worse for 2025 Without Project Conditions during the peak hours, with existing lane geometry and planned improvements:

The following additional improvement is recommended to accommodate 2025 Without Project Conditions (see Figure 4-4):

Queen Ka’ahumanu Highway at Huliko’a Drive (#2)

- Retain westbound free-right turn lane along with the roadway widening on Queen Ka’ahumanu Highway

With recommended 2025 Without Project intersection lane improvements, the study area intersections are projected to be mitigated to Level of Service “D” or better during the peak hours.

2025 With Project Phase 1 Conditions

Table 4-13 summarizes the results for the 2025 With Project Phase 1 Conditions intersection level of service analysis, with existing geometry and planned improvements. As shown in Table 4-13, the following study area intersections are projected to operate at Level of Service “E” or worse for 2025 With Project Phase 1 Conditions during the peak hours, with existing lane geometry and planned improvements:

- Queen Kaahumanu Highway at Huliko’a Drive (#2)
- Kanalani Street at Hina Lani Street (#4)
- Māmalahoa Highway at Hina Lani Street (#7)
- Queen Ka’ahumanu Highway at Kealakehe Parkway (#8)

Figure 4-5 shows the recommended roadway network and intersection lane geometry for 2025 With Project Phase 1 Conditions to mitigate the traffic impact. In addition to the recommended 2025 Without Project improvements previously listed above, the following additional improvement is recommended to accommodate 2025 With Project Phase 1 Conditions:

Kanalani Street at Hina Lani Street (#4)

- Restrict Northbound Left-Turn Movement

Kamanu Street at Hina Lani Street (#5)

- Add a Northbound Through Lane
- Add Southbound Left-Turn, Through, and Right-Turn Lanes
- Add an Eastbound Left-Turn Lane
- Add a Second Westbound Through Lane

Table 4-12										
2025 Without Project Conditions Intersection Level of Service Analysis Summary										
No.	Intersection	Peak Hour	WITHOUT PROJECT				WITHOUT PROJECT PLUS MITIGATION			
			Delay (Sec)	V/C	LOS	Cum. Impact	Delay (Sec)	V/C	LOS	Cum. Impact
1	Queen Ka'ahumanu Hwy. at Kaiminani Dr.	AM	14.0	0.79	B	NO	14.0	0.79	B	NO
		PM	9.7	0.68	A	NO	9.7	0.68	A	NO
2	Queen Ka'ahumanu Hwy. at Huliko'a Dr.	AM	18.4	0.50	C	NO	0.1	0.01	A	NO
		PM	46.2	0.81	E	YES	0.1	0.01	A	NO
3	Queen Ka'ahumanu Hwy. at Hina Lani St.	AM	10.6	0.59	B	NO	10.6	0.59	B	NO
		PM	14.8	0.79	B	NO	14.8	0.79	B	NO
4	Kanalani St. at Hina Lani St.	AM	24.2	0.59	C	NO	24.2	0.59	C	NO
		PM	29.2	0.67	D	NO	29.2	0.67	D	NO
5	Kamanu St. at Hina Lani St.	AM	4.1	0.30	A	NO	4.1	0.30	A	NO
		PM	4.6	0.46	A	NO	4.6	0.46	A	NO
6	Ane Keohokālole Hwy. at Hina Lani St.	AM	9.3	0.47	A	NO	9.3	0.47	A	NO
		PM	15.4	0.65	B	NO	15.4	0.65	B	NO
7	Māmalahoa Hwy. at Hina Lani St.	AM	40.7	0.98	D	NO	40.7	0.98	D	NO
		PM	15.9	0.79	B	NO	15.9	0.79	B	NO
8	Queen Ka'ahumanu Hwy. at Kealakehe Pkwy.	AM	17.5	0.79	B	NO	17.5	0.79	B	NO
		PM	43.3	1.00	D	NO	43.3	1.00	D	NO

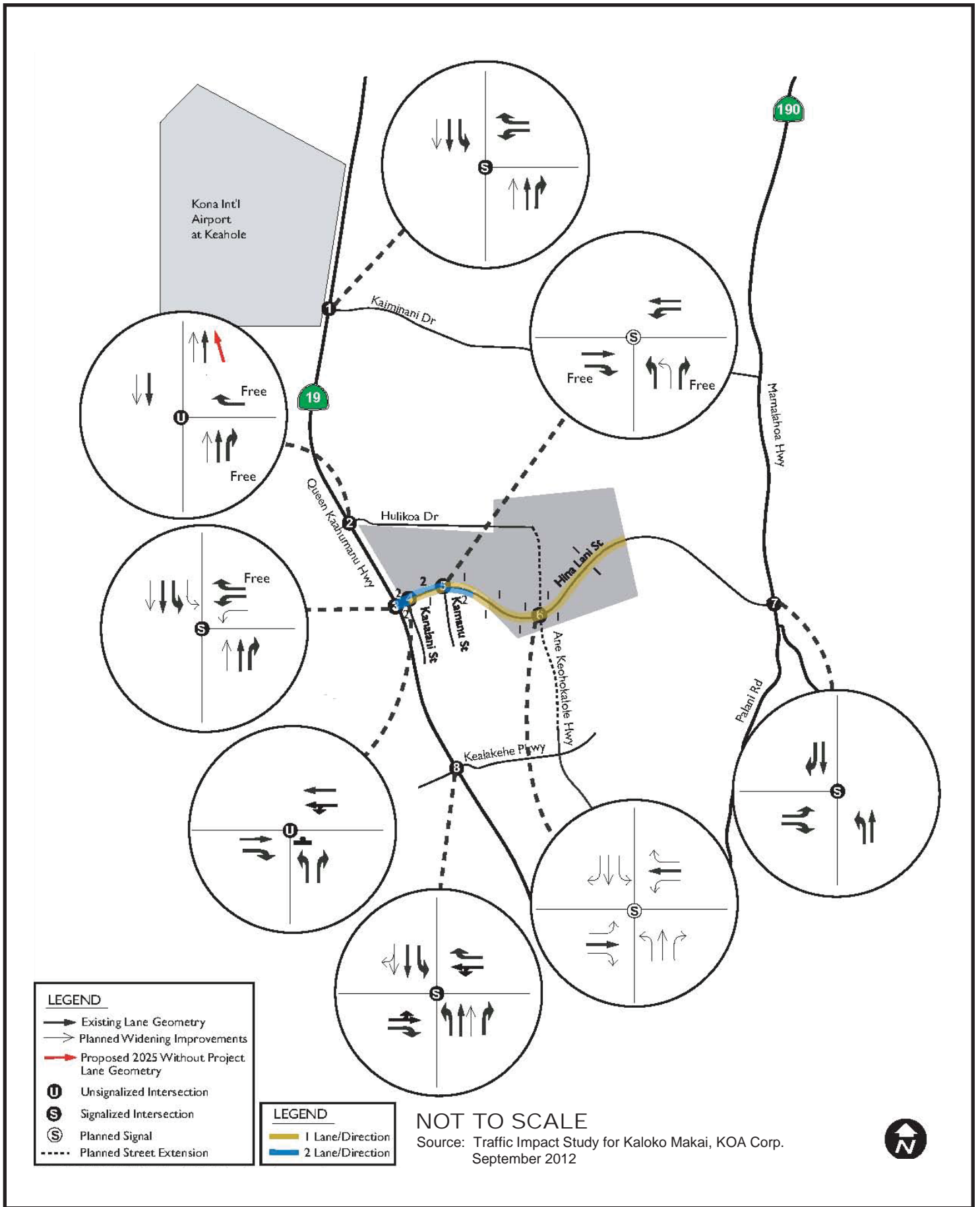


FIGURE 4-4
Recommended 2025 Without Project Lane Geometry
Kaloko Makai

Table 4-13 2025 With Project Phase 1 Intersection Level of Service Analysis Summary										
No.	Intersection	Peak Hour	WITH PROJECT				WITH PROJECT PLUS MITIGATION			
			Delay (Sec)	V / C	LOS	Project Impact	Delay (Sec)	V / C	LOS	Project Impact
1	Queen Ka'ahumanu Hwy. at Ka'imani Dr.	AM	16.7	0.87	B	NO	16.7	0.87	B	NO
		PM	12.8	0.81	B	NO	12.8	0.81	B	NO
2	Queen Ka'ahumanu Hwy at Huliko'a Dr.	AM	36.8	0.80	E	YES	0.1	0.01	A	NO
		PM	>100	1.43	F	YES	0.1	0.01	A	NO
3	Queen Ka'ahumanu Hwy. at Hina Lani St.	AM	24.6	0.91	C	NO	24.6	0.91	C	NO
		PM	53.9	1.07	D	NO	53.9	1.07	D	NO
4	Kanalani St. at Hina Lani St.	AM	>100	>2	F	YES	23.5	0.09	C	NO
		PM	>100	>2	F	YES	34.3	0.40	D	NO
5	Kamanu St. at Hina Lani St.	AM	13.5	0.55	B	NO	32.5	0.70	C	NO
		PM	35.7	0.85	D	NO	40.8	0.78	D	NO
6	Ane Keohokālole Hwy. at Hina Lani St.	AM	19.0	0.7	B	NO	19.0	0.70	B	NO
		PM	21.8	0.80	C	NO	21.8	0.80	C	NO
7	Māmalahoa Hwy. at Hina Lani St.	AM	74.9	1.14	E	YES	47.6	1.00	D	NO
		PM	25.5	0.90	C	NO	15.1	0.78	B	NO
8	Queen Ka'ahumanu Hwy. at Kealakehe Pkwy.	AM	32.3	0.98	C	NO	29.8	0.82	C	NO
		PM	>100	1.27	F	YES	54.0	0.94	D	NO

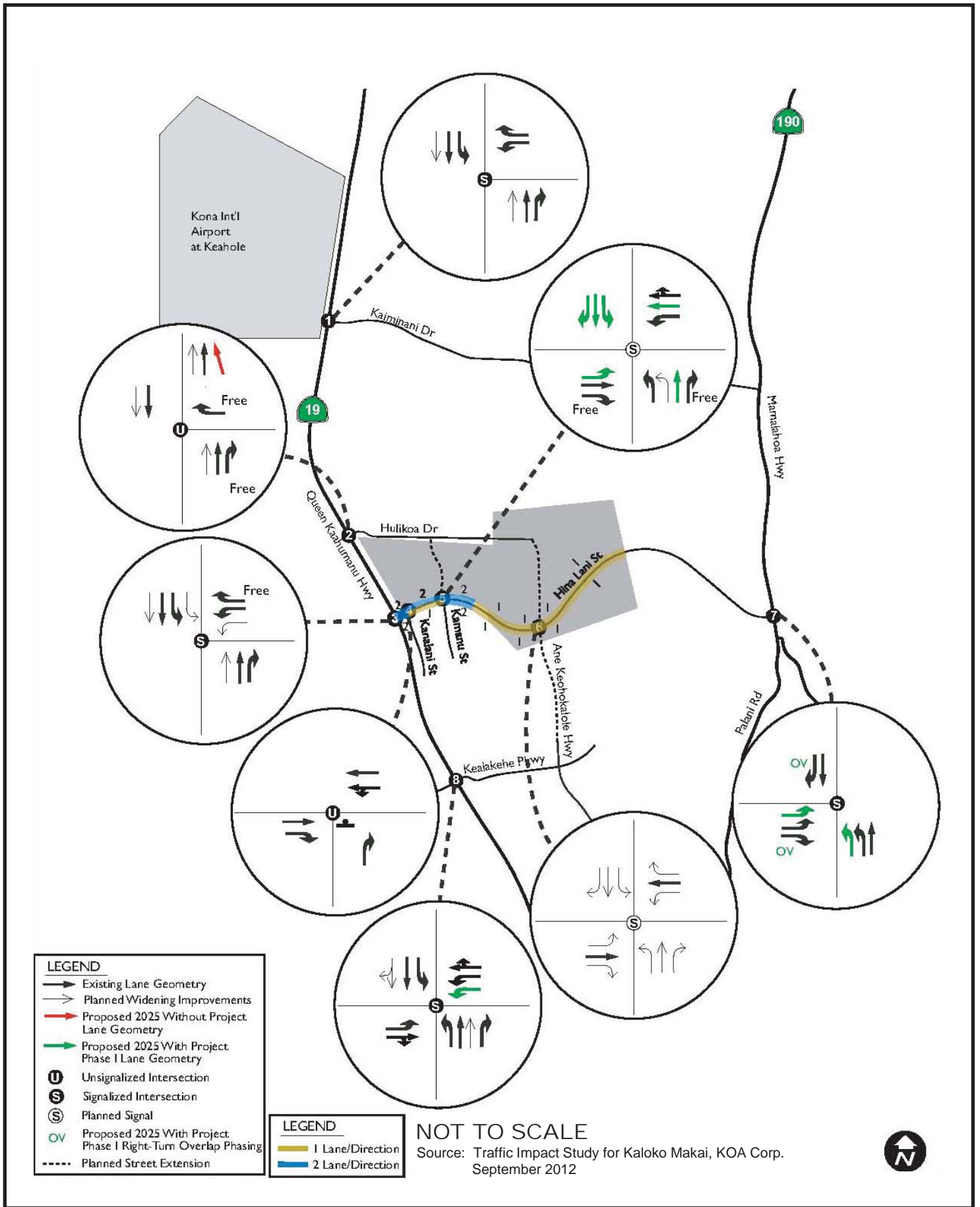


FIGURE 4-5
Recommended 2025 Project Lane Geometry
Kaloko Makai

Māmalahoa Highway at Hina Lani Street (#7)

- Add a Second Northbound Left-Turn Lane
- Provide Southbound Right-Turn Overlap Signal Phasing
- Add a Second Eastbound Left-Turn Lane
- Provide Eastbound Right-Turn Overlap Signal Phasing

Queen Ka‘ahumanu Highway at Kealakehe Parkway (#8)

- Add a Second Westbound Left-Turn Lane

With recommended 2025 With Project Phase 1 intersection lane improvements, the study area intersections are projected to be mitigated to Level of Service “D” or better during the peak hours.

2035 Without Project Conditions

The 2035 Without Project Conditions have the same planned improvements as the 2025 Without Project Conditions which were previously listed. The planned improvements include the widening of Queen Ka‘ahumanu Highway and the construction of Ane Keohokālole Highway.

Table 4-14 summarizes the results for the 2035 Without Project Conditions intersection level of service analysis, with existing geometry and planned improvements. As shown in Table 4-14, the intersection of Queen Ka‘ahumanu and Huliko‘a Drive (#2) is projected to operate at Level of Service “E” or worse for 2035 Without Project Conditions during the peak hours, with existing lane geometry and planned improvements:

The recommended lane improvements for 2035 Without Project Conditions are same as the ones previously listed in the 2025 Traffic Conditions Section above and as shown in Figure 4-4.

With recommended 2035 Without Project intersection lane improvements, the study area intersections are projected to be mitigated to Level of Service “D” or better during the peak hours.

2035 With Project Phase 2 Conditions

Table 4-15 summarizes the results for the 2035 With Project Phase 2 Conditions intersection level of service analysis, with existing geometry and planned improvements. As shown in Table 4-15, the following study area intersections are projected to operate at Level of Service “E” or worse for 2035 With Project Phase 2 Conditions during the peak hours, with existing lane geometry and planned improvements:

- Queen Ka‘ahumanu Highway at Huliko‘a Drive (#2)
- Queen Ka‘ahumanu Highway at Hina Lani Street (#3)
- Kanalani Street at Hina Lani Street (#4)
- Kamanu Street at Hina Lani Street (#5)
- Ane Keohokālole Highway at Hina Lani Street (#6)
- Māmalahoa Highway at Hina Lani Street (#7)
- Queen Ka‘ahumanu Highway at Kealakehe Parkway (#8)

Figure 4-6 shows the recommended roadway network and intersection lane geometry for 2035 With Project Phase 2 Conditions to mitigate the traffic impact. In addition to the recommended 2025 With Project Phase 1 improvements previously listed, the following additional improvements are recommended to accommodate 2035 With Project Phase 2 Conditions:

Queen Ka'ahumanu Highway at Hina Lani Street (#3)

- Add a Third Northbound Through Lane
- Add a Second Northbound Right-Turn Lane
- Add a Third Southbound Through Lane

Kanalani Street at Hina Lani Street (#4)

- Add a Second Eastbound Through Lane

Kamanu Street at Hina Lani Street (#5)

- Add a Southbound Free-Right Turn Lane
- Add a Second Eastbound Left-Turn Lane
- Add a Westbound Right-Turn Lane

Ane Keohokālole Highway at Hina Lani Street (#6)

- Add a Northbound Free-Right Turn Lane
- Add a Second Eastbound Through Lane
- Add a Second Westbound Through Lane
- Add a Second Westbound Left-Turn Lane

Queen Ka'ahumanu Highway at Kealakehe Parkway (#8)

- Add a Third Northbound Through Lane
- Provide Northbound Right-Turn Overlap Signal Phasing
- Add a Third Southbound Through Lane

With recommended 2035 With Project Phase 2 intersection lane improvements, the study area intersections are projected to be mitigated to Level of Service "D" or better during the peak hours.

2045 Without Project Conditions

It should be noted that the 2045 Without Project Conditions have the same planned improvements as the 2025 Without Project Conditions which were previously listed.

Table 4-16 summarizes the results for the 2045 Without Project Conditions intersection level of service analysis, with existing geometry and planned improvements. As shown in Table 4-16, the following study area intersections are projected to operate at Level of Service "E" or worse for 2045 Without Project Conditions during the peak hours, with existing lane geometry and planned improvements:

Table 4-14 2035 Without Project Conditions Intersection Level of Service Analysis Summary										
No.	Intersection	Peak Hour	WITHOUT PROJECT				WITHOUT PROJECT PLUS MITIGATION			
			Delay (Sec)	V/C	LOS	Cum. Impact	Delay (Sec)	V/C	LOS	Cum. Impact
1	Queen Ka'ahumanu Hwy at Ka'imianani Drive	AM	17.1	0.77	B	NO	17.1	0.77	B	NO
		PM	14.5	0.73	B	NO	14.5	0.73	B	NO
2	Queen Ka'ahumanu Hwy at Huliko'a Drive	AM	20.1	0.53	C	NO	0.1	0.01	A	NO
		PM	36.9	0.75	E	YES	0.1	0.01	A	NO
3	Queen Ka'ahumanu Hwy at Hina Lani Street	AM	10.6	0.59	B	NO	10.6	0.59	B	NO
		PM	14.2	0.77	B	NO	14.2	0.77	B	NO
4	Kanalani Street at Hina Lani Street	AM	19.2	0.51	C	NO	19.2	0.51	C	NO
		PM	22.8	0.58	C	NO	22.8	0.58	C	NO
5	Kamanu Street at Hina Lani Street	AM	3.7	0.42	A	NO	3.7	0.42	A	NO
		PM	4.3	0.4	A	NO	4.3	0.4	A	NO
6	Ane Keohokālole Hwy at Hina Lani Street	AM	25.9	0.71	C	NO	25.9	0.71	C	NO
		PM	22.6	0.79	C	NO	22.6	0.79	C	NO
7	Māmalahoa Hwy at Hina Lani Street	AM	26.7	0.92	C	NO	26.7	0.92	C	NO
		PM	18.2	0.8	B	NO	18.2	0.8	B	NO
8	Queen Ka'ahumanu Hwy at Kealakehe Pkwy	AM	17.8	0.92	B	NO	17.8	0.92	B	NO
		PM	50.4	1.04	D	NO	50.4	1.04	D	NO

Table 4-15 2035 With Project Phase 2 Intersection Level of Service Analysis Summary										
No.	Intersection	Peak Hour	WITH PROJECT				WITH PROJECT PLUS MITIGATION			
			Delay			Project	Delay			Project
			(Sec)	V / C	LOS	Impact	(Sec)	V / C	LOS	Impact
1	Queen Ka'ahumanu Hwy. at Ka'iminani Dr.	AM	37.6	1.01	D	NO	37.6	1.01	D	NO
		PM	36.2	0.96	D	NO	36.2	0.96	D	NO
2	Queen Ka'ahumanu Hwy. at Huliko'a Dr.	AM	54.0	0.90	F	YES	0.1	0.01	A	NO
		PM	>100	1.27	F	YES	0.1	0.01	A	NO
3	Queen Ka'ahumanu Hwy. at Hina Lani St.	AM	50.2	1.07	D	NO	22.7	0.85	C	NO
		PM	>100	1.42	F	YES	43.2	1.00	D	NO
4	Kanalani St. at Hina Lani St.	AM	>100	>2.00	F	YES	13.4	0.04	B	NO
		PM	>100	>2.00	F	YES	18.2	0.23	C	NO
5	Kamanu Street at Hina Lani St.	AM	83.7	1.42	F	YES	21.7	0.63	C	NO
		PM	>100	>2.00	F	YES	26.0	0.70	C	NO
6	Ane Keohokālole Hwy. at Hina Lani St.	AM	78.3	1.35	E	YES	43.3	0.89	D	NO
		PM	>100	1.46	F	YES	44.7	1.02	D	NO
7	Māmalahoa Hwy. at Hina Lani St.	AM	81.2	1.17	F	YES	38.7	0.98	D	NO
		PM	47.9	1.04	D	NO	16.7	0.82	B	NO
8	Queen Ka'ahumanu Hwy. at Kealakehe Pkwy.	AM	66.1	1.16	E	YES	24.4	0.78	C	NO
		PM	>100	1.46	F	YES	36.8	0.88	D	NO

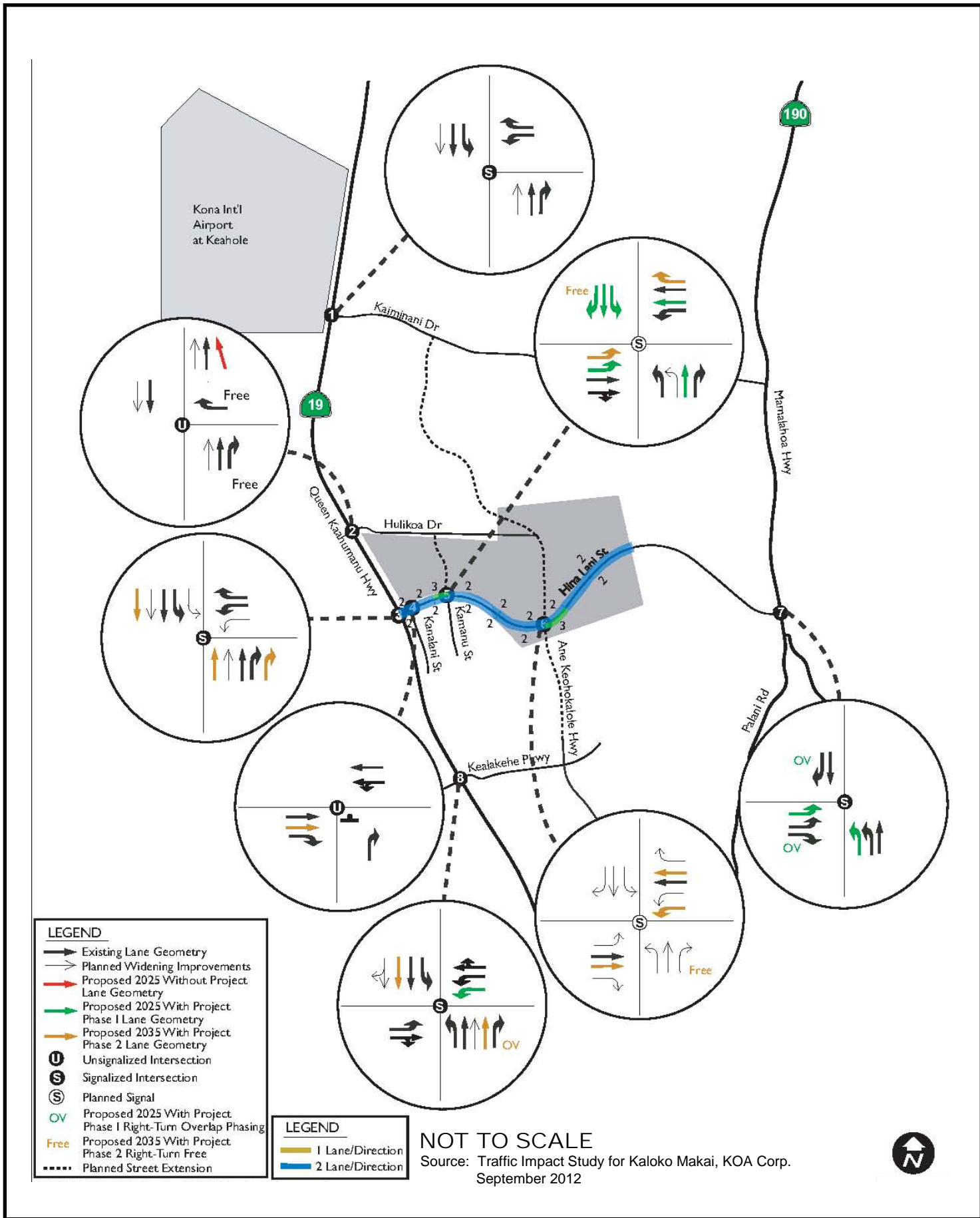


FIGURE 4-6
Recommended 2035 Project Lane Geometry
Kaloko Makai

Table 4-16 2045 Without Project Intersection Level of Service Analysis Summary										
No.	Intersection	Peak Hour	WITHOUT PROJECT				WITHOUT PROJECT PLUS MITIGATION			
			Delay (Sec)	V/C	LOS	Cum. Impact	Delay (Sec)	V/C	LOS	Cum. Impact
1	Queen Ka'ahumanu Hwy. at Ka'imani Dr.	AM	20.0	0.87	C	NO	20.0	0.87	C	NO
		PM	15.9	0.76	B	NO	15.9	0.76	B	NO
2	Queen Ka'ahumanu Hwy. at Huliko'a Dr.	AM	25.2	0.61	D	NO	0.1	0.01	A	NO
		PM	52.1	0.85	F	YES	0.1	0.01	A	NO
3	Queen Ka'ahumanu Hwy. at Hina Lani St.	AM	11.1	0.65	B	NO	11.1	0.65	B	NO
		PM	15.7	0.82	B	NO	15.7	0.82	B	NO
4	Kanalani St.at Hina Lani St.	AM	19.2	0.51	C	NO	19.2	0.51	C	NO
		PM	22.8	0.58	C	NO	22.8	0.58	C	NO
5	Kamanu St. at Hina Lani St.	AM	3.7	0.42	A	NO	3.7	0.42	A	NO
		PM	4.3	0.40	A	NO	4.3	0.40	A	NO
6	Ane Keohokālole Hwy. at Hina Lani St.	AM	24.5	0.74	C	NO	24.5	0.74	C	NO
		PM	24.3	0.81	C	NO	24.3	0.81	C	NO
7	Māmalahoa Hwy. at Hina Lani St.	AM	44.8	1.01	D	NO	44.8	1.01	D	NO
		PM	22.2	0.86	C	NO	22.2	0.86	C	NO
8	Queen Ka'ahumanu Hwy.at Kealakehe Pkwy.	AM	19.7	0.90	B	NO	23.7	0.76	C	NO
		PM	63.2	1.11	E	YES	37.2	0.87	D	NO

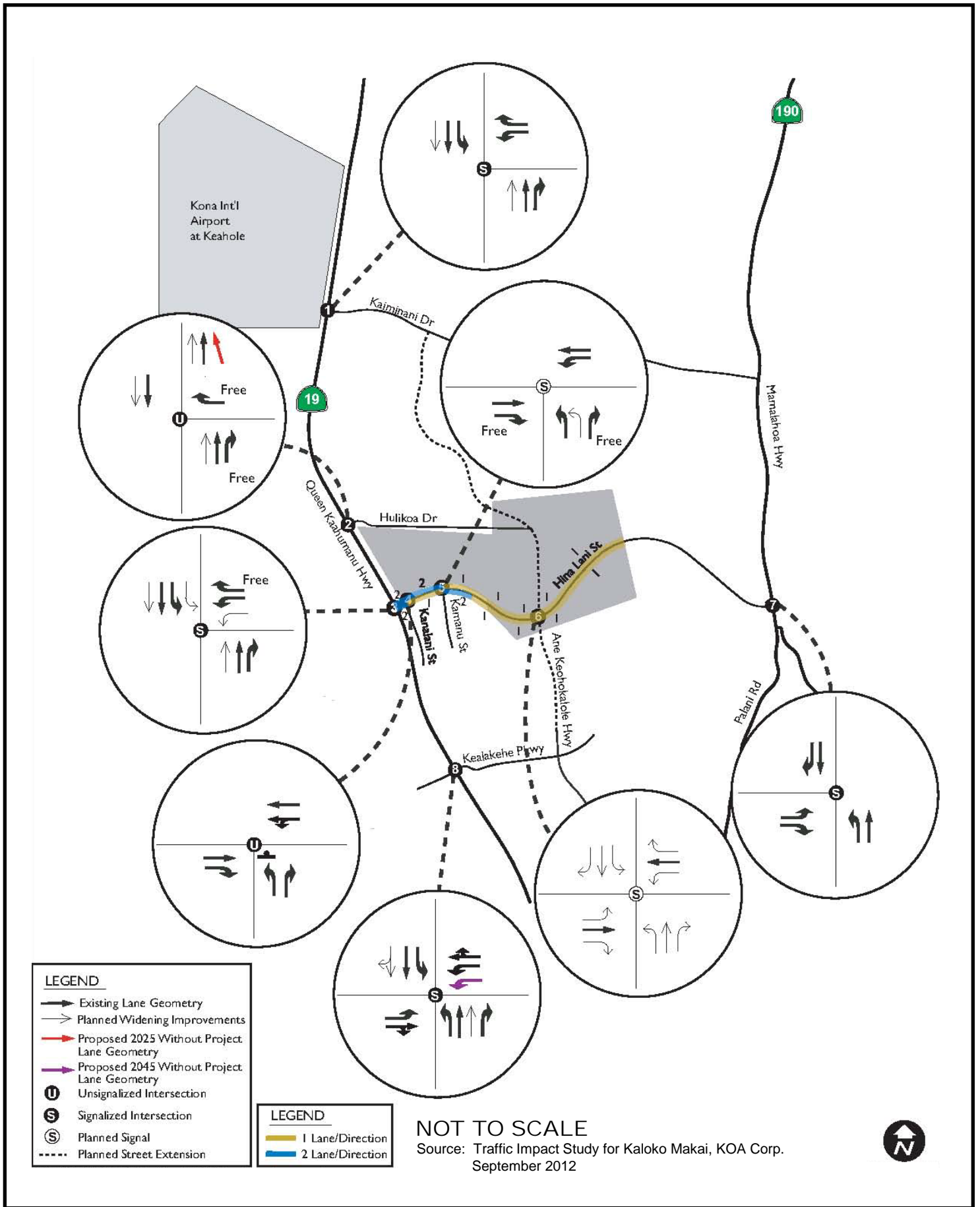


FIGURE 4-7
Recommended 2045 Without Project Lane Geometry
Kaloko Makai

- Queen Ka‘ahumanu Highway at Huliko‘a Drive (#2)
- Queen Ka‘ahumanu Highway at Kealakehe Parkway (#8)

In addition to the recommended 2025 Without Project improvements previously listed, the following additional improvement is recommended to accommodate 2045 Without Project Conditions (see Figure 4-7):

Queen Ka‘ahumanu Highway at Kealakehe Parkway (#8)

- Add a second Westbound Left-Turn Lane

With recommended 2045 Without Project intersection lane improvements, the study area intersections are projected to be mitigated to Level of Service “D” or better during the peak hours.

2045 With Project Phase 3 Conditions

Table 4-17 summarizes the result of the 2035 With Project Phase 3 intersection LOS analysis. As shown in Table 4-17, the following study area intersections are projected to operate at Level of Service “E” or worse for 2045 With Project Phase 3 Conditions during the peak hours, with existing lane geometry and planned improvements:

- Queen Ka‘ahumanu Highway at Ka‘iminani Drive (#1)
- Queen Ka‘ahumanu Highway at Huliko‘a Drive (#2)
- Queen Ka‘ahumanu Highway at Hina Lani Street (#3)
- Kanalani Street at Hina Lani Street (#4)
- Kamanu Street at Hina Lani Street (#5)
- Ane Keohokālole Highway at Hina Lani Street (#6)
- Māmalahoa Highway at Hina Lani Street (#7)
- Queen Ka‘ahumanu Highway at Kealakehe Parkway (#8)

Figure 4-8 shows the recommended roadway network and intersection lane geometry for 2045 With Project Phase 3 Conditions to mitigate the traffic impact. In addition to the recommended 2035 with Project Phase 2 improvements previously, the following additional improvements are recommended to accommodate 2045 With Project Phase 3 Conditions:

Queen Kaahumanu Highway at Ka‘iminani Drive (#1)

- Add a Third Northbound Through Lane
- Add a Second Southbound Left-Turn Lane
- Add a Third Southbound Through Lane
- Add a Second Westbound Left-Turn Lane
- Provide Westbound Right-Turn Overlap Signal Phasing

Queen Ka‘ahumanu Highway at Huliko‘a Drive (#2)

- Add a Third Southbound Through Lane

Table 4-17 2045 With Project Phase 3 Intersection Level of Service Analysis Summary										
No.	Intersection	Peak Hour	WITH PROJECT				WITH PROJECT PLUS MITIGATION			
			Delay			Project	Delay			Project
			(Sec)	V / C	LOS	Impact	(Sec)	V / C	LOS	Impact
1	Queen Ka'ahumanu Hwy. at Ka'iminani Dr.	AM	65.9	1.13	E	YES	17.6	0.84	B	NO
		PM	69.9	1.11	E	YES	16.2	0.85	B	NO
2	Queen Ka'ahumanu Hwy. at Huliko'a Dr.	AM	>100	1.20	F	YES	0.1	0.01	A	NO
		PM	>100	1.62	F	YES	0.1	0.01	A	NO
3	Queen Ka'ahumanu Hwy. at Hina Lani St.	AM	>100	1.29	F	YES	Interchange			
		PM	>100	1.76	F	YES				
4	Kanalani St. at Hina Lani St.	AM	>100	>2.00	F	YES	15.5	0.05	C	NO
		PM	>100	>2.00	F	YES	26.1	0.32	D	NO
5	Kamanu St. at Hina Lani St.	AM	>100	>2.00	F	YES	26.5	0.72	C	NO
		PM	>100	>2.00	F	YES	37.3	0.80	D	NO
6	Ane Keohokālole Hwy. at Hina Lani St.	AM	>100	1.96	F	YES	46.5	0.89	D	NO
		PM	>100	>2.00	F	YES	54.4	0.99	D	NO
7	Māmalahoa Hwy. at Hina Lani St.	AM	>100	1.35	F	YES	51.5	1.03	D	NO
		PM	86.3	1.23	F	YES	22.2	0.90	C	NO
8	Queen Ka'ahumanu Hwy. at Kealakehe Pkwy.	AM	>100	1.28	F	YES	30.5	0.85	C	NO
		PM	>100	1.64	F	YES	41.7	0.93	D	NO

Queen Ka'ahumanu Highway at Hina Lani Street (#3)

- Construct a grade-separated interchange

Kanalani Street at Hina Lani Street (#4)

- Add a Westbound Left-Turn Lane

Ane Keohokālole Highway at Hina Lani Street (#6)

- Add a Second Eastbound Left-Turn Lane
- Provide Eastbound Right-Turn Overlap Signal Phasing
- Provide Westbound Right-Turn Overlap Signal Phasing

Māmalahoa Highway at Hina Lani Street (#7)

- Add a Southbound Free Right-Turn Lane

With recommended 2045 With Project Phase 3 intersection lane improvements, the study area intersections are projected to be mitigated to Level of Service "D" or better during the peak hours.

Figures 4-9A and 4-9B summarizes the recommended intersection lane geometry to mitigate traffic impact for the following conditions:

- 2025 Without Project conditions, with existing lane geometry and planned widening
- 2035 Without Project conditions, with existing lane geometry and planned widening
- 2045 Without Project conditions, with recommended intersection improvements
- 2025 With Project Phase 1 conditions, with recommended intersection improvements
- 2035 With Project Phase 2 conditions, with recommended intersection improvements
- 2045 With Project Phase 3 conditions, with recommended intersection improvements

Table 4-18 summarizes the intersection level of service analysis results with existing lane geometry and planned improvements. Table 4-19 summarizes the expected levels of service for the study area intersections with additional mitigation measures in place.

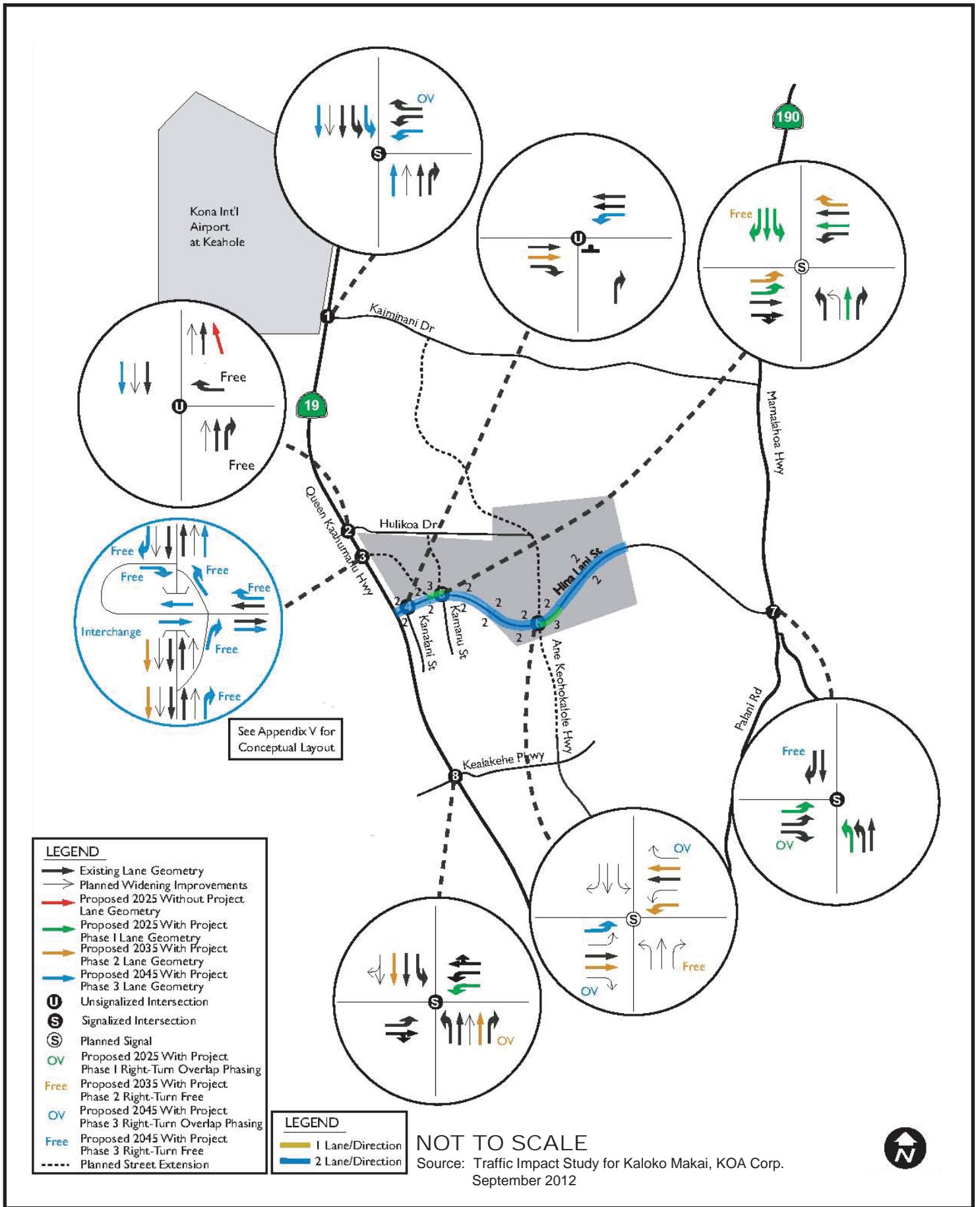


FIGURE 4-8
Recommended 2045 Project Lane Geometry
Kaloko Makai

INTERSECTION	1. Queen Kaahumanu Hwy & Kaiminani Dr.	2. Queen Kaahumanu Hwy & Hulikoia Dr.	3. Queen Kaahumanu Hwy & Hina Lani St.	4. Hina Lani St. & Kanalani St.
EXISTING CONDITIONS				
2025 and 2035 WITHOUT PROJECT				
2045 WITHOUT PROJECT				
2025 WITH PROJECT PHASE I				
2035 WITH PROJECT PHASE 2				
2045 WITH PROJECT PHASE 3				

LEGEND

- Existing Lane Geometry
- Planned Widening Improvements
- Proposed 2025 Without Project Improvements
- Proposed 2025 With Project Phase I Improvements
- Proposed 2035 With Project Phase 2 Improvements
- Proposed 2045 With Project Phase 3 Improvements
- Unsignalized Intersection
- Signalized Intersection
- Planned Signal
- Right Turn Overlap Phasing

NOT TO SCALE

Source: Traffic Impact Study for Kaloko Makai, KOA Corp. September 2012



FIGURE 4-9A
Intersection Improvement Summary 1 of 2
Kaloko Makai

INTERSECTION	5. Hina Lani St. & Kamanu St.	6. Hina Lani St. & Ane Keohokalole Hwy.	7. Hina Lani St. & Mamalahoa Hwy.	8. Queen Kaahumanu Hwy & Kealakehe Pkwy.
EXISTING CONDITIONS				
2025 and 2035 WITHOUT PROJECT				
2045 WITHOUT PROJECT				
2025 WITH PROJECT PHASE 1				
2035 WITH PROJECT PHASE 2				
2045 WITH PROJECT PHASE 3				

LEGEND

- Existing Lane Geometry
- Planned Widening Improvements
- Proposed 2025 Without Project Improvements
- Proposed 2045 Without Project Improvements
- Proposed 2025 With Project Phase 1 Improvements
- Proposed 2035 With Project Phase 2 Improvements
- Proposed 2045 With Project Phase 3 Improvements
- Unsignalized Intersection
- Signalized Intersection
- Planned Signal
- Right Turn Overlap Phasing

NOT TO SCALE

Source: Traffic Impact Study for Kaloko Makai, KOA Corp. September 2012



FIGURE 4-9B
Intersection Improvement Summary 2 of 2
Kaloko Makai

**Table 4-18
Intersection Level of Service Analysis Summary, Without Recommended Mitigations**

No.	Intersection	Peak Hour	Existing		2025 Without Project		2035 Without Project		2045 Without Project		2025 With Project Phase 1		2035 With Project Phase 2		2045 With Project Phase 3			
			Delay		Delay		Delay		Delay		Delay		Delay		Delay		Delay	
			(Sec)	LOS	(Sec)	LOS	(Sec)	LOS	(Sec)	LOS	(Sec)	LOS	(Sec)	LOS	(Sec)	LOS	(Sec)	LOS
1	Queen Kaahumanu Hwy at Kaiminani Dr	AM	16.9	B	14.0	B	17.1	B	20.0	C	16.7	B	37.6	D	65.9	E		
		PM	8.6	A	9.7	A	14.5	B	15.9	B	12.8	B	36.2	D	69.9	E		
2	Queen Kaahumanu Hwy at Hulikoa Dr	AM	25.2	C	18.4	C	20.1	C	25.2	D	36.8	E	54.0	F	>100	F		
		PM	52.1	C	46.2	E	36.9	E	52.1	F	>100	F	>100	F	>100	F		
3	Queen Kaahumanu Hwy at Hina Lani St	AM	11.1	B	10.6	B	10.6	B	11.1	B	24.6	C	50.2	D	>100	F		
		PM	15.7	C	14.8	B	14.2	B	15.7	B	53.9	D	>100	F	>100	F		
4	Kanalani St at Hina Lani St	AM	19.2	B	24.2	C	19.2	C	19.2	C	>100	F	>100	F	>100	F		
		PM	22.8	C	29.2	D	22.8	C	22.8	C	>100	F	>100	F	>100	F		
5	Kamanu St at Hina Lani St	AM	10.7	B	4.1	A	3.7	A	3.7	A	13.5	B	83.7	F	>100	F		
		PM	14.1	B	4.6	A	4.3	A	4.3	A	35.7	D	>100	F	>100	F		
6	Ane Keohokalole Hwy at Hina Lani St	AM	--	--	9.3	A	25.9	C	24.5	C	19.0	B	78.3	E	>100	F		
		PM	--	--	15.4	B	22.6	C	24.3	C	21.8	C	>100	F	>100	F		
7	Mamalahoa Hwy at Hina Lani St	AM	44.8	B	40.7	D	26.7	C	44.8	D	74.9	E	81.2	F	>100	F		
		PM	22.2	A	15.9	B	18.2	B	22.2	C	25.5	C	47.9	D	86.3	F		
8	Queen Kaahumanu Hwy at Kealakehe Pkwy	AM	15.7	B	17.5	B	17.8	B	19.7	B	32.3	C	66.1	E	>100	F		
		PM	26.5	C	43.3	D	50.4	D	63.2	E	>100	F	>100	F	>100	F		

**Table 4-19
Intersection Level of Service Analysis Summary, with Recommended Mitigations**

No.	Intersection	Peak Hour	2025 Without Project		2035 Without Project		2045 Without Project		2025 With Project Phase 1		2035 With Project Phase 2		2045 With Project Phase 3			
			Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Queen Kaahumanu Hwy at Kaiminani Dr	AM	14.0	B	17.1	B	20.0	C	16.7	B	37.6	D	17.6	B		
		PM	9.7	A	14.5	B	15.9	B	12.8	B	36.2	D	16.2	B		
2	Queen Kaahumanu Hwy at Hulikoa Dr	AM	0.1	A	0.1	A	0.1	A	0.1	A	0.1	A	0.1	A		
		PM	0.1	A	0.1	A	0.1	A	0.1	A	0.1	A	0.1	A		
3	Queen Kaahumanu Hwy at Hina Lani St	AM	10.6	B	10.6	B	11.1	B	24.6	C	22.7	C	Interchange			
		PM	14.8	B	14.2	B	15.7	B	53.9	D	43.2	D				
4	Kanalani St at Hina Lani St	AM	24.2	C	19.2	C	19.2	C	23.5	C	13.4	B	15.5	C		
		PM	29.2	D	22.8	C	22.8	C	34.3	D	18.2	C	26.1	D		
5	Kamanu St at Hina Lani St	AM	4.1	A	3.7	A	3.7	A	32.5	C	21.7	C	26.5	C		
		PM	4.6	A	4.3	A	4.3	A	40.8	D	26.0	C	37.3	D		
6	Ane Keohokalole Hwy at Hina Lani St	AM	9.3	A	25.9	C	24.5	C	19.0	B	43.3	D	46.5	D		
		PM	15.4	B	22.6	C	24.3	C	21.8	C	44.7	D	54.4	D		
7	Mamalahoa Hwy at Hina Lani St	AM	40.7	D	26.7	C	44.8	D	47.6	D	38.7	D	51.5	D		
		PM	15.9	B	18.2	B	22.2	C	15.1	B	16.7	B	22.2	C		
8	Queen Kaahumanu Hwy at Kealakehe Pkwy	AM	17.5	B	17.8	B	23.7	C	29.8	C	24.4	C	30.5	C		
		PM	43.3	D	50.4	D	37.2	D	54.0	D	36.8	D	41.7	D		

4.5. NOISE

Y. Ebisu & Associates prepared an acoustic study to describe and assess the regional and local existing and future noise environment in the environs of Kaloko Makai, as well as provide guidance for the mitigation of noise impacts. Appendix L details the complete acoustic study in full.

Noise within Kaloko Makai's regional vicinity is primarily derived from: 1) the natural environment (wind, rain, and the ocean); 2) traffic along Queen Ka'ahumanu Highway and other regional roads; and 3) Aircraft passing overhead in flight to/from the Kona International Airport.

The noise descriptor currently used by federal agencies (i.e. the Federal Housing Administration, Housing and Urban Development (FHA/HUD), the Department of Transportation (DOT), and the Federal Aviation Administration (FAA)) to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn). This unit of measure is also utilized by the Hawai'i State DOT, and the metered values are indicative of the average noise during a typical day of the year.

Specifically, DNL exposure levels of 55 or less are generally typical of quiet rural or suburban areas, while levels of 55-65 are indicative of standard urbanized regions with medium to high levels of activity and street traffic. DNL levels exceeding 65 are associated with densely developed urban regions and regions fronting high volume roadways.

4.5.1. Traffic Noise

Existing traffic conditions within the vicinity of the project indicate noise levels of approximately 62 DNL along the makai (west) property boundary, to less than 55 DNL at the mauka (east) property boundary. It was further concluded that the existing 65 DNL traffic noise contour is located approximately 132 to 141 feet from the centerline of Queen Ka'ahumanu Highway, and approximately 93 to 95 feet from the centerline of Māmalahoa Highway in the immediate vicinity of the project site. At the interior portions of the project site existing background noise levels drop to 55 DNL or less, and aircraft noise and the natural sounds of birds and winds in foliage are the dominant noise sources. Between intermittent noise events, background ambient noise levels drop to a range of 35 to 40 dB. During calm wind periods, background ambient noise levels decrease to levels less than 40 dB.

4.5.2. Aircraft Noise

Aircraft noise within the project environs are associated with fixed and rotary wing aircraft operations at Kona International Airport at Keahole. On occasion, depending upon weather, visibility, or air traffic conditions, helicopter and light, fixed wing aircraft may cross over the western boundary of the project site, as an additional source of aircraft-related noise. While the majority of noisier jet aircraft flight patterns do not fall within the project vicinity, larger overseas jet aircraft occasionally overfly the west end of the project site. Figures 4-10 to 4-12 depict existing aircraft noise contours over the project site. As noted in Figure 4-13, the locations of the 55 through 75 DNL aircraft noise contours during the 2008 (Kona International Airport at Keahole 14 CFR Part 150 Report) period are notably distant from the project site and as such, are considered to be in the

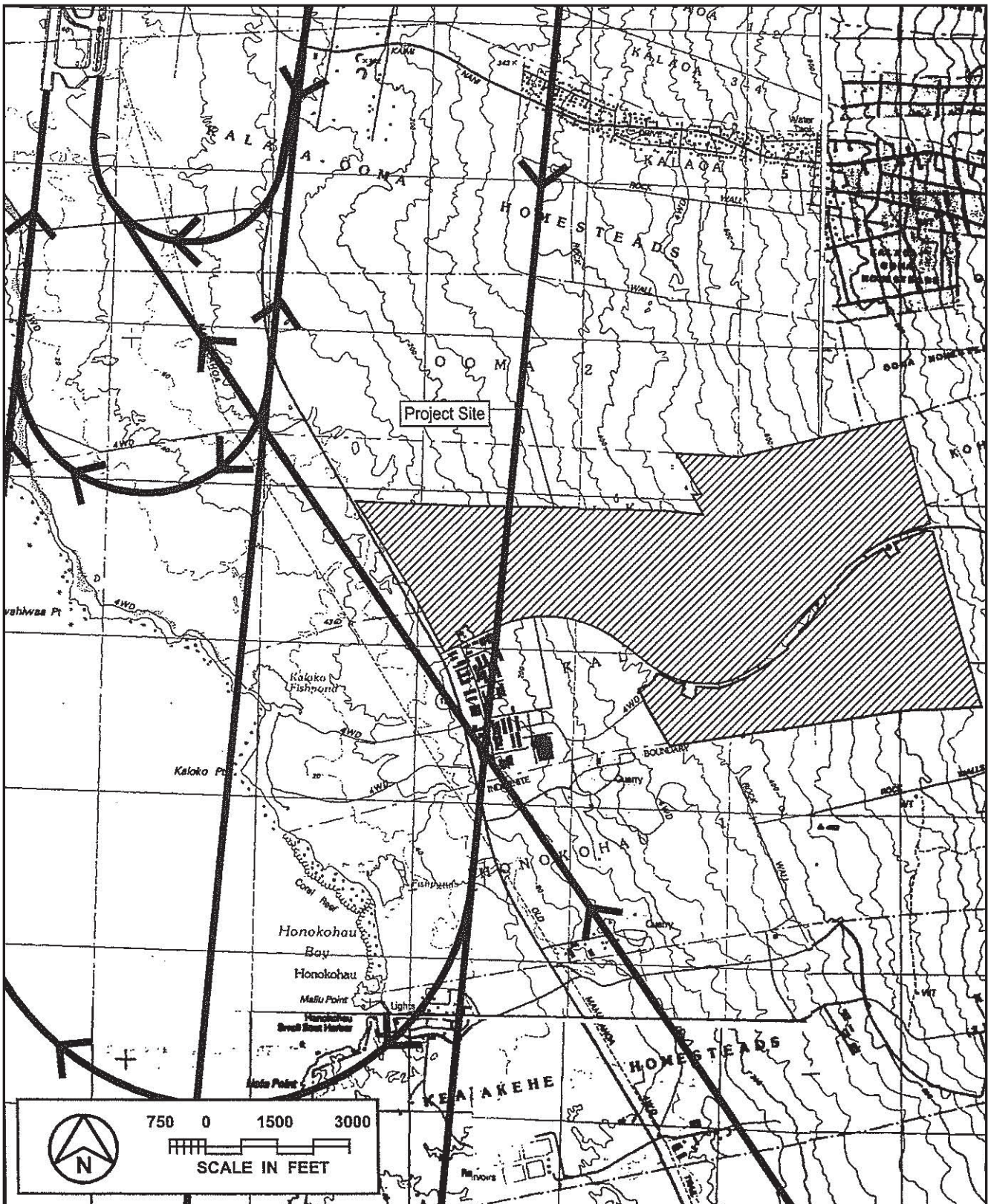


Source: Acoustic Study for the Proposed Kaloko Makai Project, Y. Ebisu & Associates, August 2012



FIGURE 4-10
Locations of Existing Average Aircraft Departure Flight Tracks in
Project Environs

Kaloko Makai

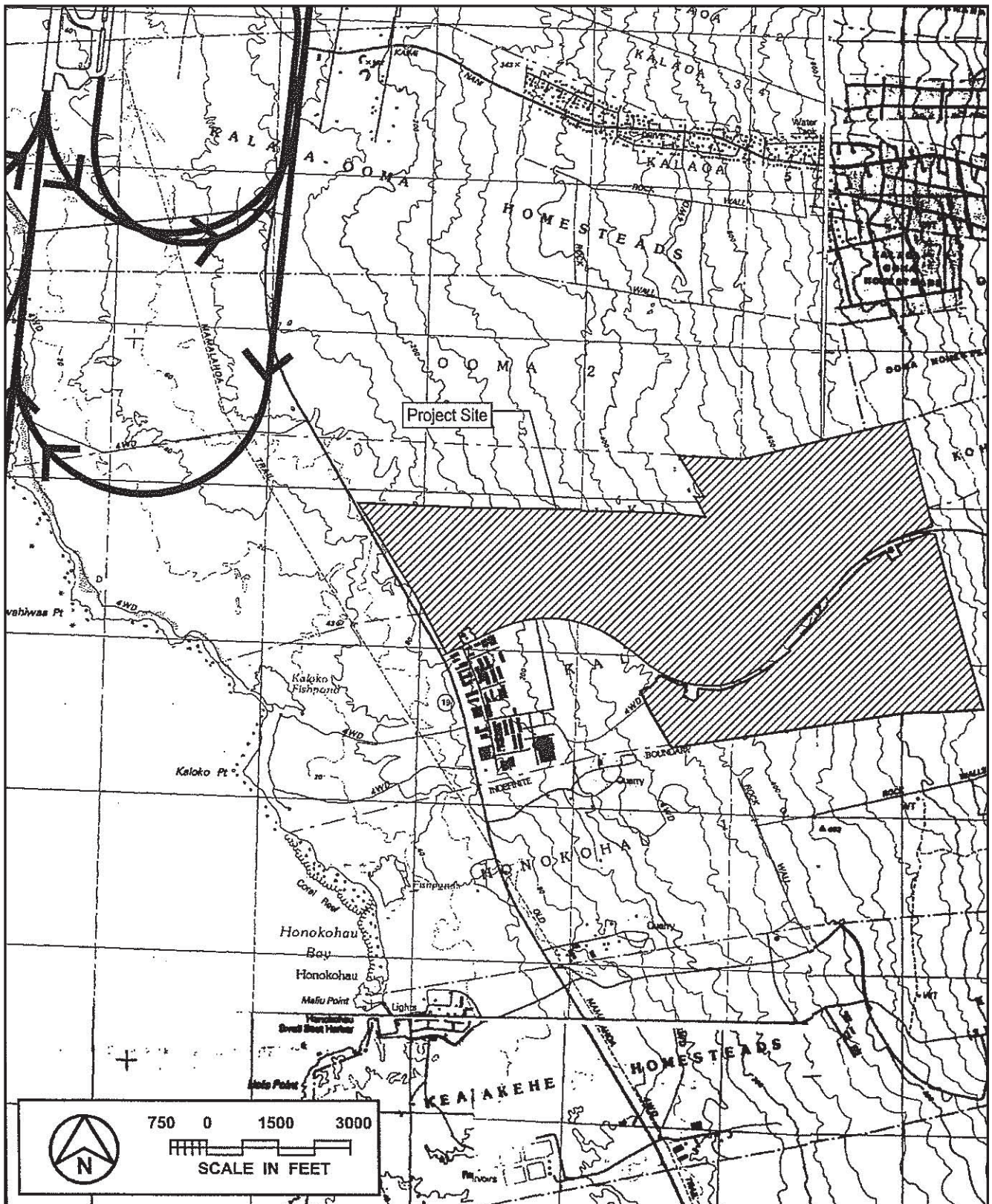


Source: Acoustic Study for the Proposed Kaloko Makai Project, Y. Ebisu & Associates, August 2012



FIGURE 4-11
Locations of Existing Average Aircraft Arrival Flight Tracks in
Project Environs

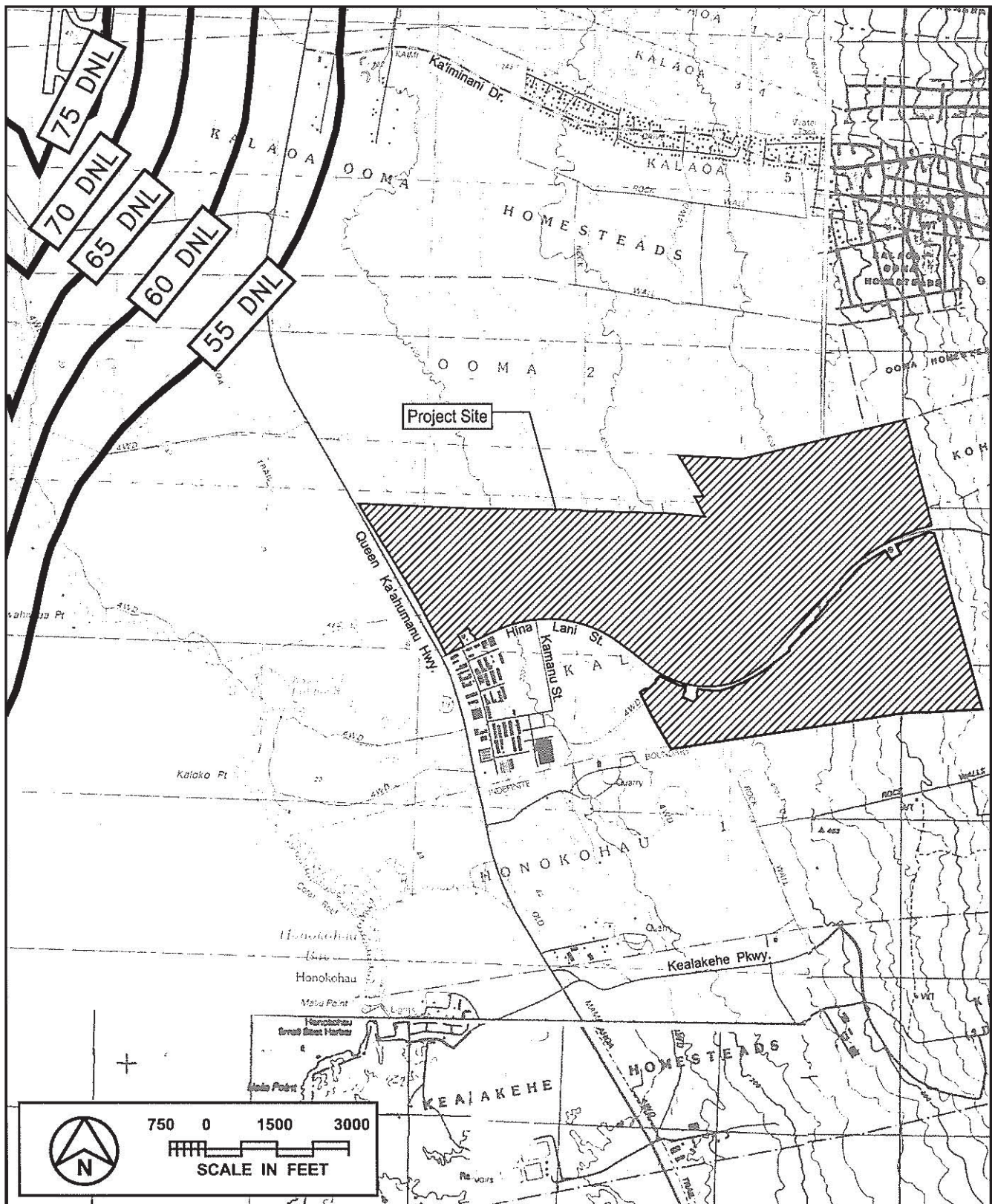
Kaloko Makai



Source: Acoustic Study for the Proposed Kaloko Makai Project, Y. Ebisu & Associates, August 2012



FIGURE 4-12
Locations of Existing Average Aircraft Training Flight Tracks in
Project Environs
Kaloko Makai



Source: Acoustic Study for the Proposed Kaloko Makai Project, Y. Ebisu & Associates, August 2012



FIGURE 4-13
2008 14 CFR Part 150 Noise Contours for Kona International Airport
at Keahole
Kaloko Makai

“Minimal Exposure, Unconditionally Acceptable” category for the planned land uses on the project site. Based on these 14 CFR Part 150 noise contours and their relationship to the project site it was concluded that special aircraft noise mitigations are not required, and that existing aircraft noise levels do not place special development constraints on the project site. The acoustic study further concludes that existing aircraft noise levels over and within the proximity of the project site fall well in line with federally mandated compatibility guidelines, as well as with the proposed land uses of Kaloko Makai.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Potential impacts on the ambient acoustic integrity of the site and surrounding project area due to the development of Kaloko Makai are primarily constrained to short-term construction activity, and long-term human activity within the community.

Short-term Construction Noise – During construction, there will likely be unavoidable noise impacts associated with operation of heavy construction machinery, paving equipment and material transport vehicles. Proper mitigating measures will be employed to minimize construction-related noise impacts and comply with all Federal and State noise control regulations. Increased noise activity due to construction will be limited to daytime hours and persist only during the construction period. Noise from construction activities will be short-term and will comply with DOH noise regulations (Hawaii Administrative Rules (HAR), Chapter 11-46, Community Noise Control). When construction noise exceeds, or is expected to exceed the DOH’s allowable limits, a permit must be obtained from the DOH. Specific permit restrictions for construction activities are:

- No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday.
- No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels before 9:00 a.m. and after 6:00 p.m. on Saturday.
- No permit shall allow any construction activities that would emit noise in excess of the maximum permissible sound levels on Sundays and holidays.

Traffic Noise – Table 4-20 summarizes the traffic noise levels by calendar year 2045 following complete project build-out. Traffic noise levels along Queen Ka’ahumanu Highway in the areas fronting the project site are predicted to increase by approximately 6 to 7 DNL. Along Māmalahoa Highway, traffic noise levels are predicted to increase by 2 to 3 DNL. Along Hina Lani Street, traffic noise levels are predicted to increase by 6 to 9.4 DNL. The range of increases in traffic noise levels from 0 to 6 is considered to be low to moderate, since it represents the growth in forecasted project and non-project traffic in the project area over the buildout of the project (2045.) The range of increases from 6 to 10 DNL over the same period is considered to be moderate to high.

Table 4-21 summarizes the predicted increases in future setback distances to the 65 and 75 DNL traffic noise contour lines along the roadways in the project environs attributable to both project and non-project traffic in 2045. The setback distances to the 65 DNL contour are predicted to range from 292 feet to 348 feet from the centerline of Queen Ka’ahumanu following project build-

STREET SECTION	NOISE LEVEL (DNL) INCREASE DUE TO:	
	NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Māmalahoa Hwy. – N. of Hina Lani St.	2.2	0.9
Māmalahoa Hwy. – S. of Hina Lani St.	1.2	1.1
Hina Lani St. – W. of Māmalahoa Hwy.	4.1	2.2
Hina Lani St. – E. of Ane Keohokālole Hwy.	4.9	4.5
Ane Keohokālole Hwy. – N. of Hina Lani St.	59.5	5.1
Ane Keohokālole Hwy. – S. of Hina Lani St.	62.8	2.4
Hina Lani St. – W. of Ane Keohokālole Hwy.	3.2	5.3
Hina Lani St. – E. of Kamanu St.	2.2	6.7
Hina Lani St. – W. of Kamanu St.	1.2	7.4
Hina Lani St. – E. of Queen Ka’ahumanu Hwy.	0.6	5.4
Kamanu St. – N. of Hina Lani St.	N/A	60.1
Queen Ka’ahumanu Hwy. – N. of Hina Lani St.	5.2	1.1
Queen Ka’ahumanu Hwy. – S. of Hina Lani St.	4.9	2.2

STREET SECTION	65 DNL SETBACK (FT)		75 DNL SETBACK (FT)	
	2011	2045	2011	2045
Māmalahoa Hwy. – N. of Hina Lani St.	95	136	28	40
Māmalahoa Hwy. – S. of Hina Lani St.	93	121	26	35
Hina Lani St. – W. of Māmalahoa Hwy.	76	159	21	48
Hina Lani St. – E. of Ane Keohokālole Hwy.	64	223	18	57
Ane Keohokālole Hwy. – N. of Hina Lani St.	N/A	96	N/A	31
Ane Keohokālole Hwy. – S. of Hina Lani St.	N/A	103	N/A	33
Hina Lani St. – W. of Ane Keohokālole Hwy.	64	197	18	50
Hina Lani St. – E. of Kamanu St.	64	208	18	52
Hina Lani St. – W. of Kamanu St.	54	172	15	42
Hina Lani St. – E. of Queen Ka’ahumanu Hwy.	86	197	24	48

Table 4-21 (continued)				
Year 2011 and 2045 Distances to 65 and 75 DNL Contours				
STREET SECTION	65 DNL SETBACK (FT)		75 DNL SETBACK (FT)	
	2011	2045	2011	2045
Kamanu St. - N. of Hina Lani St.	N/A	56	N/A	17
Queen Ka'ahumanu Hwy. - N. of Hina Lani St.	132	292	38	92
Queen Ka'ahumanu Hwy. - S. of Hina Lani St.	141	348	41	107
Notes:				
(1) All setback distances are from the roadways' centerlines.				
(2) See Tables 5A, 5B, 7A, and 7B in Appendix L for traffic volume, speed, and mix assumptions.				
(3) Setback distances are for unobstructed line-of-sight conditions.				

out in 2045. Along Māmalahoa Highway, setback distances to the 65 DNL contour are predicted to range from 121 to 136 feet from the centerline of Māmalahoa Highway. Along Hina Lani Street, setback distances to the 65 DNL contour are expected to range from 159 to 223 feet.

As indicated in Table 4-20, the increases in traffic noise along Queen Ka'ahumanu Highway due to project traffic are much greater than those resulting from non-project traffic. Along Māmalahoa Highway, project traffic noise contributions are expected to be much less than non-project traffic noise contributions by 2045. Along Hina Lani Street, project traffic is expected to increase traffic noise levels above those associated with non-project traffic by 2.2 to 7.4 DNL. The largest increases in traffic noise levels attributable to project traffic are expected to occur along Hina Lani Street near Kamanu Street. The relatively large increases in future traffic noise levels along Ane Keohokālole Highway are due to the relatively low non-project traffic volumes expected on that roadway prior to 2045.

By 2045 with the project, a highway interchange will be required on Queen Ka'ahumanu at Hina Lani Street. In cooperation with the County (pursuant to the Kona CDP) and other project developers in the area, Kaloko Makai will pay for its pro rata share of the costs of the interchange. The proposed park at the west end of the Project Site is the closest land use to the future interchange which may be considered noise sensitive. In order that the 2045 traffic noise levels not exceed 65 DNL at the park's west boundary, the centerline of the northbound on-ramp should be located at least 85 feet west of the park's west boundary.

The predicated noise level from the grade separation interchange in 2045 ws 65 DNL at 116 feet from the centerline of the ramp structure (interchange). Because the overpass ramp structure will probably be located on the northwest quadrant of the interchange, the 65 DNL count from Queen Ka'ahumanu Highway through traffic will extend between 110 to 130 feet beyond the westernmost edge of the overpass ramp structure. Beyond the future interchange at Hina Lani Street, the 2045 setback distances to the highway's 65 DNL contours north and south of Hina Lani Street should be similar to those shown in Table 4-21.

Increased traffic noise attributable to the project ranging from the present to the 2045 horizon are predicted to range from 1.1 to 2.2 DNL along Queen Ka'ahumanu Highway, where traffic noise levels

are expected to be at or above 65 DNL at relatively large distances from the highway right-of-way. The project's development plan has allowed for adequate setback distances of the project's noise sensitive parcels from Queen Ka'ahumanu Highway, with the light industrial properties acting as a functional buffer for sound attenuation between the highway and the noise sensitive parcels planned to the east. The lands along the highway right-of-way are generally vacant in the project environs, with the exception of a handful of existing commercial developments south of the Hina Lani Street intersection. Resultantly, traffic noise impacts along Queen Ka'ahumanu Highway and resulting from project traffic are not considered to be serious, however, setback distances to the 65 and 75 DNL contours are expected to increase as a result of both project and non-project traffic.

Relatively small increases (1.0 DNL or less) in traffic noise levels along the north and south sections of Māmalahoa Highway at the Hina Lani intersection are expected to occur as a result of the proposed project. Non-project traffic is expected to cause increases of 1.2 and 2.2 DNL (see Table 4-20) during the same period. By 2045, project traffic is expected to increase traffic noise levels along the north and south sections of Māmalahoa Highway by approximately 0.9 and 1.1 DNL, respectively. This level of increase is not considered significant, and traffic noise levels resulting from project traffic along these sections of the highway will be difficult to quantify over 34 year period.

Existing and future residences which are located along the Hina Lani Street, between Māmalahoa Highway and Queen Ka'ahumanu Highway, may be impacted by the future traffic noise along the roadway if setback distances from roadway centerline is less than 223 feet. As traffic noise along public roadways such as Hina Lani Street is generated by non-project as well as project traffic, mitigation of off-site traffic noise impacts are generally performed by individual property owners along the roadways' rights-of-way or by public agencies during roadway improvement projects. These mitigation measures ordinarily take the form of increased setbacks, sound attenuating walls, total closure and air-conditioning, in addition to the utilization of sound attenuating windows and window fixtures. Where adequate setbacks beyond the 65 DNL noise contour are not available, Kaloko Makai proposes to utilize 6 foot high sound walls as an effective means of traffic noise attenuation for single-story structures, or at the ground floors of multi-story structures. Along the future Ane Keohokālole Highway, project residences and school buildings will require setback distances in the order of 96 to 103 feet from the centerline of the highway, or sound attenuation walls constructed along the rights-of-way may be required for traffic noise mitigation.

Aircraft Noise – Aircraft noise contours in the project environs for the 2013 and 2030 periods are similar to the existing (2008) airport noise contours, thus the risks of adverse noise impacts from aircraft noise should be minimal at the project site, and the proposed noise sensitive developments on the project site conforms to the land use compatibility recommendations of the State DOT, Airports Division.

In observance of existing and forecasted aircraft noise contours over the project site, special aircraft noise attenuation measures are not considered mandatory for the project. Furthermore, the implementation of airport noise disclosure provisions of Act 208 is not required as existing and forecasted 55 DNL noise contours do not enter the project's physical boundaries.

4.6. AIR QUALITY

B.D. Neal & Associates prepared an air quality study for the proposed Kaloko Makai project to: 1) define existing air quality in the project region; 2) evaluate the potential short- and long-term direct and indirect air quality impacts that may arise from the development of Kaloko Makai; 3) advise on actionable measures and policies to mitigate potential impacts where possible and appropriate. The findings of the air quality study are summarized below and the report is included in its entirety in Appendix M.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its near coastal situation and nearby mountains. Winds are predominantly light and variable, although Kona storms generate occasional strong winds from the south or southwest during winter. Temperatures in the project area are generally very consistent and moderate with average daily temperatures ranging from about 65° to 85°F. The extreme minimum temperature recorded at the nearby Old Kona Airport is 47°F, while the extreme maximum temperature is 93°F. Average annual rainfall in the area amounts to about 25 inches with each month typically contributing about 2 inches.

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Much of the manmade particulate emissions in Hawai'i originate from area sources, such as the mineral products industry and agriculture. Manmade sulfur oxides are emitted almost exclusively by point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions emanate predominantly from area sources (mostly motor vehicle traffic), although industrial point sources contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Hawai'i, emissions of particulate and nitrogen oxides may have increased during the past several years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have likely declined.

Table 4-22 summarizes State of Hawai'i and National Ambient Air Quality Standards (AAQS). At this time, there are no reported measurements of lead, ozone, nitrogen dioxide or carbon monoxide in the project vicinity. These are primarily motor vehicle related air pollutants. Lead, ozone and nitrogen dioxide typically are regional scale problems. Concentrations of lead and nitrogen dioxide generally have not been found to exceed AAQS elsewhere in the state.

Unlike its sister islands, the Island of Hawai'i is unique in that it experiences frequent volcanic activity. Specifically in terms of natural volcanic air pollution, concentrated volcanic haze (vog), comprised primarily of sulfur dioxide, persistently looms over the island. After entering the atmosphere, these sulfur dioxide emissions are carried away by the wind and either washed out as acid rain or gradually transformed into particulate sulfates or acid aerosols. Although emissions from Kilauea are vented on the other side of a mountain barrier more than 50 miles east of the project site, the prevailing wind patterns eventually carry some of the emissions into the Kona area. These emissions can be seen in the form of the volcanic haze (vog) which persistently looms over the region.

Table 4-22 Summary of State of Hawai'i and National Ambient Air Quality Standards					
Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawai'i
Particulate Matter (<10 microns)	µg/m ³	Annual 24 Hours	- 150 ^a	- 150 ^a	50 150 ^b
Particulate Matter (<2.5 microns)	µg/m ³	Annual 24 Hours	15 ^c 35 ^d	15 ^c 35 ^d	- -
Sulfur Dioxide	ppm	Annual 24 Hours	- -	- -	0.03 0.14 ^b
		3 Hours	-	0.5 ^b	0.5 ^b
		1 Hour	0.075 ^e	-	-
Nitrogen Dioxide	ppm	Annual 1 Hour	0.053 0.100 ^f	0.053 -	0.04 -
		8 Hours 1 Hour	9 ^b 35 ^b	- -	4.4 ^b 9 ^b
Ozone	ppm	8 Hours	0.075 ^g	0.075 ^g	0.08 ^g
Lead	µg/m ³	3 Months Quarter	0.15 ^h 1.5 ⁱ	0.15 ^h 1.5 ⁱ	- 1.5 ⁱ
		Hydrogen Sulfide	ppm	1 Hour	-

^a Not to be exceeded more than once per year on average over three years.
^b Not to be exceeded more than once per year.
^c Three-year average of the weighted annual arithmetic mean.
^d 98th percentile value of the 24-hour concentrations averaged over three years.
^e Three-year average of annual fourth highest daily 1-hour maximum.
^f 98th percentile value of the daily 1-hour maximum average over three years.
^g Three-year average of annual fourth highest daily 8-hour maximum.
^h Rolling 3-month average
ⁱ Quarterly average.

Major industrial source of air pollution in the project vicinity is Hawai'i Electric Light Company's Keahole Power Plant, which is located approximately 2 miles to the north. Air pollution emissions consist of sulfur dioxide and oxides of nitrogen.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion, the present air quality of the project area is believed to be relatively good. The limited air quality data that are available for the area from the DOH indicate that fine particulate concentrations, which are due to the vog, exceed the national air quality standards.

POTENTIAL IMPACTS AND MITIGATION MEASURES

If the proposed project is given the necessary approvals to proceed, the development and continued operation of the Kaloko Makai project will inevitably result in a number of short- and long-term impacts to regional air quality as direct or indirect consequence of project construction and use. It is however anticipated that no Federal or State air quality standards will be infringed upon by Kaloko Makai's development and operation.

Short-term Impacts- Short-term impacts to regional air quality will likely arise from construction, and construction related activities. For a project of this nature, there are two potential types of air pollution that could directly result in short-term air quality impacts during project construction: 1) fugitive dust from vehicle movement and soil excavation; and 2) exhaust emissions from on-site construction equipment. Fugitive dust emissions may result from grading and dirt-moving activities associated with site clearing and preparation work. Furthermore, project construction activities may potentially obstruct the normal flow of traffic to such an extent that overall vehicular emissions in the project area will temporarily increase.

A dust/particulate matter control plan will be implemented throughout the entire construction phase. All construction and construction related activities will comply with the provision set forth in Chapter 11-60.1-33 of the HAR on fugitive dust. Measures to be utilized include:

- Planning construction in phases to minimize the amount of dust-generating materials and activities, refining on-site vehicular traffic routes, and situating potential dust-generating equipment in areas of minimal impact.
- Watering active work areas and any temporary unpaved work roads on a consistent, daily basis.
- Landscaping and accelerated covering of barren areas, including slopes, commencing from the outset of the grading phase.
- Controlling dust from debris and materials being hauled off-site.
- Using wind screens and/or minimizing the area of disturbance as possible at any given time.
- Preventing trucks from tracking dirt and sediment onto paved roadways by routine road washing and tire cleaning.
- Monitoring dust at the project site boundary throughout construction as a method of evaluating the efficiency of the dust/particulate matter control program, and subsequently modifying and updating the program as deemed necessary.

Long-term Impacts- Post-construction, the increase in regional population and internal community traffic may potentially result in a long-term increase in emissions; however, it is anticipated that concentrations will fall well within State and Federal standards. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide, and also emit nitrogen oxides among other contaminants.

To evaluate the potential long-term indirect ambient air quality impact of the increased roadway traffic associated with a project such as Kaloko Makai, computerized emission and atmospheric dispersion study were undertaken to contrast ambient concentrations of carbon monoxide levels at critical receptor areas in the vicinity of the project site. Seven scenarios were evaluated for carbon

monoxide: 1) 2011 with present conditions; 2) years 2025, 2035, and 2045 without the Project; and 3) years 2025, 2035, and 2045 with Project. For this analysis, roadway intersections were identified as critical receptor areas because of traffic congestion and the subsequent increase in vehicular emissions associated with traffic queuing. For this study, several of the key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Queen Ka'ahumanu Highway at Huliko'a Drive
- Queen Ka'ahumanu Highway at Ka'iminani Drive
- Queen Ka'ahumanu Highway at Hina Lani Street
- Queen Ka'ahumanu Highway at Kealakehe Parkway
- Hina Lani Street at Kamanu Street
- Hina Lani Street at Māmalahoa Highway
- Hina Lani Street at Ane Keohokālole Highway (future)

The assessment was based on the future traffic conditions and proposed configurations of the above intersections in the Traffic Impact Assessment Report (see Section 4.4 and Appendix K for more details).

Tables 4-23 and 4-24 summarize the worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations for the seven scenarios. As indicated in Tables 4-23 and 4-24, all predicted worst-case 1-hour concentrations for the 2011 scenario were within both the National AAQS of 35 ppm and the State standard of 9 ppm. The predicted concentrations for 2025 without the project are slightly higher at most of the locations studied compared to the 2011 scenario, but the predicted worst case concentrations remained within the standards. The results were similar for 2035 and 2045 without the project, with the worst-case concentrations tending to increase slightly, but concentrations still remained within standards.

With the project and assuming the roadway improvements identified in the TIAR are implemented, carbon monoxide concentrations in the year 2025 were predicted to increase compared to the without project scenario at all locations studied. However, the predicted worst-case concentrations remained within the standards.

In 2035 with Project, this trend would tend to continue. In 2045 with Project, worst-case concentrations generally decreased (improved) slightly or remained unchanged. For all three years with Project, worst-case concentrations were predicted to remain within standards.

Tables 4-25 and 4-26 summarize the worst-case 8-hour morning and afternoon ambient carbon monoxide concentrations for the seven scenarios. As indicated in Tables 4-25 and 4-26, all predicted worst-case 8-hour concentrations for the 2011 scenario were within both the National AAQS of 9 ppm and the State standard of 4.4 ppm. The predicted concentrations for 2025 without the project increased slightly or remain nearly unchanged compared to the 2011 scenario. Analysis also shows that this trend would continue through 2035 and 2045 without the Project, and worst-case 8-hour concentrations should remain within the standards through 2045.

Table 4-23
Estimated Worst-Case 1-Hour Carbon Monoxide Concentrations
Along Roadways Near Kaloko Makai Project: Present and Without Project (parts per million)

ROADWAY INTERSECTION	YEAR/SCENARIO							
	2011/Present		2025/Without Project		2035/Without Project		2045/Without Project	
	AM	PM	AM	PM	AM	PM	AM	PM
Queen Ka’ahumanu Highway at Ka’iminani Drive	2.7	1.9	2.5	1.8	3.0	2.2	2.9	2.0
Queen Ka’ahumanu Highway at Huliko’a Drive	2.9	1.9	3.0	1.9	3.3	2.1	3.2	2.0
Queen Ka’ahumanu Highway at Hina Lani Street	2.9	2.6	3.2	2.7	3.4	2.7	3.4	2.4
Queen Ka’ahumanu Highway at Kealakehe Parkway	3.6	2.3	3.9	2.7	4.3	2.9	4.3	2.8
Hina Lani Street at Kanalani Street	2.3	1.7	2.3	1.6	2.2	1.6	1.9	1.4
Hina Lani Street at Kamanu Street	1.4	1.5	1.7	1.6	1.5	1.5	1.3	1.5
Hina Lani Street at Ane Keohokālōle Highway	-	-	1.5	1.4	2.5	2.0	2.3	1.8
Hina Lani Street at Māmalahoa Highway	2.2	1.5	2.8	1.8	2.8	1.8	2.7	1.8
Hawai’i State AAQS: 9 National AAQS: 35								

Table 4-24
Estimated Worst-Case 1-Hour Carbon Monoxide Concentrations
Along Roadways Near Kaloko Makai Project: With Project (parts per million)

ROADWAY INTERSECTION	YEAR/SCENARIO					
	2025/With Project		2035/With Project		2045/With Project	
	AM	PM	AM	PM	AM	PM
Queen Ka’ahumanu Highway at Ka’iminani Drive	2.9	2.1	4.0	3.0	4.6	2.8
Queen Ka’ahumanu Highway at Huliko’a Drive	3.6	2.2	3.9	2.5	3.4	2.2
Queen Ka’ahumanu Highway at Hina Lani Street	5.4	3.6	5.6	4.4	-	-
Queen Ka’ahumanu Highway at Kealakehe Parkway	5.1	3.6	5.8	3.9	5.5	3.6
Hina Lani Street at Kanalani Street	3.1	2.0	3.4	2.2	3.4	2.3
Hina Lani Street at Kamanu Street	3.3	3.0	3.7	2.9	3.6	2.9
Hina Lani Street at Ane Keohokālōle Highway	2.7	2.1	4.2	2.8	4.3	3.0
Hina Lani Street at Māmalahoa Highway	3.8	2.4	4.1	2.6	4.2	2.5
Hawai’i State AAQS: 9 National AAQS: 35						

Table 4-25				
Estimated Worst-Case 8-Hour Carbon Monoxide Concentration				
Along Roadways Near Kaloko Makai Project: Present and Without Project (parts per million)				
ROADWAY INTERSECTION	YEAR/SCENARIO			
	2011/Present	2025/Without Project	2035/Without Project	2045/Without Project
Queen Ka’ahumanu Highway at Ka’iminani Drive	1.4	1.2	1.5	1.4
Queen Ka’ahumanu Highway at Huliko’a Drive	1.4	1.5	1.6	1.6
Queen Ka’ahumanu Highway at Hina Lani Street	1.4	1.6	1.7	1.7
Queen Ka’ahumanu Highway at Kealakehe Parkway	1.8	2.0	2.2	2.2
Hina Lani Street at Kanalani Street	1.2	1.2	1.1	1.0
Hina Lani Street at Kamanu Street	0.7	0.8	0.8	0.8
Hina Lani Street at Ane Keohokālole Highway	-	0.8	1.2	1.2
Hina Lani Street at Māmalahoa Highway	1.1	1.4	1.4	1.4
Hawai’i State AAQS: 4.4 National AAQS: 9				

Table 4-26			
Estimated Worst-Case 8-Hour Carbon Monoxide Concentrations			
Along Roadways Near Kaloko Makai Project: With Project (parts per million)			
ROADWAY INTERSECTION	YEAR/SCENARIO		
	2025/With Project	2035/With Project	2045/With Project
Queen Ka’ahumanu Highway at Ka’iminani Drive	1.4	2.0	2.3
Queen Ka’ahumanu Highway at Huliko’a Drive	1.8	2.0	1.7
Queen Ka’ahumanu Highway at Hina Lani Street	2.7	2.8	-
Queen Ka’ahumanu Highway at Kealakehe Parkway	2.6	2.9	2.8
Hina Lani Street at Kanalani Street	1.6	1.7	1.7
Hina Lani Street at Kamanu Street	1.6	1.8	1.8
Hina Lani Street at Ane Keohokālole Highway	1.4	2.1	2.2
Hina Lani Street at Māmalahoa Highway	1.9	2.0	2.1
Hawai’i State AAQS: 4.4 National AAQS: 9			

For 2025 with Project scenario, worst-case 8-hour concentrations increased at all locations studied. Worst-case concentrations for 2035 and 2045 were predicted to increase slightly or remain nearly unchanged, but still remain within the standards.

The air quality study concludes that the implementing any air quality mitigation measures for long-term traffic-related impacts is probably unnecessary and unwarranted.

Construction contractors will comply with the State DOH regulations that prohibit visible dust emissions at property boundaries. Compliance with State regulations will require adequate measures to control airborne dust by methods such as water spraying and sprinkling of loose or exposed soil or ground surface areas and dust-generating equipment, and the use of wind screens in sensitive areas during construction.

No significant impacts on air quality are anticipated with appropriate mitigation during the construction phase and no violations of federal and state air quality standards are anticipated in the long-term.

Electrical Demand and Solid Waste Demand- The air quality study concludes that any long-term impacts on air quality resulting from indirect emissions stemming from the provision of electricity and fulfillment of solid waste disposal requirements for the project will likely be small based on the relatively minute magnitudes of these emissions. Table 4-27 details the projected indirect air pollution emissions from Kaloko Makai's anticipated electrical demand. Regardless, Kaloko Makai will seek to include and promote renewable technologies and measures to reduce further reduce any associated impacts and to engender the conservation of the island's natural resources and environment.

AIR POLLUTANT	EMISSION RATE (TONS/YEAR)			
	Phase 1	Phase 2	Phase 3	Total
Particulate	9	9	4	22
Sulfur Dioxide	91	91	44	226
Carbon Monoxide	9	9	4	22
Volatile Organics	<1	<1	<1	1
Nitrogen Oxides	39	39	19	97
*Based on U.S. EPA emission factors for utility boilers [2]. Assumes annual electrical demand of 35 million kw-hrs for Phase 1, 35 million kw-hrs for Phase 2 and 17 million kw-hrs for Phase 3, for a total of 87 million kw-hrs per year of electrical power use [12]. Estimated emission rates assume low-sulfur oil used to generate power.				

4.7. VISUAL RESOURCES

The project site occupies an area of relatively uniform slope, ranging from 5 to 8%. The lowest elevation along the makai boundary of the site is approximately 100-feet AMSL. Along the mauka boundary, the site reaches an elevation of about 700-feet AMSL.

As described in Chapter 3, the project area is presently undeveloped land overgrown with scrub forest that includes grasses, trees and dense Christmasberry. The project also includes 150-acre Dryland Forest located within the southern portion of the project site.

Due to the sloping topography, the project site is highly visible from lower elevations looking uphill. It is less visible looking laterally along the same elevation, such as the view from Hina Lani. Visibility looking downhill depends on the elevation of the viewpoint and any obstructions such as vegetation or structures. Most of the views from Māmalahoa Highway are obscured by homes and vegetation along the makai side of the highway.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Development of the project site will result in the replacement of vacant and vegetated land with urban uses such as homes, a hospital, and light industrial uses. There will also be generous open space features including approximately 293 acres of parks and open space consisting of 87 acres of open space, 56 acres of parks, and preservation of a Dryland Forest.

Kaloko Makai will be visible almost entirely from the shoreline and Queen Ka'ahumanu Highway looking mauka and visible from existing surrounding developments which lie to the east. The project site will appear as a continuation of the proposed Kaloko Heights and Kula Nei developments to the east and Kaloko Industrial Park to the south.

From the shoreline and Queen Ka'ahumanu Highway, Kaloko Makai will be distinguishable from the open and undeveloped areas surrounding the project site on the north, east and south.

The proposed project will not obstruct views from Queen Ka'ahumanu Highway or from the shoreline to the summit of Hualalai because of its location on the lower slope of the mountain.

The views of the on-site wastewater treatment plant and desalinization plant will be landscaped and setback to reduce the visual impact.

4.8. PUBLIC SERVICES AND FACILITIES

4.8.1. Police Protection

The Kealakehe Police Station, located on Queen Ka'ahumanu Highway less than 2 miles south of the project site, provides service to the North and South Kona Districts. The station has a force of 45 uniformed officers, with ten patrol units assigned to each of the three watches within a 24-hour period. There is also a small substation in Captain Cook for South Kona.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project will increase housing inventory and resident population in the project area, thereby increasing the demand on existing County police services. The proposed project may require an increase in police staffing and possible expansion of existing police facilities that would presumably be funded out of property taxes generated by the project.

Kaloko Makai will coordinate with the Police Department to address service capabilities of police protection services, address their concerns, and develop appropriate mitigation measures, if appropriate. Plans include providing a site for a Fire Station with room for a Police Sub-Station on Hina Lani Street.

4.8.2. Fire Protection

Fire protection service for the project area is provided by the Kailua-Kona Fire Station located approximately 3.6 miles to the southeast near the intersection of Palani Avenue and Queen Ka'ahumanu Highway. The station serves areas within a 30-miles radius extending from Keauhou to the Kona Village Resort. The station is equipped with a ladder truck, a tanker, a rescue boat, and an Emergency Medical Service (EMS) ambulance. There is also a volunteer-operated fire station along Māmalahoa Highway that provides back-up support to the Kailua-Kona Station. Other fire stations are located in South Kohala, Waikoloa, and Keauhou.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project will increase housing inventory and resident population in the project area, thereby increasing the demand on existing County fire protection services. The proposed project may require an increase in fire protection service and possible expansion of existing fire protection facilities that would presumably be funded out of property taxes generated by the project.

The proposed project will provide a water system whereby all appurtenances, hydrant spacing and fire flow requirements will meet the standards of the County of Hawai'i. Kaloko Makai will contain fire prevention measures including access roads in accordance with Uniform Fire Code (UFC) Section 10.207, water supply for fire suppression in accordance with UFC Section 10.301(c), buildings under construction in compliance with the provisions of UFC Article 87.

As discussed in Section 3.4.6, Kaloko Makai development will reduce the probability of wildfires on site by replacing vegetation with buildings and structures. Additionally, landscaping will incorporate native species and appropriate vegetation for the area.

To further support firefighting efforts, Kaloko Makai may install a helicopter dip tank within the Kaloko Makai Dryland Forest Preserve. It will be placed in the previously graded portion of land within the Dryland Forest Preserve.

Kaloko Makai will coordinate with the Fire Department to address service capabilities of fire protection services, address their concerns, and develop appropriate mitigation measures, if

appropriate. Plans include providing a site for a Fire Station with room for a Police Sub-Station on Hina Lani Street.

4.8.3. Health Care Services

Kona Community Hospital (KCH) is the primary health care facility serving West Hawai'i. KCH is a 94-bed full-service medical center; including 49-beds Acute, 34-beds Skilled Nursing/Long Term Care, and an 11-bed Psychiatric Unit. It is located in Kealahou, Kona, 18 miles south of Kona International Airport.

KCH is part of the State of Hawai'i's public hospital system, operated by the Hawai'i Health Systems Corporation (HHSC). HHSC is a public benefit corporation governed by a 13-member Board of Directors whose responsibility is to develop policies, procedures, and rules necessary to plan, operate, and manage the 13 facilities included in the State's public hospital system.

KCH employs approximately 475 employees. There are a little over 60 active medical staff members representing a wide variety of medical specialties. Approximate annual workload consists of over 4,000 acute inpatient admissions, nearly 500 births and over 15,000 emergency room visits.

In 2010, KCH was designated a Level III emergency center. Under this program, first responders alert the emergency room to the arriving trauma patients; a trauma announcement is made at the hospital and team members assemble in the emergency room prior to the patient's arrival.

Another medical facility in the region is the North Hawai'i Community Hospital in Waimea. The hospital has 50 beds and provides a full spectrum of acute care services, including a 24-hour emergency room, medical/surgical care, obstetrical/gynecological care, cardiac care, and long-term care.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project will increase the demand on the existing medical and emergency services in the North Kona region. Kaloko Makai is strategically located to incorporate the new hospital into its master plan and is actively pursuing a hospital developer/operator for the new facility on a 40-acre site along Ane Keohokālole Highway. The site will also have access to Queen Ka'ahumanu Highway via Hina Lani Street and interconnecting roads (possibly also through adjoining Kohanaiki Business Park). A new regional hospital for Kona is projected to provide approximately 100-150 total beds (with 150 targeted - which will include between 50-70 beds for medical surgery) to serve the growing West Hawai'i population.

Ultimately, Kaloko Makai intends to continue discussions with HHSC and KCH concerning the new hospital at Kaloko Makai. Any new hospital may impact the future operations of KCH. A transition plan needs to be developed for the ultimate use of the KCH.

A new regional hospital at Kaloko Makai will likely replace some of the services (primarily the acute care medical surgery) that are presently performed at KCH. It is envisioned that KCH will remain

open, transitioning out of acute care and into a long-term care facility. In addition, the existing KCH emergency room, some outpatient services, oncology and imaging will remain at KCH.

4.8.4. Schools

Schools servicing the project area include Kealakehe Elementary, Kealakehe Intermediate and Kealakehe High Schools located approximately two (2) miles to the southeast. The elementary school's capacity is 1,064 students, and the 2009/2010 school year enrollment was 946 students (Department of Education, 2010a). Kealakehe Intermediate School, with facilities for 1,078 students, has an enrollment of 850 students (Department of Education, 2010b). Kealakehe High School opened in 1997, and currently has a student body numbering 1,610 (Department of Education, 2010c).

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project will generate increased demand on student enrollment within the region. The Applicant will dedicate land to the State Department of Education (DOE) for three sites in selected locations, anticipated to be comprised of two elementary schools and one middle school, as well as provide for all required off-site infrastructure.

Based on the proposed components within the Kaloko Makai project, full build-out (after the 30-year development and marketing period) population estimates indicate that approximately 12,000 to 15,000 people will live at Kaloko Makai.

Applying State DOE criteria for student generation estimates, after the 30-year build-out (the year 2045), the 5,000-units proposed in Kaloko Makai will generate an estimated stabilized student body of approximately 1,207 school-aged children.² This is broken down as approximately 641-Elementary School, 275-Middle School and 291-High School students.

In 2008, the Board of Education (BOE) adopted a policy on School Design Enrollment Guidelines. In that policy, the following enrollment and land area guidelines were established (see Table 4-28):

School Type	Enrollment	Usable Land Area
Elementary (K-5)	400 - 750	8 - 15
Middle (6-8)	500 - 1,000	15 - 20
High (9-12)	800 - 1,000	50

Given these parameters, Kaloko Makai generates the need for an Elementary School but falls short of the BOE suggested guidelines for a Middle and/or a High School.

²The 1,207 school aged children estimate is broken down as approximately 641-Elementary School, 275-Middle School and 291-High School students.

School campuses can and should be the center of a community. The core focus of the Kaloko Makai neighborhoods are its schools and adjoining parks which serve as civic spaces, neighborhood centers and gathering places for arts, culture, education and recreation.

Several schools are proposed within Kaloko Makai, each within the neighborhood pedestrian shed and easy walking distance for neighborhood residents. Kaloko Makai is setting aside approximately 42 acres for three schools, proposed to be two elementary schools and one middle school, as shown in Figure 2-11. School sites include buildings and facilities, plus school-associated playgrounds

It is envisioned that each school, in conjunction with the adjoining park, will serve as a draw to bring the community into a multi-generational learning center that provides life-long learning opportunities and interaction of the residents within the community.

Consistent with the policy on education within the Kona CDP (Public Facilities – PUB-6.3a,) Kaloko Makai will seek cooperation with the State DOE for joint use of school facilities for recreational and community uses.

The goal is to draw all segments of the community to the school, throughout the day, rather than limit their use for the children during the weekday school hours.

Rather than stand-alone, children-based facilities that tend to serve only a portion of the population, Kaloko Makai schools will seek to encourage community access and use for all of the schools, after the State DOE school day. This will make for more efficient use of limited public resources, as well as bring the community together into central, core facilities.

While the scale of fixtures and equipment in elementary schools may not be applicable for adult use, school cafeterias may serve a dual role as community gathering place and meeting halls. Likewise, school libraries and other meeting rooms may further drive wider community use.

4.8.5. Recreational Facilities

Kailua Park (aka Old Airport Park/Maka'eo), located on the site of the former airport, is the only full-service active recreational park in the region. There are five baseball fields, two soccer fields, two football fields, and four tennis courts. Gym facilities include a full-sized basketball court, a multi-purpose room, and a small office.

The Honokōhau Small Boat Harbor is located approximately 1 mile southwest of the project site on Honokōhau Bay. Approximately 450 berthing slips are provided for both recreational and commercial vessels. The Harbor is administered by the State DLNR, Division of Boating and Ocean Recreation (DOBOR).

The 1,178-acre Kaloko-Honokōhau National Historical Park, located west of the project site, makai of Queen Ka'ahumanu Highway, is administered by the National Park Service. The Park contains extensive natural and cultural resources, such as archaeological sites, wetlands and fishponds, and is designated as a national historical landmark.

The playfields at Kealakehe High School are located approximately 1 mile south of Kaloko Makai.

Other State parks located elsewhere in Kona include Kealakekua Bay State Historical Park, Kekaha Kai State Park, and Keolonāhihi State Historical Park.

County parks in the region include Wai'aha (Honl's) Beach Park, La'aloa (Magic Sands) Beach Park, Ho'okena Beach Park, Kahalu'u Beach Park, Miloli'i Beach Park, and Pāhoehoe Beach Park. The Kona Community Aquatic Center, administered by the County of Hawai'i, provides facilities for lap swimming, and also includes a water-play area for young children.

Tennis courts are also available at Arthur L. Greenwell Park in Captain Cook, Harold H. Higashihara Park in Keauhou, and at Kailua Playground. There are also numerous private, semi-private, and resort-owned golf courses in the area which are open to the public.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project will increase demand for recreational facilities in the region. Both active and passive recreation parks are planned for the project which will comply with applicable County park dedication requirements.

Kaloko Makai will contain approximately 56 acres of neighborhood parks and recreation areas. Kaloko Makai will provide interlinking natural features, open space and cultural features as core components of the community; the historic Kohanaiki Trail (Road to the Sea) runs through the entire length of the project. It will be restored for use, and will interconnect the communities within the project.

As discussed in the previous Section 4.8.4, Kaloko Makai will seek cooperation with the State DOE for joint use of school facilities for recreational and community uses, to be consistent with the policy on education within the Kona CDP (Public Facilities – PUB-6.3a).

4.9. SOCIO ECONOMIC CHARACTERISTICS

Mikiko Corporation prepared a market assessment report and an economic and fiscal impacts report for Kaloko Makai. Essential components of this report are summarized in the following sections. Appendix A contains the full market assessment report and Appendix N contains the full economic and fiscal impact report.

4.9.1. Population

The most recent United States Census, conducted in 2010, reported Hawai'i County's resident population to number approximately 185,079 (compared to approximately 149,000 residents in 2000,) indicative of an 2.2.% annualized rate of growth since the previous census conducted in 2000.

The Kaloko Makai project is situated in the North Kona Region of Hawai'i, north of Kailua. This rapidly developing area comprises the northwestern portion of the North Kona district and is contained within Census Tract 215.01 (also referred to as North Kona-North.)

It already is the commercial and industrial heart of West Hawai'i, serving the Kona Airport and the needs of residents, visitor, agriculture, ranching, technology and other industries of the western half of the Island. The area also has a long-standing and growing residential base. This area will continue to be the focus of such developments as the Island's population grows, given its proximity to the Kona Airport and other infrastructure.

Together with the coastal portion of the adjacent South Kohala District (Census Tract 217.01,) North Kona-North was estimated to provide 23% of the Island's employment in 2009. However, as of 2010, this center of employment supported residences for only about 12% of the Island's population. This imbalance of jobs and housing leads to crowding among area households and a tremendous amount of commuting into the region by persons who live in distant areas.

Mikiko Corporation projected a conservative view of long-term growth and estimates a 2045 resident population of 295,600 persons for the Island. Based on their analysis, Census Tracts 215.01 (North Kona-North) and 217.01 (South Kohala-South) would have the following projected population, 49,800 persons in 2025 and 69,500 persons in 2045.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Kaloko Makai is one of a relatively small group of area properties that could offer a substantial solution for the imbalance of primary resident-oriented housing services and the area's existing and anticipated job base.

Proposed uses in the Kaloko Makai project are in response to the regional demand for housing by the growing population in the North Kona and South Kohala districts, as well as provide prime opportunities for existing Hawai'i residents seeking to relocate to West Hawai'i.

Specifically, Kaloko Makai will provide opportunities for people and families living in other regions of the island to move to homes closer in proximity to West Hawai'i's growing job market; resulting in a marked positive societal impact in terms of lifestyle, allowing for increased freedom, reductions in commuting, gasoline consumption, and pollution. This will comprehensively improve the general quality of life across the entire island of Hawai'i—for all of its residents and visitors, not just Kaloko Makai's residents.

Residential demand for homes within the North Kona and South Kohala districts is characterized by the following market segments:

- **Entry-level markets** – Those units designated as affordable units, as well as many of the multifamily market units are conceived to appeal to entry-level markets, typified by the rapidly increasing 25- to 34-year-old Echo Boom cohort in the 2010 to 2020 period.
- **Move-up markets** – Kaloko Makai's single-family products could appeal to move-up markets and growing families.
 - The first level move-up market, typified by persons aged 35 to 44, is projected to grow particularly rapidly in the 2020 to 2030 period as the Echo Boomers mature.

- A more affluent move-up market could also be attracted to the views, convenient location and lifestyle offerings at Kaloko Makai.
- **Downsizers** – Kaloko Makai’s more compact single-family and some of its multifamily units are seen to appeal to the Baby Boomer cohort that is looking to simplify its lifestyle, lessen homeowner commitments and enhance access to town amenities. This market may overlap with the retiree segment described below.
- **Retirement/senior markets** – All of the multifamily units and some of the single-family product could appeal to retiree markets. The age 70+ population will be a rapidly increasing age classification especially towards the latter years of Kaloko Makai’s marketing.

Kaloko Makai is an extremely attractive option for expanding population market segments due to its proximity to major transit corridors, existing and future centers of economic growth and development, the shoreline, entertainment and retail venues, the Airport, as well as a host of ongoing regional private and public investments in infrastructure throughout the region.

Potential impacts and mitigative measures resulting from Kaloko Makai’s generated population, encompassing traffic, infrastructure, and public services are discussed in other sections of this EIS. Nonetheless, it should be noted that the population of Hawai’i County is projected to increase independent of Kaloko Makai, and the resultant effects of such growth on traffic, infrastructure, and public services among other issues must be addressed regardless of whether or not Kaloko Makai is developed.

4.9.2. Economy and Employment

Kaloko Makai would generate significant, on-going economic and fiscal benefits for residents of Hawai’i, as well as for the County and State governments. Development of facilities would generate employment and consequent income and taxes. In addition, by attracting new residents to the Island of Hawai’i and generating additional real estate sales activity, the Project is expected to support long-term impacts, including additional consumer expenditures, employment opportunities, personal income and government revenue enhancement.

Highlights of the project impacts are summarized in Table 4-29.

4.9.2.1. Employment

During its buildout, Kaloko Makai is estimated to generate employment for some 300 to 400 full-time equivalent (FTE) persons annually, including positions created directly and indirectly by its development activities. These jobs would be located throughout the State, with greatest concentration on Island of Hawai’i.

The new development-related positions are expected to be associated with total personal earnings³ of some \$1.09 billion over the Project’s initial buildout, or \$23 to \$38 million per year. The earnings

³ Earnings are defined as wage, salary and proprietary income, plus director’s fees and employer contributions to health insurance, less employee contributions to social insurance.

represent an average of about \$83,000 to \$87,000 per FTE job, including direct construction-related jobs as well as indirect and induced opportunities created throughout the economy

By the time of its expected completion in 2045, the Project could be expected to have generated some 3,100 direct FTE jobs on-site at its retail, office, industrial, lodge, and medical-related facilities. Because these on-site jobs would all be supported at Project components, they are all direct impacts; there are assumed to be no indirect or induced employment impacts on-site.

Considering the Project's direct, indirect and induced impacts statewide, Kaloko Makai could alternatively be seen to have generated some 1,700 permanent, on-going FTE jobs. These are positions that might not have existed had the Project not been developed. These "net new" jobs could include a small share of the professional, technical, managerial and other staff positions at the new hospital, other medical facilities, office and retail areas; sales and marketing positions supported by the on-going resales and releasing of property at the Project; positions generated at the business and kama`aina-oriented lodge; and myriad other positions generated throughout the economy.

Personal earnings from the new operational positions will increase over time as more facilities and establishments are opened. New personal earnings are projected to total about:

- \$59 million in 2025,
- \$88 million in 2035,
- \$94 million in 2045, and
- \$90 million per year after 2045, on an ongoing basis.

On average, these new FTE positions are expected to earn about \$55,000 to \$59,000 per year during Project buildout, and \$53,000 per year after 2045. Considering the 2009-2010 observed ratio of total family earnings of 1.8 times the average County wage, these earnings could be expected to be associated with average family incomes of about \$97,000, or 145% of the County median reported for fiscal year 2010, in an ongoing basis.

Opportunities created by Kaloko Makai, particularly its professional, technical and managerial career opportunities, will create incentives for some neighbor islanders or former Hawai'i residents to move back to the State and/or to the Island of Hawai'i.

In addition, some of Kaloko Makai's homes could be expected to attract some households that previously lived off-island or out-of-state. These could include retirees as well as younger households.

Table 4-29
Summary of Projected Economic and Fiscal Impacts
2010 DOLLARS

	<i>Comment</i>	2025	2035	2045	After 2045
FTE employment:*	<i>Direct, indirect and induced except as noted</i>				
Development-related	<i>Average annual since prior date</i>	400	400	300	0
Operations-related - On-site	<i>Annual, on-going Generated at Project facilities (direct impacts only)</i>	1,900	2,700	3,100	3,100
Net new jobs on Island	<i>New to County</i>	1,000	1,500	1,700	1,700
Total personal earnings:**	<i>Direct, indirect and induced</i>				
Development-related	<i>Average annual since prior date</i>	\$37	\$38	\$23	\$0
Operations-related	<i>Annual, on-going, on net new jobs only</i>	\$59	\$88	\$94	\$90
Average earnings per FTE job:**	<i>Direct, indirect and induced (not in millions)</i>				
Development-related	<i>Average annual since prior date</i>	\$87,000	\$87,000	\$83,000	NA
Operations-related	<i>On net new jobs only</i>	\$58,000	\$59,000	\$55,000	\$53,000
In-migrant resident population:	<i>Average daily employees, dependents, and new island residents</i>				
To the County		330	650	840	840
To the State	<i>Subset of County in-migrants</i>	230	480	630	630
Net additional government revenues:	<i>Projected revenues less projected expenditures</i>				
For the County		\$3.9	\$6.9	\$8.8	\$8.8
For the State		\$5.4	\$6.2	\$4.9	\$2.8
Revenue/expenditure ratio:					
For the County		6.0	6.0	6.1	6.1
For the State		5.2	3.4	2.4	1.8

Note: Other than for on-site jobs, estimates shown do not consider impacts of the planned schools, since equivalent facilities would be assumed to be developed elsewhere on the island even if the Project was not developed.

* FTE = Full-time equivalent, defined as 40 hours per week or 2,080 hours per year.

** Earnings defined to include wage, salary and proprietary incomes, plus directors' fees and employer contributions to health insurance, less employee contributions to social insurance.

Sources: SCD-TSA Kaloko Makai, LLC, 2012 and 2013; Cattaneo & Stroud, 2011; Mikiko Corporation, 2012.

The influences described above are estimated to result in perhaps 330 persons living on the Island of Hawai'i who might not otherwise have lived on the island (in-migration to the County) by 2025, or up to 840 after Project completion in late 2045. Of this total, some 230 and 630 persons, respectively, might be persons who had previously lived out-of-state.

4.9.2.2. Fiscal Impacts

Kaloko Makai could be expected to contribute some \$8.8 million per year in net additional County revenues at its completion and annually thereafter. By 2045, new County government revenues are estimated to represent about 6.1 times the new County government operating expenditures required to support the additional population that could be attracted to the Island of Hawai'i by the Project. The Project's real property taxes would be the major contributor to the County net fiscal benefits.

For the State, net additional operating revenues generated by the Project are estimated at \$4.9 to \$6.2 million per year during buildout, when development activity would generate high gross excise and income taxes. The Project is projected to continue to contribute to gains in the State budget in the long-run, with net additional revenues of some \$2.8 million per year after 2045. These fiscal impacts represent a revenue/expenditure ratio for the State of some 2.4 to 5.2 during buildout, or 1.8 by 2045 and thereafter.

These public sector contributions do not consider the value of the school sites, public parks or various off-site infrastructural improvements to be contributed by SCD-TSA. Neither do they consider the various impacts and permit fees expected to be paid to the County and State governments during the development of the Project.

The fiscal analysis did not allocate any value for infrastructure to be dedicated to the County (public).

4.9.3. Market Assessment

West Hawai'i is among the most desirable resort and residential areas in Hawai'i. The region is home to many full-time residents, and is also a popular vacation destination, encompassed by numerous hotels, resorts, and vacation homes. Kaloko Makai is situated in a region that is rapidly developing, with immediate access to Kona International Airport and is adjacent to the well established commercial and light industrial-service centers of North Kona and Kailua-Kona which serve the needs of the visitor, agriculture, ranching, and technology industries, among others, which populate the western half of the island.

Ascending towards Queen Ka'ahumanu Highway, to about two-thirds of the way mauka to Māmalahoa Highway, Kaloko Makai's slope affords excellent ocean and regional views throughout.

Kaloko Makai is attractively located within proximity to regions that will continue to be the focus of further development as the Island's population grows, and has the potential to be a major cornerstone of residential, commercial, and light industrial growth as a center of community, commercial, and economic activity.

4.9.3.1. Residential Market

Market Summary

The two census tracts 215.01 and 217.01 are considered Kaloko Makai's Competitive Regional Market Area for residential market conditions. North Kona and South Kohala District developments have been primarily characterized by resort and resort residential projects makai of Queen Ka'ahumanu Highway. These developments have contributed heavily to the economic activity and the creation of jobs, but have not provided housing for the workforce that they depend on.

Current housing opportunities within the market do not satisfy demand stemming from existing employment levels within the region. Together with the coastal portion of the adjacent South Kohala District (CT 217.01, also referred to herein as "South Kohala-Waikoloa"), North Kona-North was estimated to provide 23% of the Island's employment in 2009. However, as of 2010, this center of employment supported residences for only about 12% of the Island's population.

Market trends concurrent with recent data are indicative of an economic downturn, stemming largely as result of the mortgage-financing crisis that has impacted the nation in recent years.

As current economic conditions have dampened actionable pent-up demand, the market area should be poised for a significant share of the Islands' anticipated future population growth, and will lead to further growth in demand for housing within the region.

Currently entitled projects are estimated to yield up to 8,200 of the potentially demanded 17,800 new housing units in the market area by 2045, assuming all proposed and entitled projects are built out within this timeframe and developed to the maximum levels of their respective current plans and entitlements.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Kaloko Makai will support the housing imbalance within the region by offering approximately 5,000 homes to the market region. Kaloko Makai is close to major employment centers and areas of commercial and industrial activity, and its mixed use community centered design will facilitate innate commercial activity.

Furthermore, Kaloko Makai will respond to varying spectrums of demand for housing within the North Kona/South Kohala area by providing a wide range of housing opportunities inclusive of affordable housing alternatives. Kaloko Makai will seek to create and sustain a mixed-income community allowing for unparalleled social diversity.

Exact outcomes will depend on agreements to be reached with the County, but some 700 to 1,000 units, or up to 20% of Kaloko Makai's homes are assumed to be built as "affordable" housing.

The balance of homes at Kaloko Makai will be comprised of its 4,000-4,300 "market" homes, ranging from traditional single-family homes to mixed use, mid- and higher-density multifamily units.

Current forecasts allow for rough 70% of this inventory to encompass multifamily products, with the remaining 30% balance characterized by a range of single-family offerings.

The first residential product at Kaloko Makai is projected to be available for sale within a few years of receiving necessary land use approvals and permits. Thereafter, it is anticipated that the 5,000 maximum proposed units, homes and lots could be absorbed over approximately 31 years at an average rate of 170 units per year, as summarized below in Table 4-30.

Table 4-30 Illustrative Summary of Maximum Potential Residential Sales Absorption at Kaloko Makai, 2015 to 2045				
	Affordable Homes	Market Homes	Maximum Total Housing	
Maximum Inventory	700-1,000	4,000- 4,300	5,000	
Average Annual Sales*	22-32	130- 140	170 (rounded)	
*Assumes several but not all products are marketed simultaneously in any given year. Thus, since market home sales may extend over a longer period than affordable home sales, the overall average rate is less than the sum of the two sub-market rates shown. Source: Mikiko Corporation, April 2012				

Forecasted figures expect Kaloko Makai’s 5,000 homes to be absorbed over a period of approximately 31 years, at an average rate of about 170 units per year. Actual sales would vary on a year-to-year basis depending on market cycles, financing availability, and the types of units available at any given time.

Nonetheless, the projects inventory will represent a significant answer for the anticipated future unmet demand for some 9,600 new housing units in the Consumer Residential Market Area through 2045, based on currently LUC-entitled projects and their plan maximums.

4.9.3.2. Commercial

Market Summary

The Primary Trade Area (PTA) for commercial uses at Kaloko Makai is considered to be the entire North Kona and South Kohala districts of the Island. While the proposed hospital and business park uses will create research, development, and other employment and enterprise opportunities not already evident on the island, the commercial market assessment is based on a more conservative, narrow view of retail and office-based factors as evidenced in Hawai’i County presently.

Commercial establishments in North Kona, and particularly its northern half, CT 215.01, serve broad regional markets on the Island that extend far beyond the physical boundaries of the CT in question.

Obvious examples of this are Costco and The Pottery Terrace, the latter being the largest office building on the island. Such venues anchor the region as a significant point of interest for resident and visiting consumers, as evidenced by the large daily visitor population within the PTA.

Data collected and analyzed by Mikiko Corporation demonstrates clear inadequacy of both retail and office space relative to the day-time population of the PTA. Looking forward, the increase in development and expansion within the PTA itself will further create additional need for accessible commercial retail and office space. Current projections forecast a 2.7% annual rate of growth in consumer population within the Trade Area, numbering 223,900 consumers by 2045.

Kaloko Makai proposes up to 600,000 square feet of various commercial uses at Kaloko Makai, including retail and office. If developed to the full-proposed capacity 600,000 square feet, Kaloko Makai's commercial spaces could represent some 8% of the PTA's projected total 2045 inventory.

This will include spaces in shopping centers, retail and office complexes, and mixed-use developments.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Kaloko Makai's mixed use, TOD Village design will help to alleviate vehicular activity, as establishments providing daily resident needs will always be within walking and biking distance.

As a result of the projected growth and demand for commercial within the target region, Kaloko Makai stands to further impact the market through the proposed development of a Lodge and Business center as a complementary means of promoting intelligent growth.

Specifically, the Kaloko Makai Lodge and Business Center are proposed to cater to business and leisure demands generated by general market demand and other uses in Kaloko Makai's vicinity such as the recently selected Kealakehe Judiciary site and medical complexes, its residences, and proximity to the Kona International Airport. The Lodge is envisioned to offer up to 120-rooms, a business center, and meeting and conference spaces.

The Lodge and Business Center at Kaloko Makai is planned in alignment with the goals and standards of the Kona CDP.

Development and lease-up of the proposed commercial areas are anticipated to be supported by future market conditions in the PTA as detailed in Table 4-31.

This analysis profiles market trends within the North Kona and South Kohala Districts (PTA). However, the realized demand for such lands at Kaloko might be stronger than presented herein due to further potential interest from a broader market base.

Table 4-31 Projected Supportable Commercial Market Absorption and Kaloko Makai Share of the Primary Trade Area (Cumulative square feet)			
	<u>2025</u>	<u>2035</u>	<u>2045</u>
Kaloko Makai proposed development phasing	430,000	560,000	600,000
Total Supportable Commercial Areas in Trade Area	5,500,000	6,800,000	7,200,000
Kaloko Makai as Share of Future Trade Area	8%	8%	8%

This analysis does not consider industrial-uses or industrial-designated lands at military bases, harbors, universities or airports.

Market trends for light industrial warehouse buildings are reflective of the current economic downturn highlighted in the residential and commercial markets. The PTA as a whole reflected a 14% vacancy in total warehouse space as of the end of 2010, according to data provided by CMF. This is up significantly from an estimated 8% in 2008. Positive space absorption was, however, reported to have resumed in 2010.

Considering the potential of future developments, plus areas in current use, the PTA could pose to offer some 1,110 gross acres of private business or industrial park lands by 2045, assuming all future projects are developed to their estimated capacity on projected time tables.

Light Industrial/Business Park Development Proposal

The Kaloko Makai plan designates 75 acres of light industrial or business park land uses in the Special District located at its makai end fronting Queen Ka’ahumanu Highway. Approximately 25 acres of these lands have been identified by the State DOT for an eventual highway interchange at the entrance to the Project.

Thus, industrial/business activity on those lands will be interim uses and only 50 gross acres (approximately 40 net usable acres after allowing for circulation and infrastructure) are seen as long-term light industrial land uses. These 25-acres would have interim industrial use then would be available for State DOT’s interchange, when needed.

POTENTIAL IMPACTS AND MITIGATION MEASURES

With its proposed 75 acres of designated light industrial or business park land uses in the Special District located at its makai end fronting Queen Ka’ahumanu Highway, Kaloko Makai does not stand to significantly impact market conditions for light industrial use in the Trade Area, at least in terms of raw acreage and useable space.

Due to the proximity of its designated light industrial or business park land uses to viable commercial centers of development, Kaloko Makai's limited light industrial/business park lands are poised as attractive market offerings, and offer considerable market synergy and contributory value to bordering commercial uses.

4.9.4. Social Impact Assessment

John M. Knox & Associates conducted an assessment (May and June 2011) of the potential Social Impacts of the Kaloko Makai project, assaying an array of Community interests and concerns regarding the development and outcome of the project. The report is included in its entirety as Appendix O and is summarized below.

The following issues are referenced in the Social Impact Assessment as prevalent areas of community interest and concern:

Health Care: Interviewees articulated the need for health care and education in Kona – specifically citing a lack of access to medical facilities, which reportedly lead to people having to be evacuated to Honolulu for treatment, attributing insufficient staff, lack of good doctors, nurses and health care specialists, and inadequate facilities as primary causes. Not only has this been logistically challenging, but the lack of quality care and proper facilities has incurred significant cost to the people of Kona as well. A few people said the hospital has been having funding problems, which has made it difficult to retain qualified and experienced doctors, specialists and nurses in Kona.

Current Economic Outlook: The entire nation has experienced economic hardship, and Kona's economy has been directly impacted by compounded economic decline. Issues associated with the impacts of the national economic crisis include a lack of new money coming in, local businesses suffering (even affecting the success of longtime industries ranching and cattle raising), higher cost of living, lack of local jobs (and good paying jobs), and lack of adequate housing for workers, especially low-income ones; and an overall decline in home and property values county-wide. Residents also reported a perceived imbalance between where jobs are located and the location of "affordable" housing for the local workforce.

Community and Effects of Rapid Growth Issues: Interviewees expressed concern about the prior rapid growth occurring in Kona, and the difficulties associated with managing this growth. The rate of development and population growth, were both viewed with apprehension. The ongoing influx of people and rapid development were seen as precursors of cultural, social, and environmental change. Some people said newer residents may not understand local lifestyle and have more of a "land for profit" as opposed to "land for living" mentality. Increased crime and drug use were also reported as concerns attributed to rapid growth (though it should be noted that we also often encounter the same issues in rural areas with stagnant economies).

Housing: A Lack of housing options for the local workforce is an area of primary concern for the people of Kona. Interviewees reached the general consensus that there is simply not enough affordable housing to satisfy demand by the local workforce, and that developments planned in the region often do not cater to the mainstream population, but for those interested in vacation and/or retirement homes, i.e. the affluent and wealthy. Generally speaking, the local interviewed

population base is aware that developments, by their for-profit nature, are geared primarily towards the optimized capitalization of land value, but is cognitively repulsed by the realization that such developments significantly impact their lives, but do not immediately nor specifically benefit them.

Access and Infrastructure: According to interviewees, access and infrastructure issues are a significant concern in Kona. Interviewees remarked that Kona Harbor is old, county infrastructure is aging (sewers specifically), and that access and traffic are an escalating issue in Kona. There also have been numerous problems with the Queen Ka’ahumanu Highway widening project.

Political Interests: The decades old imbalanced representative relationship between West and East Hawai’i has been a thematic point of concern for area residents. Specifically, while West Hawai’i is the County’s prime source of growth in tax revenues, the majority of planning and infrastructure decisions are made in the East Hawai’i county seat (Hilo). Interviewees said they perceived a perverse incentive in the fact that Hilo benefits from developments in Kona, but Kona suffers from the resulting traffic and socio-economic impacts of these approvals. They saw this as inefficient planning, as planning projects are approved with no adequate infrastructure to support projects, from a remote place that won’t feel the consequences of failing to plan properly.

Lack of strong political leadership from decision-making officials was underlined as a perceived catalyst for the frequent, rationally devoid conversion of land uses (conservation and agricultural to urban land uses), resulting in developments being allowed to move forward, with no follow-through conditions or stipulations.

Environmental Effects: Although vog and volcanic activities were of some concern to interviewees, threats *to* the environment – as opposed to threats *from* the environment – were at the forefront of interviewee concerns. Participants, however, strongly emphasized that they were seriously concerned about increasing negative impacts to the local natural environment, coastal areas and cultural resources due to development and population growth.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Kaloko Makai stands to strongly benefit areas of community interest and concern as underlined previously. On a fundamental basis, the Kaloko Makai project will directly address vested community interests in a considerably positive fashion.

From a baseline socioeconomic vantage, Kaloko Makai’s planned development will serve to stimulate growth and development throughout West Hawai’i, as well as directly and indirectly revamp the scope and scale of services and facilities (both private and public) available to residents of West Hawai’i – through the planned and structured creation of jobs, spending, infrastructure, tax revenue, and facilities (Kona Regional Hospital/Schools/Parks).

Kaloko Makai will contribute to ameliorating Kona’s housing supply issues through (a) market-priced housing aimed primarily at working families rather than off-shore buyers, and (b) 1,000 "affordable" units with pricing to be determined in consultation with government agencies. These contributions cannot totally reverse the high land and development costs that have kept Hawai’i among the most expensive housing markets in the nation for the past 50 or 60 years. However, failure to provide

housing supply in pace with increasing demand by local residents would worsen rather than help the overall housing affordability situation.

Continued economic and population growth in West Hawai'i stemming from Kaloko Makai's ongoing development will further level and balance the weight of political interests throughout the County, by virtue of representative population redistribution.

Kaloko Makai will utilize proper measures to mitigate potential environmental impacts on the natural environment, coastal areas, and cultural resources as discussed in Sections 3.3, 3.5 and 4.1.

4.10. INFRASTRUCTURE AND UTILITIES

Wilson Okamoto Corporation prepared a Preliminary Engineering Report (PER) for Kaloko Makai. For ease of reference in this document, the essential components of the PER have been included in the following sections. Appendix P contains a summary PER.

4.10.1. Water System

The Hawai'i County Department of Water Supply (DWS) operates and maintains public water systems on the Island of Hawai'i. Water system improvements, including wells, reservoirs and mains, for private development are usually dedicated to the County DWS and then put into operation.

As part of the process, private developers secure a Water Agreement with County DWS to define the improvements to be constructed and the allowable water credits and Facilities Charge for these improvements.

The County DWS's system in North Kona is the second largest system on the island. The system is supplied by ground water sources, including deep drilled wells and the Kahalu'u Shaft. The North Kona Water System extends from the Kona International Airport south to Kealahou Bay where interconnection to its South Kona Water System is made.

The County DWS operates and maintains drinking water supply facilities in the vicinity of the project site. The County DWS facilities include three water reservoirs (Kaloko Control Tanks, Kaloko Tank No. 1 and Hina Lani Tank No. 2) along Hina Lani Street, each with a capacity of 1.0 million gallons (MG), and each supplying a different pressure zone. The existing 20-inch transmission line along Hina Lani Street connects the water reservoirs extending the water system from Queen Ka'ahumanu Highway to Māmalahoa Highway, and completing the Hina Lani water supply system. The Hina Lani water system provides water to the nearby Kaloko Industrial Subdivision and the County Housing Development off of Hina Lani Street.

Of the three existing water reservoirs, the makai reservoir (near Queen Ka'ahumanu Highway) has been abandoned by County DWS and will be dedicated to the County Department of Environmental Management (DEM) for use as an R-1 water storage reservoir.

DWS currently has three projects planned in the vicinity of Kaloko Makai.

1. Installation of a new 16-inch water main in parallel with the existing 12-inch water main along Queen Ka'ahumanu Highway.
2. A water tank currently is in construction for the proposed Kaloko Heights project.
3. A new water tank (Hina Lani Tank No. 3) is sited mauka of the Kaloko Makai project site.

Refer to Section 3.5.1 Groundwater Resources for more information about groundwater resources and groundwater quality.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Please refer to Section 3.5.1 Groundwater Resources which presents water demand for Kaloko Makai and the proposed alternatives for developing groundwater resources to supply drinking water to meet those demands.

4.10.2. Wastewater System

Currently, there are no public or private wastewater treatment facilities on the property.

Existing properties within the nearby Kaloko Light Industrial Subdivision are serviced by septic tank and seepage pit. Planned development within Kaloko Light Industrial Subdivision and Lanihau Properties incorporate individual septic systems for short-term use and installation of dry sewers for long-term build out of North Kona Improvement District (NKID). Current development of the Kaloko Heights project proposes to incorporate a private wastewater treatment system.

The nearest wastewater treatment plant (WWTP) is the County's Kealakehe WWTP located approximately one mile southwest of Kaloko Makai.

The Kaloko Makai project area falls within the boundary of the County DEM's North Kona Sewer Master Plan. The project site is further evaluated under the North Kona Improvement District Project Sewer Master Plan – 2006 and North Kona Improvement District Implementation Report – 2008 (NKID).

The Kona CDP made sewer system hookup a priority and includes the following policy:

Policy PUB-4.4: Sewer Priorities. In order to protect the nearshore water quality, the requirement to hookup to the County sewer system (HCC Section 21-5) shall be strictly enforced. The highest priority in expanding the sewer system within the Kona Urban Area shall be to service any shoreline properties that do not have access to a public sewer system and then to service lots within approximately 1-mile of the shoreline (shown in pink in Figure 4-14). Any new subdivision within 1 mile of shoreline within the Kona Urban Area shall either hookup to the public sewer system, or provide a private treatment system, and/or install dry sewers (see Figure 4-10c Official Public Facilities and Services Map-Waste Management). Private wastewater collection systems within the 1-mile zone shall be designed and constructed to County standards to enable potential connection to County sewer system.

The County shall ensure that TODs can be served by the public sewer system in a timely manner.

In addition, the Kona CDP addresses wastewater facilities and notes the following policy related to the siting of a new facility:

Policy PUB-4.5: Wastewater Treatment and Effluent Reuse. The Kealahou WWTP shall be expanded to accommodate the projected sewage volume from the Urban Area extending south of Hina Lani Street to the Kealahou WWTP. A new County wastewater treatment plant shall be located in the vicinity shown on Figure 4-10c Official Public Facilities and Services Map-Waste Management and designed to the extent feasible to utilize a natural treatment system that can double as an open space feature (shown in green, north of Kaloko Makai in Figure 4-14).

A natural wastewater treatment plant or system is typically known as a "constructed wetland" or a "Constructed Ecosystem" and are an alternative to mechanical wastewater treatment systems, which are methods that treat and purify wastewater. Constructed wetlands simulate natural wastewater treatment systems, using flow beds to support water-loving plants. The roots of these plants help provide an aerobic environment to aggressively break down contaminants.

Representatives from the County DEM noted that there are no plans for construction of this decentralized WWTP in the immediate future. (Dora Beck and Lyle Hirota personal communication, July 2011).

Concerns are raised as to the proposed location of the proposed new wastewater facility, especially its proximity to the Kona International Airport.

The Kona Airport Manager responded to inquiries concerning this location and indicated that the FAA would probably consider constructed wetlands and wastewater treatment facilities to pose similar wildlife attractant hazards. For all airports, the FAA recommends a distance of 5-statute miles between the farthest edge of the airport's operations area and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach, departure and circling airspace. Therefore, State DOT-Airports would be expected to object to or discourage the creation of potential attractants in this location (Chauncey Wong-Yuen personal communication, date unknown).

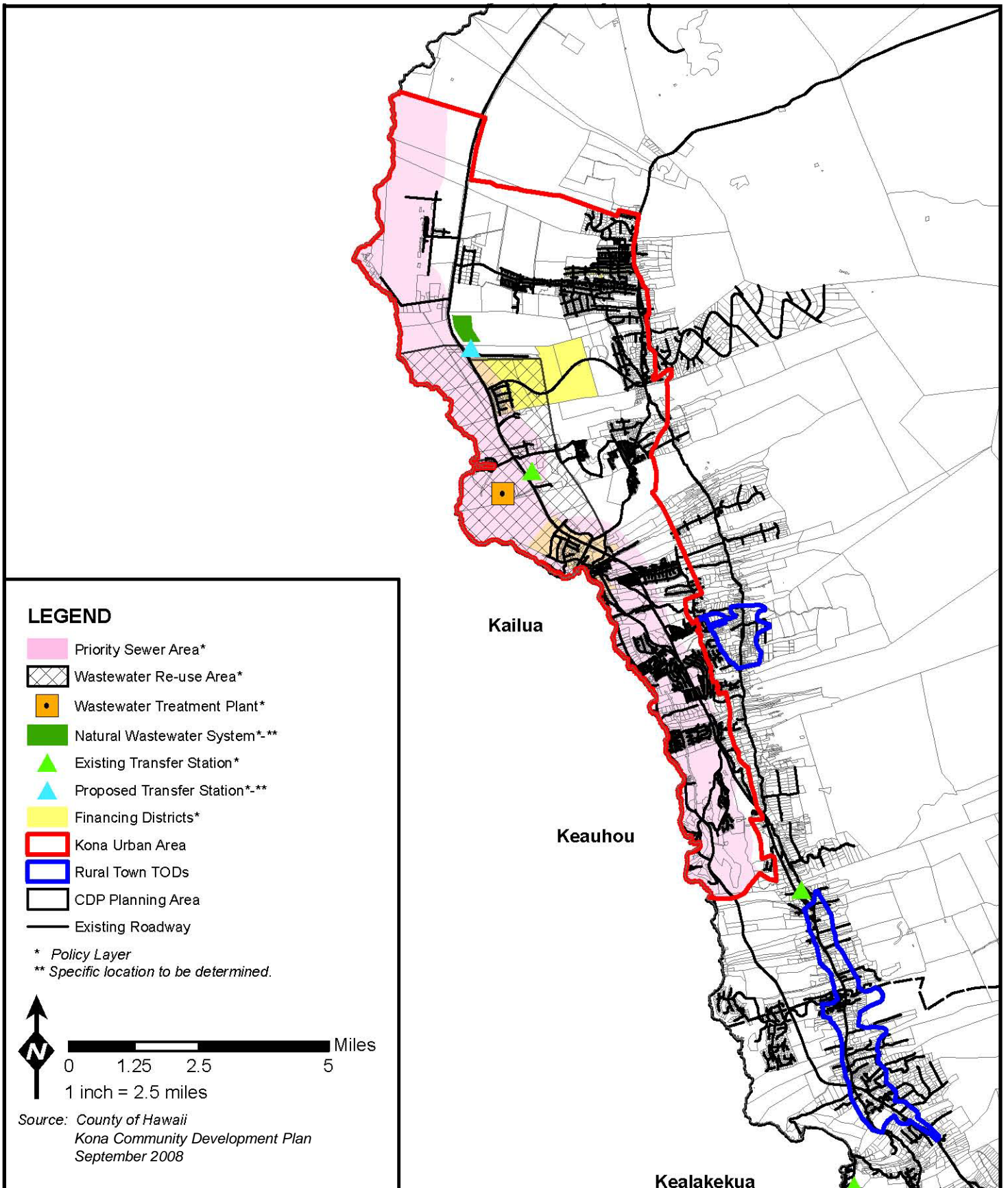


FIGURE 4-14
Kona Community Development Plan Official Public Facilities and
Sewers Map Wastewater Management

Kaloko Makai



POTENTIAL IMPACTS AND MITIGATION MEASURES

Sanitary sewer volumes for the project are derived using the project's program requirements provided by SCD and generalized simulation of projected demands for similar developments. The State DOH requires that wastewater systems be designed based on county flow standards, and if applicable county standards are not established, the City and County of Honolulu standards are to be used. The County of Hawai'i has not yet established wastewater flow standards. Based on City and County of Honolulu flow standards, the average dry weather flow from the development at build out is 2.38 mgd. The projected design peak wastewater flow is approximately 11.80 mgd. See Appendix P PER for detailed information.

Current County DEM plan is to build a portion of NKID along with the next phase of the Queen Ka'ahumanu Widening project. The County DEM proposes to install a dry gravity force main along Queen Ka'ahumanu Highway from Hina Lani Street to the future pump station. Prior to becoming active, the County DEM needs to implement at least two more projects to connect to the Kealakehe WWTP.

The County DEM is also considering development of a decentralized treatment plant. The tributary area considered for the decentralized treatment plant includes the Kaloko Makai property. The treatment plant would likely be located on state land north of Kaloko Makai and along Queen Ka'ahumanu Highway. Detailed planning of the decentralized treatment plant with respect to treatment system and flow capacity and footprint size has not been determined.

The proposed sewer system will follow guidance and general criteria as described and outlined in the Final NKID, Sewer Master Plan Summary Report, October 2006. Line sizes will be determined during the design phase of the project.

Wastewater Treatment Alternatives

If a connection to either the Kealakehe WWTP or the proposed natural wastewater treatment system is accessible to the project prior to the County Council's approval of the Change of Zone (COZ), Kaloko Makai shall develop the project with sewer lines to be used to connect the Project to the Kealakehe WWTP.

In addition, if the connection to the Kealakehe WWTP is made, Kaloko Makai shall collaborate with the County of Hawai'i to include the project within an improvement district, if one is developed, to fund the connection to the Kealakehe WWTP, or to have incorporated as a condition of approval to the COZ, the requirement that the Project pay, at the time of full funding for such improvements, its fair share of the cost to fund such connection to the Kealakehe WWTP, whether or not an improvement district is established.

If the connection to the Kealakehe WWTP is not accessible to the Project prior to approval of the COZ and no connection to a public WWTP acceptable to Kaloko Makai is available prior to the completion of construction of the private WWTP, Kaloko Makai shall develop the Project to be served by an on-site Private WWTP.

Because the County DEM has indicated that the Kealakehe WWTP is not available for Kaloko Makai use, an on-site wastewater treatment plant is the preferred alternative for processing wastewater generated by Kaloko Makai.

Wastewater from the development would be delivered to an on-site WWTP approximately 20-acre site and would be located at the makai end of the project site. The on-site WWTP is self-sufficient, water efficient, and environmentally sound. The WWTP would produce R-1 quality effluent which would be the source of supply for the project's non-drinking water system. Brown and Caldwell prepared a conceptual wastewater management report for Kaloko Makai. The report is included in the PER (Appendix P). Further discussion is also provided in Section 3.5.1 Groundwater Resources.

The WWTP will be designed to achieve the following:

- a. Produce R-1 quality water in accordance with DOH regulations; and
- b. Reduce phosphorus and nitrogen concentrations in the effluent to address potential impacts to the adjacent Kaloko-Honokōhau National Historical Park and the near shore environment.

The first treatment goal is readily achievable via conventional secondary treatment, followed by coagulant addition, filtration and disinfection with ultraviolet light. The second goal requires an advanced wastewater treatment process. The description that follows assumes that the NPS agrees that similar nutrient removal objectives are appropriate for the Kaloko Makai project (see Figure 4-15).

- Influent Pump Station: A pump station will be required to lift raw wastewater from the sewer system to the treatment processes.
- Headworks: The headworks would include screening systems to remove debris and grit removal to remove inorganic particles (e.g., sand) from the waste stream. Grit and screenings will be disposed at the West Hawai'i Landfill.
- Biological Treatment: Organic matter and nutrients will be removed using an activated sludge process. The process will incorporate biological nutrient removal (BNR). BNR incorporates aerobic and anoxic zones within the treatment process and recycle flows to facilitate biological reduction of total nitrogen (TN) and total phosphorous (TP) to 10 mg/L and 2 mg/L, respectively. Clarifiers will be used to separate the activated sludge from the secondary effluent.
- Coagulant Addition/Flocculation: Coagulants (such as aluminum sulfate and/ or polymer) will be added to the secondary effluent downstream of the secondary clarifiers and mixed to combine small particles into larger "flocs" that can be removed in the filtration process.
- Filtration: The filtration process will provide two treatment benefits: turbidity reduction to meet R-1 water recycling requirements, and additional nitrogen removal.

Denitrification filters are available that are accepted by the California Department of Public Health (CD PH) for Title-22 recycled water production and are also capable of reducing TN concentrations to 5 mg/L via denitrification. The State DOH allows the use of filtration processes that are accepted by CDPH for R-1 recycled water production. Addition of a carbon source (typically methanol) is required upstream of the filters to facilitate denitrification process. The State DOH requires that R-1 quality water have effluent turbidity of less than 2.0 Nephelometric turbidity units (NTU) at all times.

- Disinfection: The effluent will be disinfected with ultraviolet light (UV) to meet R-1 recycled water requirements. The State DOH requires that R-1 recycled water have a median density of fecal coliform that does not exceed 2.2 per 100 mL.
- Effluent Pump Station: An effluent pump station will deliver recycled water to the R-1 storage tank for reuse, or to disposal wells.
- Aerobic Digester: Waste solids (sludge) from the biological treatment and filtration systems will be pumped to an aerobic digester system for stabilization and thickening via periodic decanting.
- Mechanical Dewatering: Aerobically digested sludge will be mechanically dewatered prior being hauled offsite for disposal or composting at the West Hawai'i Landfill.

The WWTP will be designed to produce R-1 recycle water suitable for irrigation within the project boundaries. The treated effluent will be pumped to a R-1 storage tank located on-site and will be used to irrigate parks, school fields, landscaping and other allowed uses for R-1 quality water (see Figure 4-16).

Supplemental drinking water will be added to the R-1 storage tank as needed to ensure that the irrigation demands of the users can be met. During periods of wet weather, excess R-1 quality water will be disposed of via disposal wells (see Figure 4-16).

Potential acceptable uses for R-1 recycled water in the project are listed in Table 4-32. Note that irrigation of single-family residential parcels is not allowed by State DOH.

There will be times when there is more R-1 quality water available than the irrigation users require; for example, during periods of extended wet weather. The State DOH requires that a disposal system be provided for when recycled water supply exceeds the demand. The excess would be disposed of in injection wells at the WWTP if other uses for this water cannot be found.

The Kaloko Makai WWTP will be designed to reduce nitrogen and phosphorous concentrations in the treated effluent to address over nutrient impacts to the adjacent Kaloko-Honokōhau National Historical Park and the near shore environment. During the wastewater treatment process, organic matter and nutrients will be removed using an activated sludge process.

Table 4-32 Potential R-1 Recycled Water Uses at Kaloko Makai		
Landscape Irrigation <ul style="list-style-type: none"> • Parks • School Yards • Athletic Fields • Road sides and medians • Commercial property (if managed by irrigation supervisor) • Multi-family residential property (if managed by an irrigation supervisor) 	Industrial <ul style="list-style-type: none"> • Commercial and public laundries • Industrial cooling • Industrial process water 	Other <ul style="list-style-type: none"> • Toilet and urinal flushing in buildings with dual water systems • Decorative fountains • Street sweeping • Dust control

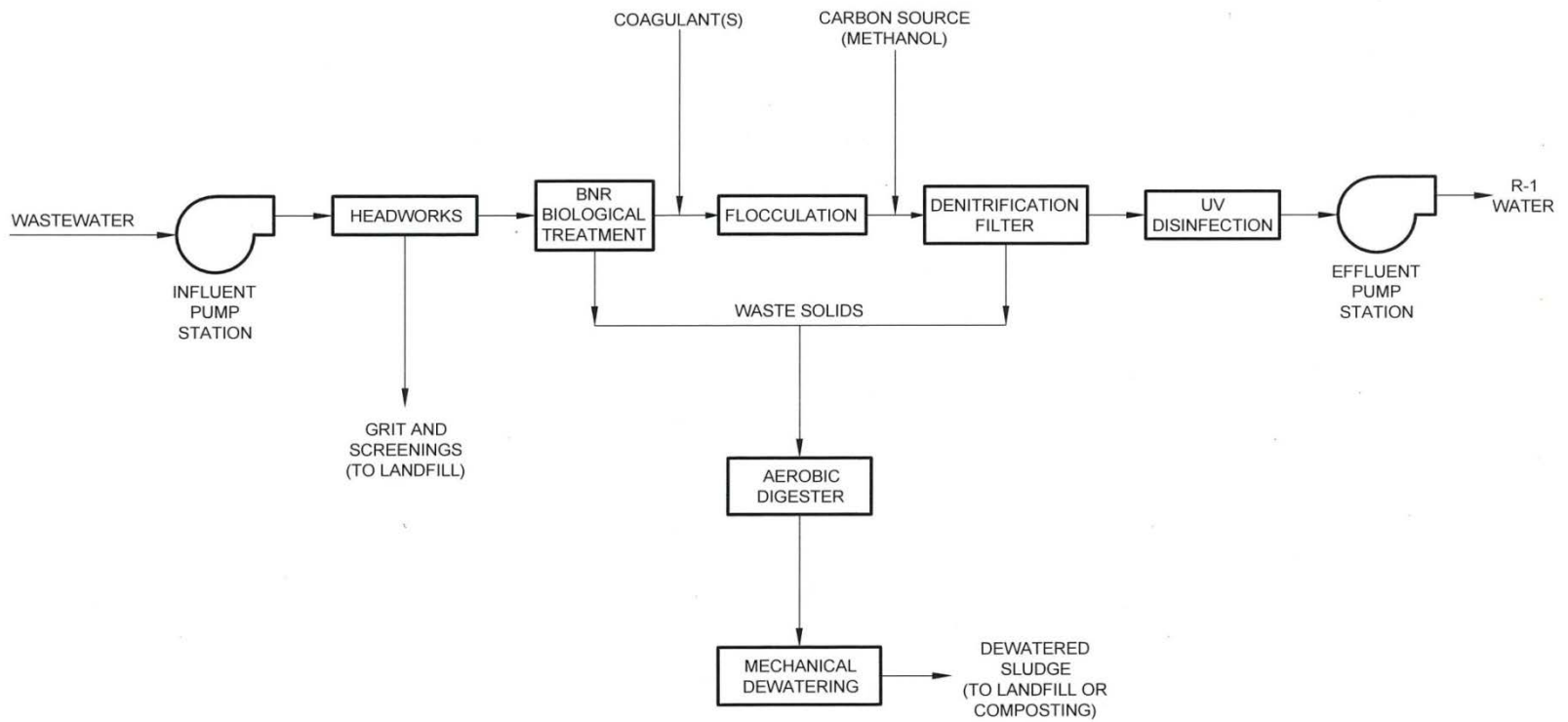
As previously mentioned, the process will incorporate BNR which incorporates aerobic and anoxic zones within the treatment process and recycle flows to facilitate biological reduction of TN and TP.

The WWTP will comply with applicable provisions of Hawai'i Administrative Rules (HAR), Chapter 11-62 Wastewater Systems. The WWTP will be designed to reduce the concentrations of the following compounds in the effluent of the private WWTP to: TN to a concentration of <5 mg/l, and TP to a concentration of <2 mg/l (aerobic nitrification processes combined with anoxic/anaerobic sand filters to perform denitrification, or comparable technology.) Installation of the private WWTP shall be subject to conditions of approval by the DOH, including any lower concentrations of TN and/or TP in the effluent, and HAR Chapter 11-62.

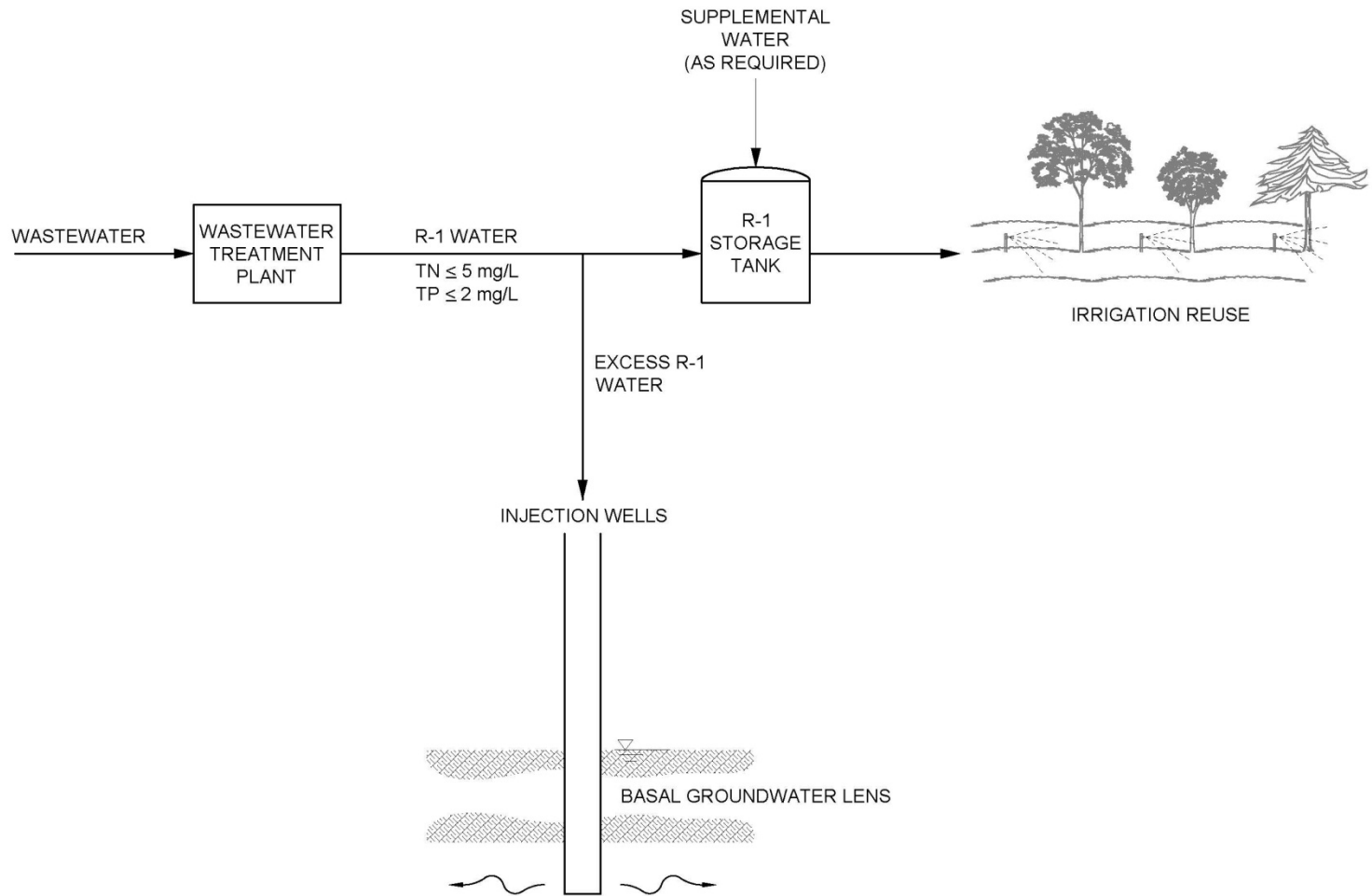
An average R-1 recycled water flow rate of 2.36 mgd has the potential to provide irrigation water for approximately 115 acres without routine supplemental water addition. The State DOH has restrictive requirements for R-1 irrigation on property located above of the underground injection control (UIC) line (e.g., groundwater or vadose zone monitoring, no excess irrigation to flush salts below the root zone allowed), and therefore R-1 reuse be limited to properties located below the UIC line.

The Kaloko Makai development includes approximately 56 acres of parks and 30 acres of schools located below the UIC Line that will likely be the largest users of the R-1 recycled water. Based on preliminary estimates, approximately 40 acres of the total park and school acreage will ultimately be irrigated.

Additional recycle water users can be added to the system if they are located near the distribution lines that carry the water to the largest users. The required R-1 water storage tank size will be based on the maximum day demand of the recycled water users.



Source: Brown and Caldwell, Kaloko Makai Development – Conceptual Wastewater Management System



Source: Brown and Caldwell, Kaloko Makai Development – Conceptual Wastewater Management System

This reuse of treated wastewater is consistent with the Kona CDP which has an action designating the area below Ane Keohokālole as a reclaimed wastewater zone (Action TRAN-3.3a: Designates the reclaimed wastewater zone (Wastewater Re-use Area) on Figure 4-10c Official Public Facilities and Services Map).

Likewise, the Kona CDP identifies a “Wastewater Reuse Area” and states in its Policy PUB-4.6 Wastewater Reuse Area: Recognizing the limited drinking water supply in the Kona area, every effort should be taken to develop a feasible wastewater reclamation system for non-drinking water uses. The wastewater reuse area should be, at a minimum, located mauka of the shoreline up to Keohokālole Highway, north of Palani Road and south of Huliko‘a Drive (again, noted on Figure 4-10c Official Public Facilities and Services Map-Waste Management).

4.10.3. Drainage System

According to the 2011 Rainfall Atlas of Hawaii (Giambelluca and Others, 2011), average annual rainfall across the project site varies from 15 to 25 inches a year. The land surface of the project site consists of unweathered and very permeable lavas with sparse deposits of ash soils and no defined drainageways. Essentially no rainfall runoff leaves the site, even during intense storm events. It is either lost to evaporation or percolates to the underlying groundwater.

Surface runoff mauka of the project site sheetflows toward the project site and percolates into the ground. Due to the high permeability of the natural ground surface at the project site (see Section 3.3), surface runoff does not occur. As a result, no natural gulches or waterways have been created on the project site. Runoff from off-site and on-site drainage was calculated for a 100-year 24 hour storm event. The approximate runoff is 9,806 ft³/s (refer to Appendix P for details).

The County of Hawai‘i currently operates and maintains a series of swales and drywells along Hina Lani Street. Typically, the V-type swales are 6 feet wide running along roadside shoulders. Drywells are located to intercept runoff collected in the swales and are approximately 5-foot in diameter, 20 feet deep, and capped with a catch basin/grated inlet drywell cover. Drywells allow collected storm water runoff from streets

In the vicinity of the project site, there are two existing culverts and headwalls under Queen Ka‘ahumanu Highway. These appear to be sized and placed to address roadway runoff and are not part of any regional drainage system associated with mauka properties.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The post development peak runoff rates for the drainage area were calculated for 100-year 24-hour storm event in accordance with the County DPW Storm Drainage Standards. The post development runoff is approximately 4,305 ft³/s (refer to Appendix P for details).

The natural drainage pattern will be modified due onsite development, including roadways, residential lots, and commercial areas. Runoff from the offsite mauka areas is not expected to increase and will be directed away from the project site through drainage channels located on the eastern and northern borders of the project site. However, the proposed drainage system

improvements will maintain or reduce the rate of runoff discharged off the project site to equal or less than the existing rates, in compliance with County BMP requirements. The use of detention basins, and natural swales or channels will store and filter the storm runoff, removing pollutants via percolation. The passage of such runoff from the ground surface to the groundwater below, though the unsaturated (vadose) zone, provides natural filtration and adsorption. Surface runoff from most of the developed areas in Kailua-Kona is handled in a similar manner without identifiable adverse impacts to groundwater or the Makai environment.

Detention basins will be placed at each park located throughout the project site. Approximately 30% of the park is assumed as useable as a drainage basin due to the natural topography and usage of the park. Any additional runoff will be stored in an underground retention system located throughout the park. At each drainage basin, a spillway will be constructed to allow any excess storm water to overflow.

Use of an underground drainage system would consist of drainlines, drain inlets, and storm drain manholes to collect and convey storm drainage runoff to the drywells and/or detention basins. The drainage system will be designed to minimize impacts to near shore coastal waters.

An open drainage channel will be constructed along the eastern boundary (mauka) of the project site to redirect any offsite drainage away from the project site and into natural drainage paths flowing through the project site. Another drainage channel will also be placed along the eastern boundary of the Dryland Forest to prevent on-site drainage from entering the Dryland Forest. A drainage channel will also be placed along the northern boundary of the project site to capture and redirect runoff generated uphill.

All drainage improvements will be developed in accordance with the applicable State DOH and County drainage requirements and standards. In addition, the Applicant will comply with all laws and regulations regarding runoff and non-point source pollution.

4.10.4. Solid Waste

The County of Hawai'i currently maintains and operates two active landfills, one located in Hilo, and the other located north of Kaloko Makai at Pu'uanahulu. As of April 2008, the County of Hawai'i has reported that the Pu'uanahulu landfill, which meets all current EPA requirements for landfills, is anticipated to have a remaining lifespan of 47 years.

As of 2007-2008, approximately 86,442 tons or 29.2 percent of the County's total 296,473 tons of solid waste were recycled. Hawai'i County's 2009 Integrated Resources and Solid Waste Management Plan calls for a transition towards increased recycling, citing a 44% recyclable volume of solid waste as a goal for the 2014-2015 fiscal year.

Hawai'i island residents collect and transport solid waste to 21 solid waste transfer stations situated across the island. A number of communities have opted to employ private contractors to collect said waste for transit and disposal. Kailua Transfer Station is the nearest transfer station to the project site, and is approximately 2.5 miles to the southeast of the project site. Solid waste is not being generated on the Property at present.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Waste generated through site development will consist predominantly of vegetation, and debris. Soil and debris displaced from grading and clearing will be utilized as fill throughout the site as required, minimizing disposal and transit/relocation of said materials. Concrete, waste lumber, and other associated building materials will comprise the bulk of solid construction waste resulting from the development of the site.

Throughout project construction and development, Kaloko Makai will adopt and establish a job-site waste management and recycling program geared towards the promotion and maintenance of clean construction sites, maximization of material recycling, and mitigation of required disposal transit traffic. On an effective basis, Kaloko Makai will seek to reduce, reuse, and recycle materials and waste to the greatest degree possible.

Construction materials that are rendered un-recyclable will be disposed of in the Pu‘uanahulu landfill.

Green waste resulting from the Project’s development will be chipped into mulch for on-site use or will be transported to green waste recycling centers; these operations will be scalable and planned to optimize transit and capacity.

Upon full build out and occupancy, Kaloko Makai is expected to produce approximately 12,795 tons/year of household/community waste. Measures and provisions to implement recycling, such as collection systems and storage for recyclables will be heavily incorporated to Kaloko Makai.

Kaloko Makai will work hand in hand with the County to produce feasible alternatives for residential curbside collection, including source-separated recyclables. Waste that is rendered unable to be recycled or incorporated into on-site green waste processing will be disposed of in the Pu‘uanahulu landfill. At the appropriate phase of project design and development, a Solid Waste Management Plan will be prepared and submitted to the County Solid Waste Division.

4.10.5. Electrical

Electrical power is provided to the Island of Hawai‘i by Hawai‘i Electric Light Company, Inc. (HELCO). As the project is currently undeveloped, it is not served by existing HELCO facilities at present. The nearest source of existing electrical power is the off-site Kaloko electrical substation which is served by a 12,470 volt underground distribution system along Hina Lani street.

Keahole Power Plant, the largest power producing facility on the island, is located mauka of the Airport and Queen Ka‘ahumanu Highway, and generates up to 75 percent of the power demanded by West Hawai‘i, and approximately 35 percent of the island’s entire electrical demands.

As of October 2010, HELCO’s system peak load was reported to be 194,600 kilowatts, with a total generation system capability of 285,500 kilowatts and a reserve margin of 37 percent.

HELCO encourages net energy metering as an effective means of harnessing eligible renewable energy systems and technologies available to residential and commercial consumers. HELCO customers that own or lease an eligible renewable energy system (e.g. photo-voltaic solar system) may enter into an agreement with HELCO to directly feed their systems into the utility grid, allowing for a surplus sharing of produced electricity with the rest of the grid. Net energy metering essentially enables renewable energy system operators to reduce or negate their kilowatt-hours of consumption registered with HELCO, allowing for cost savings, and in some cases complete electrical power independence.

Electrical service for the project will be provided by HELCO.

POTENTIAL IMPACTS AND MITIGATION MEASURES

At full build out, the annual electrical demand for Kaloko Makai is expected to reach a maximum of approximately 210.8 million kilowatt-hours/year. This is an estimated figure that does not account for potential demand reductions corollary to energy efficiency and conservation measures, such as the use of solar photo-voltaic systems.

HELCO has specified that the current nearby Kaloko substation will not satisfy the needs of the project, and the demands of the project will require an extension of an existing 69,000 volt transmission line along Queen Ka'ahumanu Highway to a new on-site substation. Approximately 62,500 square foot area (250 ft. by 250 ft.) will be set aside for the construction of a new substation on project site. The existing off-site 12,470 volt distribution system along Hina Lani Street is not adequate to serve the Project. On-site and off-site distribution line extensions and easements will be required to service the projects anticipated load. Kaloko Makai will collaborate directly with HELCO to determine, plan, and execute any facility expansion requirements. Subterranean electrical distribution systems are expected to be standard throughout Kaloko Makai.

Pursuant to Chapter 344 (State Environmental Policy) and Chapter 226 (Hawai'i State Planning Act), HRS, all Kaloko Makai activities, buildings, and grounds will be designed with a significant emphasis on energy conservation and efficiency. Efficient design practices and technologies will be the cornerstone of Kaloko Makai's design phase. Buildings within Kaloko Makai will further comply with the County of Hawai'i Energy Code (Hawai'i County Code, Section 5, Article 2). Furthermore, solar water heaters will be utilized as made requisite under Section 196-6.5, HRS.

Kaloko Makai will confer with HELCO in regards to suggestions and proposals for customized demand-oriented management programs offering rebates for the installation of alternative energy-efficient technologies and measures.

To reduce net energy consumption and demand, Kaloko Makai will consider the implementation of elements of the United States Environmental Protection Agency (EPA) Energy Star Program; including efficient insulation, high performance windows, compact construction, efficient ventilation systems, and energy efficient lighting elements and appliances. Kaloko Makai will furthermore seek to harness energy conservations and technologies to facilitate the possibility of net energy metering in building design to empower residents and tenants to reduce their electricity costs and provide energy back to the grid.

Energy conservation and efficiency measures will be implemented and emphasized where applicable in the design of Kaloko Makai. Energy-efficiency technologies to be considered include:

- Solar energy for water heating
- Photovoltaic systems, fuel cells, biofuels and other renewable energy sources
- Optimal utilization of daytime sunlight
- High efficiency light fixtures
- Roof and wall insulation, radiant barriers, and energy efficient windows
- Optimized air-flow
- Installation of heat resistant roofing
- Intelligent Landscaping to provide for shading, dust control, and heat-mitigation
- Portable solar lighting (i.e. parking lots)
- Utilization of a “district cooling” system harnessing cold sea water / water frozen using off-peak electricity as a chilling agent for HVAC systems. NELHA utilizes such technologies, which require far less maintenance than conventional compressor derived systems, resulting in energy cost savings.

These measures are compliance with the following Kona CDP objective and policy:

Objective ENGY-1. To provide a multi-prong framework, including standards, innovations, incentives, and education, to reduce the dependency on imported fossil fuels through energy efficiency and renewable energy generation.

Policy ENGY-1.5: Distributed Energy and Other Innovative Technology Support.

Photovoltaic systems are typically used as distributed generation when connected to the electrical grid where they have the potential to sell excess energy back to the grid. This is an emerging technology with challenges for the utility to incorporate such systems into the grid. This policy is aspirational and expresses general support in whatever way possible (e.g., permit coordination, grants) to encourage further development in this endeavor.

4.10.6. Telephone and Cable Communications

The Kaloko Makai project area is currently not served by any telephone, dataline, or cable access facilities.

Existing utilities in the vicinity of the project site consists of overhead lines within Kaloko Industrial Park.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Telephone, data line access to the Internet, and cable TV service for the project will be provided by Hawai'i an Telcom and Hawai'i Cablevision. All utility lines will be placed underground.

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