



Kakaako Community Development District

Final Supplemental Environmental Impact Statement - Volume III

Appendix D: Cultural Impact Assessment

Appendix E: Infrastructure Plan

Draft Mauka Area Plan

Prepared for:
Hawaii Community Development Authority
Prepared by:
EDAW, Inc.

May 2009

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Appendix D

Cultural Impact Assessment

Cultural Impact Assessment for the Kakaʻako Community Development District Mauka Area Plan, Waikīkī Ahupuaʻa, Honolulu (Kona) District Oʻahu Island

TMK: [1] 2-1-29-32, 44, 46-56 and 2-3-01-11

Prepared for

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(Job Code: KAKAAKO 5)

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Management Summary

Title	Cultural Impact Assessment for the Kaka‘ako Community Development District Mauka Area Plan, Waikīkī Ahupua‘a, Honolulu (Kona) District O‘ahu Island TMK: [1] 2-1-29-32, 44, 46-56 and 2-3-01-11
Date	December 2008
Project Number/s	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: KAKAAKO 5
Agencies	State of Hawai‘i Department of Land and Natural Resources (DLNR)/State Historic Preservation Division (SHPD); State of Hawai‘i Department of Health/Office of Environmental Quality Control (DOH/OEQC)
Project Location	The project area (hereafter referred to as the Mauka Area District) is bounded by Ala Moana Boulevard to the south, Pi‘ikoi Street to the east, King Street to the north, and Punchbowl Street to the west. This area is depicted on the 1998 Honolulu USGS 7.5-minute topographic quadrangle.
Land Jurisdiction	Both public and private land owners.
Project Acreage	Approximately 450 acres.
Project Description	According to information provided by the Hawaii Community Development Authority (HCDA), the Mauka Area Plan establishes planning principles and development objectives for the orderly redevelopment of the Kaka‘ako Mauka Area. Major revisions from previous plans include: • Developing a pedestrian-friendly mixed-use district where people are able to work, live, shop and play in a neighborhood community. New developments would be mixed horizontally as well as vertically, while achieving the highest use of prime urban land. • Creating great places, including a network of green streets and pedestrian friendly environment. • Encouraging a mix of housing opportunities, including reserved housing units for gap group residents. • Allowing easy connections and providing strong physical and visual Mauka-Makai connections. • Supporting the small lot, mixed-use pattern of Central Kaka‘ako. The intent of the Draft Mauka Area Plan is to provide necessary guidance in planning and development of a high-quality, urban community that also promotes positive economic development, preserves

	Honolulu’s diverse cultural heritage, and incorporates best practices in energy and environmental sustainability.
Area of Potential Effect (APE)	In general, the APE for Cultural Impact Assessments (CIA) is substantially larger than for archaeological studies, which focus only on the immediate physical impact of the proposed footprint of a project on the landscape. The APE for this study, in addition to the approximately 450-acre Mauka Area District described above, extends to wider associations throughout Waikīkī Ahupua‘a, Kona District, and beyond (e.g., to other places on O‘ahu and even other islands), since Hawaiian traditions recognize and value such far-reaching connections. In this report, the term “study area” denotes the larger context considered for this CIA investigation.
Document Purpose	At the request of the HCDA, CSH undertook this CIA. The project requires compliance with the State of Hawai‘i environmental review process [Hawai‘i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project’s effect on traditional cultural practices. Through document research and cultural consultation efforts this document provides information pertinent to the assessment of the proposed project’s impacts to cultural practices (per the OEQC’s *Guidelines for Assessing Cultural Impacts*). The document is intended to support the project’s environmental review and may also serve to support the project’s historic preservation review under HRS Chapter 6E-42 and Hawai‘i Administrative Rules (HAR) Chapter 13-284.
Consultation Effort	Hawaiian organizations, agencies, cultural and lineal descendants and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Mauka Area District and the vicinity. Organizations and members/representatives of the organizations consulted included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), Hui Mālama I Na Kūpuna O Hawai‘i Nei, the Ala Moana/Kaka‘ako Neighborhood Board, the O‘ahu Island Burial Council, and Kamehameha Schools
Results of Background Research	Background research indicates: 1. The current urban district known as Kaka‘ako is significantly larger than the traditional area of the same name, which is described in mid 19th century documents and maps as a small *‘ili* (traditional land unit). In addition to Kaka‘ako, the Mauka Area District also includes lands once known as Ka‘ākaukukui, Kukuluāe‘o, and Kewalo, and possibly smaller portions of other *‘ili*. 2. In traditional times, the study area is characterized by fishponds, salt ponds, trails connecting Honolulu (Kou) and Waikīkī, and

	occasional taro *lo‘i*. Wetland/fishpond deposits have been documented in the Kaka‘ako Mauka Area. 3. Previous archaeological work confirms that there are intermittent buried cultural layers in this near shore environment reflecting the Hawaiian pattern of permanent settlements in proximity to agriculture, aquaculture and marine resources. 4. There are four large historically documented cemeteries in the Mauka Area District. The full extent of these cemeteries has not been delimited and there are likely to be hundreds of burials associated with these cemeteries but outside the modern cemetery boundaries, under streets or under modern structures. Archaeological evidence has shown that during post contact times portions of the lands in and around the Mauka Area District were used to bury large numbers of people in unmarked cemeteries. A total of 274 historic burials have been recorded (*in situ* or disinterred) in the Kaka‘ako Mauka Area. 5. Kaka‘ako is a highly urbanized area with a mix of low, mid and high rise structures. There are no structures in the Mauka Area that predate or reflect the style of construction prior to western contact with native Hawaiians in 1778. A few remaining buildings were built by or inspired by nineteenth century missionaries, however, most buildings in Kaka‘ako were built during the twentieth century after Hawai‘i became a U.S. territory. To preserve Kaka‘ako historic resources in accordance with Chapter 206E, HRS, the Draft Mauka Area Plan identifies eight properties to be protected. See Table 5. All eight properties are listed on either the National or State Register of Historic Places. The Draft Mauka Area Plan also proposes to protect the City and County of Honolulu’s Neal Blaisdell Center for its cultural and aesthetic value. 6. The study area is associated with *mo‘olelo* (oral history) in which Ka‘ākaukui, Kewalo and Kukuluāe‘o were traditionally noted for their fishponds and salt pans, for the marsh lands where *pili* grass and other plants could be collected, for ceremonial sites such as Pu‘ukea Heiau, Kewalo Spring, and Kawailumalumai Pond at which sacrifices were made, and for their trails that allowed transport between the more populated areas of Waikīkī and Honolulu. Important chiefs such as Hua-nui-ka-la-la‘ila‘i were born in the area and conducted religious rites, and commoners traveled to the area to procure food and other resources; some commoners probably also lived in the

	area, possibly adjacent to the ponds and the trails. The study area is also associated with legendary accounts of the Waters of Ha‘o, Kapoi and the *heiau*, and the legend of Hi‘iaka and more.
Results of Community Consultation	Eighty-one community members (government agency or community organization representatives, or individuals such as residents, cultural and lineal descendants, and cultural practitioners) were contacted for the purposes of this CIA. Thirty-four people responded and 12 *kūpuna* (elders) and/or *kama‘āina* (native-born) were interviewed for more in-depth contributions to the CIA. Based on these consultations, there are 5 major concerns (and several ancillary ones) regarding potential adverse impacts on cultural, historic and natural resources, practices and beliefs as result of the proposed Mauka Area Plan: 1. The Mauka Area District and vicinity is likely to have surface and subsurface cultural and historic properties, including human burials. Several of the study participants indicated that there could be *iwi kūpuna* (ancestral remains) in or near the subject Mauka Area District. Phyllis “Coochie” Cayan of SHPD states, “As you know from past and current projects in the area and the ahupua‘a—the makai area is a high risk for human burials. There has been past inadvertent finds mauka, but not as numerous as the makai areas.” Study participants made the following recommendations: a. Due to the fact that the Mauka Area District is likely to have surface and subsurface cultural and historic properties, Hui Mālama I Na Kūpuna O Hawai‘i Nei has recommended a thorough, in-depth archaeology inventory survey. OHA recommended for every developer within HCDA’s jurisdiction to conduct an archaeological inventory survey to identify *iwi kūpuna* as the probability of burials and other cultural properties in the Mauka Area District is high. b. Cultural descendant Paulette Kaleikini has stated that, “any/all burials must be preserved in place and left undisturbed.” She also requested that “a cultural monitor be on duty each and everyday during the survey and testing and also that a detailed record of any/all *moepū*

	(funerary objects) and artifacts be kept." c. OHA, SHPD, Hui Mālama I Na Kūpuna O Hawai‘i Nei, Leimomi Khan, Charles Kapua, Dr. Claire Hughes, Paulette Kaleikini and Paulette Moore state that *iwi kūpuna* finds be protected and treated respectfully. 2. Several participants voiced negative feelings and concerns about the overall cumulative impacts of ongoing and future developments in Kaka‘ako and Mauka Area District environs as contributing to the loss of what is authentic and traditional about Kaka‘ako. Study participants mentioned factors such as: housing prices and rental space for businesses being beyond the reach of most *kama‘āina* and the displacement of local, family businesses by national chains. A few participants provided suggestions for development projects that might generate more tourism to the area while maintaining a Hawaiian sense of place and the look and feel of "old Kaka‘ako" including: (a) creating a pedestrian overpass over Ala Moana Boulevard to Kewalo Basin, (b) refurbishing the fish auction house, (c) creating a monument in Kaka‘ako as a repository for genealogies of the Hawaiian monarchy, (d) creating a Hawaiian "cultural market" and, (e) providing local businesses with lower rent. 3. A related concern is the loss of historic properties in the Mauka Area District and vicinity. The Historic Hawai‘i Foundation (HHF) referred CSH to an inventory study prepared by Fung Associates for General Growth Properties (GGP) (2008) in which 13 parcels were identified within the master plan boundary that contain structures of historic integrity that will become eligible for designation on the State Register of Historic Places within the 30 year planning horizon. HHF emphasized that of the 13 parcels identified in the 2008 Fung Associates inventory for state and national registers of historic places, the IBM Building at 1240 Ala Moana Boulevard designed by Vladimir Ossipoff (1962) is significant for its distinctive architecture and the work of a master and is thus eligible for designation on the Hawai‘i Register of Historic Places. HHF further recommended for this CIA that, …similar study and evaluation of the remaining blocks to be conduced and that the findings from the GGP inventory be incorporated. Notable sites will include those already listed on the Hawai‘i

	State or Nation Registers of Historic Places, such as McKinley High School and the Ala Moana Pumping Station, as well as…the Dickey-designed theater, WWII-era and post-war Quonset huts, modernist structures at the Blaisdell complex, and other residential, commercial and industrial buildings throughout Kaka‘ako. Community contacts interviewed for this study also noted the significance of historic properties in the Mauka Area District and vicinity and stated their desire to see the preservation and/or rehabilitation of properties in or near the Mauka Area District such as Fisherman’s Wharf, Ward Farmers Market (formerly, Ala Moana Fish Market), Mother Waldron Neighborhood Park, Kewalo Theater and buildings on Queen Street such as the Quonset huts and the Hamada H. Store. 4. Some participants voiced opposition to the development, construction or alteration of Kaka‘ako that threatens to negatively impact its view corridors and remaining green spaces (parks). Participants are concerned that high rises will further obstruct *mauka-makai* views; one participant stated his concern that further high rises would create a wind tunnel; another participant recommended that building height be limited to 40 feet. Two participants provided suggestions to help remediate the loss of green spaces and to protect the natural environment including: pursuing a green initiative by, for example, using a deporter that transfers deep, cold ocean water to power air conditioners in buildings close to the shoreline; creating a Hawaiian garden with plants that people used and use in everyday life such as *kukui* (*Aleurites moluccana*) and *tī* (*Cordyline fruticosa*). 5. A few participants expressed concern about the study area’s overtaxed infrastructure mentioning, for example, streets in disrepair, traffic congestion and waste management problems as a result of current and future developments in Kaka‘ako.
Recommendations	For several of the participants in this CIA there is great concern that proposed developments for Kaka‘ako will negatively impact Hawaiian resources and practices, particularly with regard to disturbance of burials or *iwi kūpuna*, as well as the loss of a Hawaiian sense of place and the

	historic look—and socio-economic vitality for *kama‘āina*—of old Kaka‘ako. A good faith effort to address the following recommendations may help mitigate potentially adverse effects of the proposed project on cultural, historic and natural resources (and associated practices) in and near the Mauka Area District: 1. Based on the archival evidence and community consultation conducted for this assessment, it is likely that there are burial sites (*iwi kūpuna*, ancestral remains) as well as significant cultural and historic properties in the subject area; it is therefore recommended that: a. Cultural monitoring and/or continuous ongoing consultation with cultural descendants of the area be conducted during all phases of development including during construction; b. Personnel involved in development activities in the Mauka Area District should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law; c. If human burials are found, cultural and lineal descendants of the area should be consulted in regard to burial treatment plans; d. A thorough, in-depth archaeological inventory survey should be conducted. 2. It is recommended that the proposed development should preserve and include themes from “old Kaka‘ako” and native Hawai‘i that enhance the sense of place and that project proponents consider suggestions provided by community members on developments such as a fish market, Kewalo Basin overpass, etc. 3. It is recommended that the proposed development plans not impinge on view corridors and green spaces and that project proponents consider suggestions provided by community members on green initiatives, gardens, etc. 4. It is recommended that the project proponents address infrastructure concerns with community members before development begins. 5. Generally, it is recommended that project proponents

	pursue proactive consultation with community members and cultural and lineal descendants with connections to Kaka‘ako in order to address community concerns and integrate preservation and restoration ideas in the design and construction of any future developments in Kaka‘ako.

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Section 1 Introduction

1.1 Project Background

At the request of the Hawaii Community (HCDA), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this Cultural Impact Assessment (CIA) in support of the Kaka‘ako Community Development District Mauka Area Plan, Waikīkī Ahupua‘a, Honolulu (Kona) District, O‘ahu Island, TMK: [1] 2-1-029 to 032, 044, 046 to 056; [1] 2-3-001 to 011. The Mauka Area District is bounded by Ala Moana Boulevard to the south, Pi‘ikoi Street to the east, King Street to the north, and Punchbowl Street to the west (Figure 1 to Figure 3).

In 1976, the Hawai‘i State Legislature created the HCDA to revitalize certain urban areas in the state. The first urban area so designated was the Kaka‘ako Community Development District. The District later expanded to include the waterfront area from Kewalo Basin to Forrest Avenue. This development area, shown in Figure 4, is larger than the ancient boundary of Kaka‘ako, and extends into lands once known as Ka‘ākaukukui, Kukuluāe‘o and Kewalo.

In 2003, the HCDA initiated a comprehensive review of the Kaka‘ako Community Development District Mauka Area Plan and Rules (“Plan”), originally adopted in 1982. The Plan establishes planning principles and development objectives for the orderly redevelopment of the Kaka‘ako Mauka Area. The comprehensive review has resulted in proposed revisions to the existing Plan. After an extensive public input process, a Draft Mauka Area Plan was completed in May 2007. Major revisions from previous plans include:

- Developing a pedestrian-friendly mixed-use district where people are able to work, live, shop and play in a neighborhood community. New developments would be mixed horizontally as well as vertically, while achieving the highest use of prime urban land.
- Creating great places, including a network of green streets and pedestrian friendly environment.
- Encouraging a mix of housing opportunities, including reserved housing units for gap group residents.
- Allowing easy connections and providing strong physical and visual Mauka-Makai connections.
- Supporting the small lot, mixed-use pattern of Central Kaka‘ako.

The intent of the Draft Mauka Area Plan is to provide necessary guidance in planning and development of a high-quality, urban community that also promotes positive economic development, preserves Honolulu’s diverse cultural heritage, and incorporates best practices in energy and environmental sustainability.

For this CIA, the Area of Potential Effect (APE) is defined as the entire approximately 450-acre footprint of the Mauka Area District, in addition to the surrounding landscape within which the Mauka Area District is located (e.g., Downtown Honolulu, Kaka‘ako Makai, the eastern

portions of Wakīkī, and *mauka*, or inland, areas north of King Street). The inclusion of these surrounding areas is relevant for the purposes of CIA documentation and assessment because associations and connections with the broader landscape reflect traditional Hawaiian concepts of cultural and historical significance. This CIA also considers the cumulative impacts on cultural practices and resources in and around the Mauka Area District. In this report, the term "study area" denotes the larger context considered for this CIA investigation.

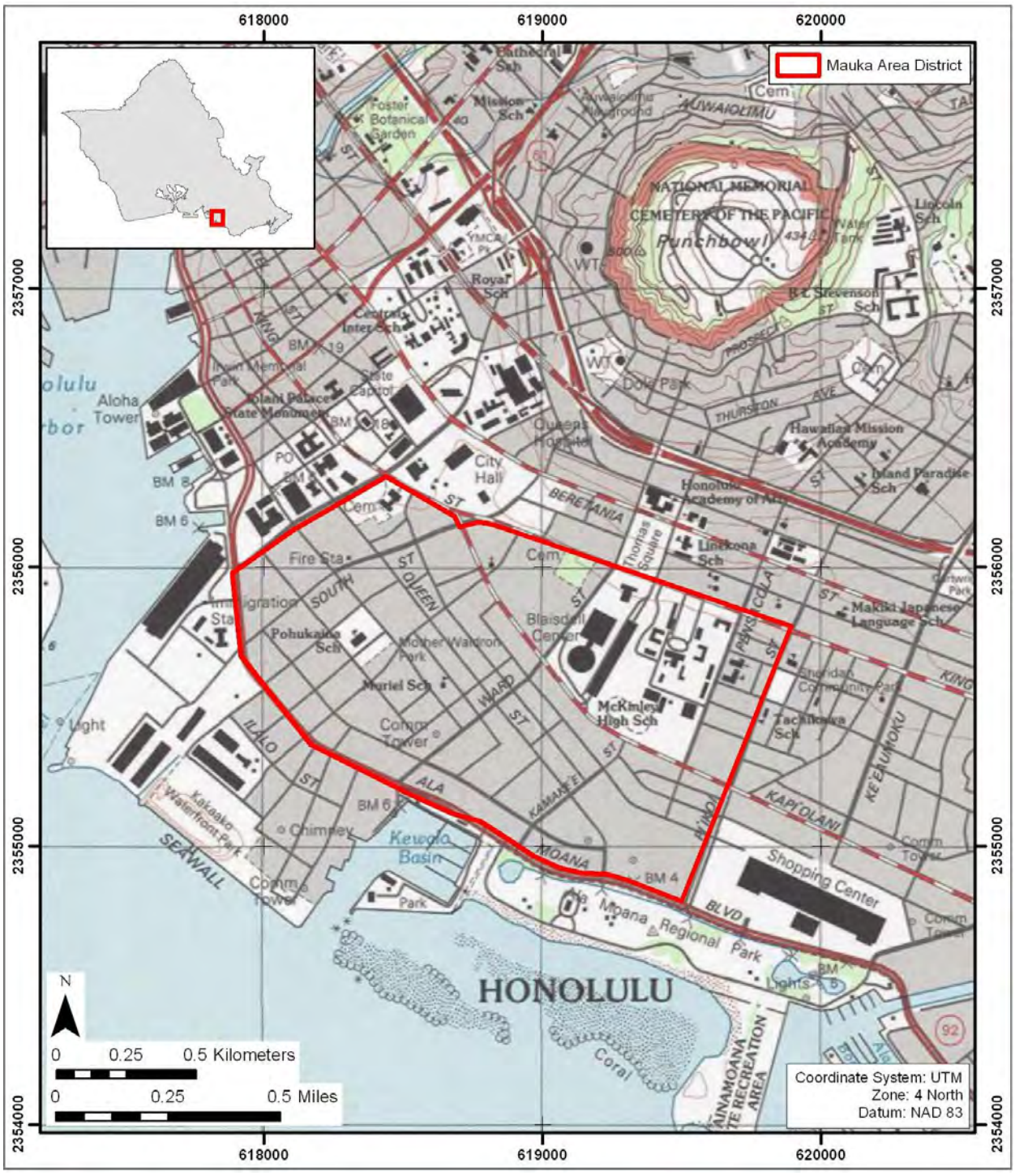


Figure 1. Mauka Area District (black hatching) depicted on 1998 Honolulu USGS 7.5-minute topographic quadrangle

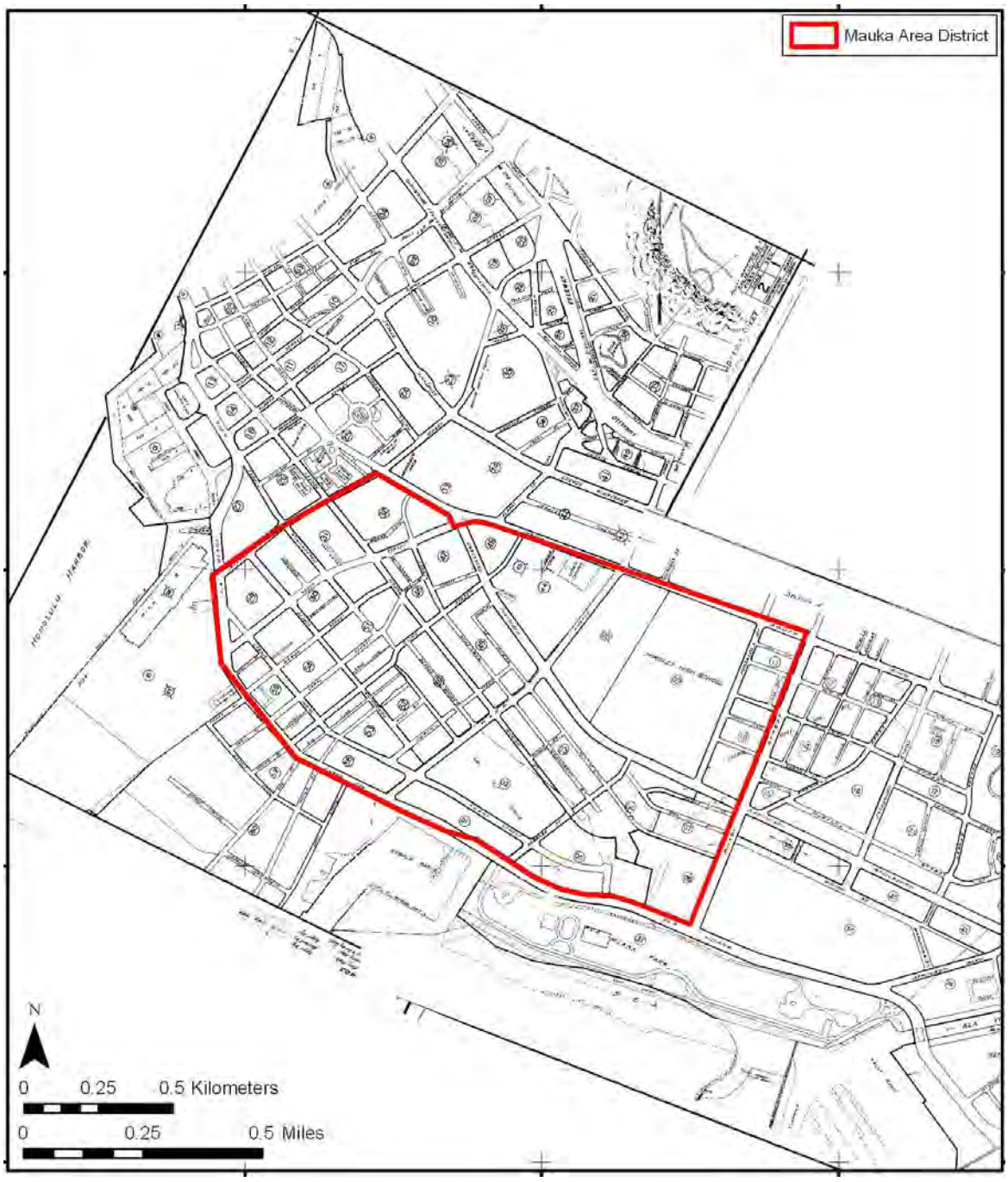


Figure 2. Mauka Area District (red hatching) depicted on combined tax maps 1-2-1 and 1-2-3

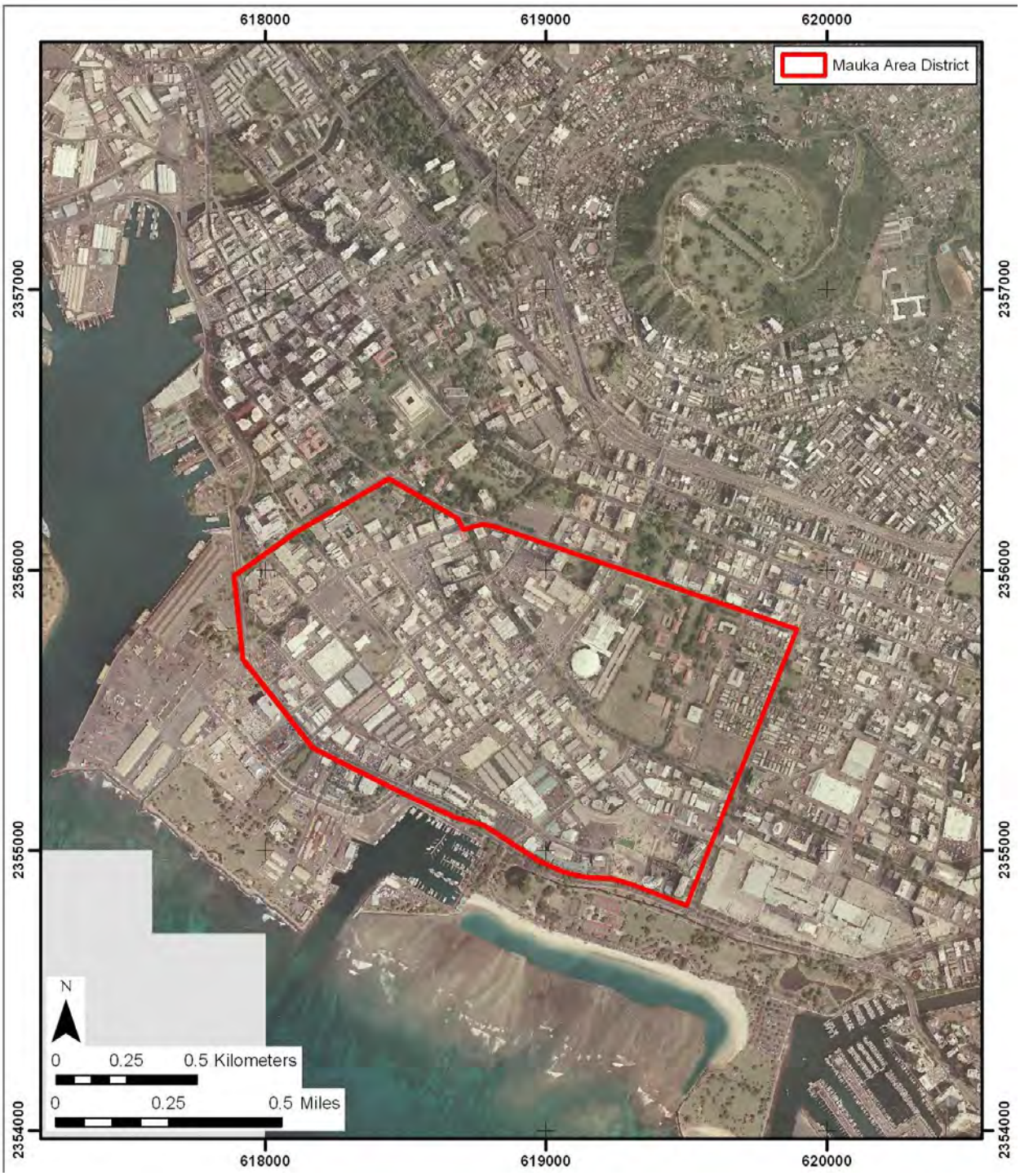


Figure 3. Aerial image of the Mauka Area District (outlined in red)

Figure 4. Kaka‘ako Community Development District boundary

1.2 Document Purpose

The project requires compliance with the State of Hawai‘i environmental review process [Hawai‘i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project’s effect on cultural practices. Through document research and cultural consultation efforts this report provides information pertinent to the assessment of the proposed project’s impacts to cultural practices and resources (per the OEQC’s Guidelines for Assessing Cultural Impacts). The draft document is intended to support the project’s environmental review and may also serve to support the project’s historic preservation review under HRS Chapter 6E-42 and Hawai‘i Administrative Rules Chapter 13-284.

1.3 Scope of Work

The scope of work for this CIA included:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources or agricultural pursuits as may be indicated in the historic record.

2. A review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Consultation and interviews with knowledgeable parties regarding traditional cultural practices at or near the parcel; present uses of the parcel; and/or other (non-Hawaiian) practices, uses, or traditions associated with the parcel.
4. Preparation of a report summarizing the results of these research activities.

1.4 Environmental Setting

1.4.1 Physical Environment

The Mauka Area District is within a physiographic section of O‘ahu called the Honolulu Plain, an area generally less than 4.5 meters (m), or 15 feet (ft) above mean annual sea level (Davis 1989:5). The Honolulu Plain is stratified with late-Pleistocene coral reef substrate overlaid with calcareous marine sand or terrigenous sediments, and stream fed alluvial deposits (Juvik and Juvik 1998). According to soil survey data compiled by Foote et al. (1972), the top soil stratum consists of Fill land, mixed (Fl), containing areas filled with material dredged from the ocean and hauled from nearby areas (Figure 5). As discussed below, several archaeological investigations in the Mauka Area District have also documented the presence of undisturbed Jaucas sands below the fill layers.

The modern Hawaiian shoreline configuration is primarily the result of: (1) rising sea level following the end of the Pleistocene (Stearns 1978; Macdonald et al. 1983); (2) the mid to late Holocene circa 1.5-2.0 m high-stand of the sea (see summary in Dye and Athens 2000:18-19); and, (3) pre-Contact and post-Contact human landscape modification.

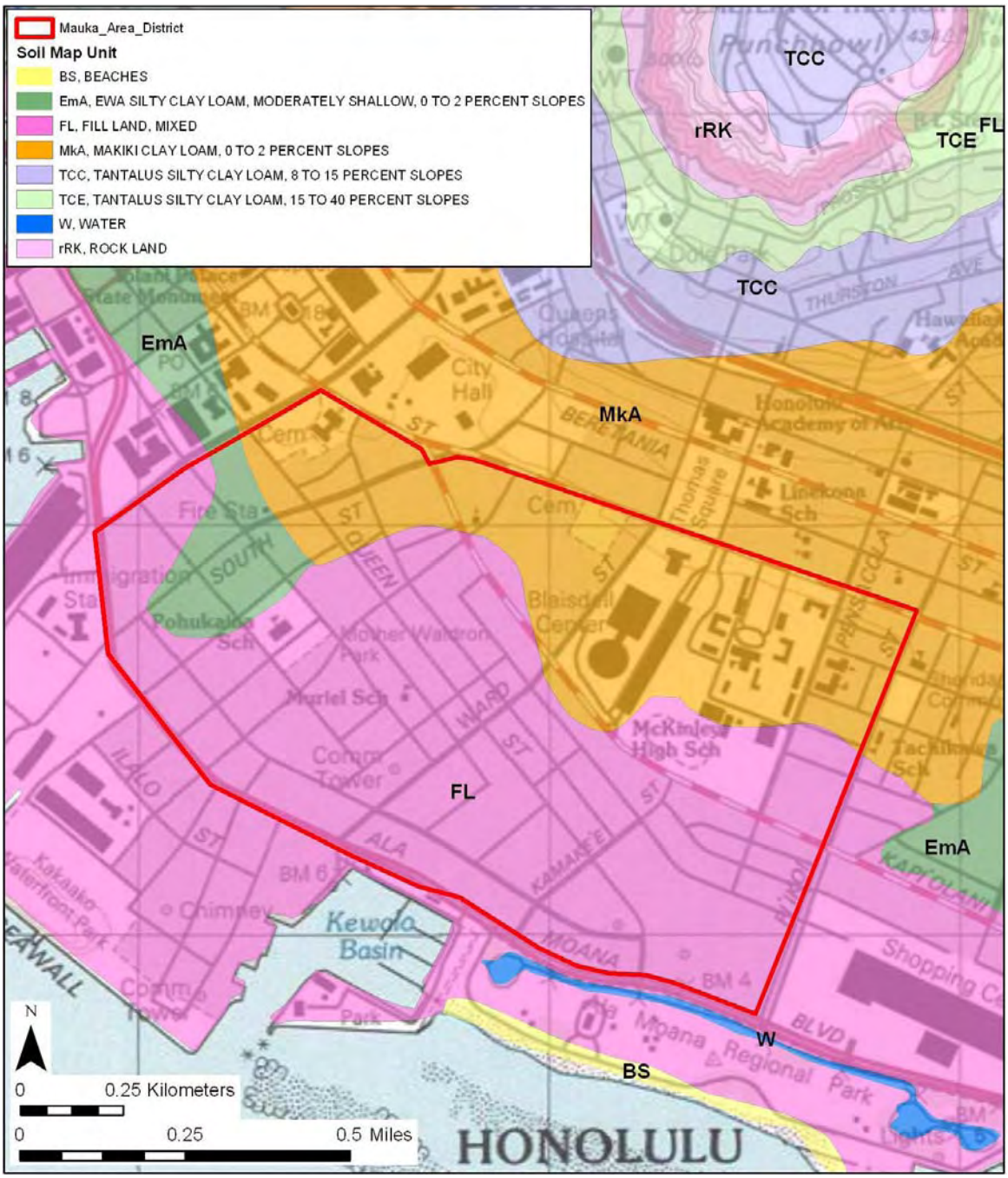


Figure 5. Soils within and surrounding the Mauka Area District (outlined in red); Mauka Area District is covered by the soil unit “fill” (FL), Makiki clay loam (MkA) and Ewa silty clay loam (EmA)

Between approximately 20,000 and 5,000 years ago, water previously locked in glacial ice returned to the world's oceans, and the sea-level rose over 100 m to approximately its current level. In the vicinity of the Mauka Area District, rising sea levels flooded the previously dry, earlier Pleistocene reef deposits, which had formed hundreds of thousands of years previously when sea level was comparable to modern levels. When sea levels reached approximately modern levels, the now coastal regions became depositional environments, where for tens of thousands of years previously, during the lower sea-levels, they had been erosional environments.

A high stand of the sea for the Hawaiian Islands, circa 1.5 to 2.0 m above present sea level, has been well documented between 4,500 and 2,000 years ago (Stearns 1978; Athens and Ward 1991; Fletcher and Jones 1996; Grossman and Fletcher 1998; Grossman et al. 1998; Harney et al. 2000). During this high stand, there appears to have been an increase in coral reef production and the production of detrital reef sediments. Littoral (i.e., coastal) environments appear to have been augmented (i.e., expanded seaward) substantially by the deposition of marine sediments. "What this means is that the great shoreline sand berms must have developed around the islands at this time because this was when calcareous sand was being produced and delivered to the shorelines in large quantities" (Dye and Athens 2000:19).

The Honolulu coastline was likely greatly affected by the deposition of marine sediments during this elevated sea level. The subsequent drop in sea level to its present level, circa 2,000 years ago, most likely created a slightly erosional regime that may have removed sediments deposited during the preceding period of deposition (Dye and Athens 2000:19). However, the net gain in sediments would have been substantial. In 1911, it was estimated that about one-third of the Honolulu Plain was a wetland (Nakamura 1979:65, citing a Hawaiian Territory Sanitary Commission report). Hawaiians used the lagoonal/estuary environment of the Honolulu plain to construct fishponds. Fishpond walls served as sediment anchors for the accumulation of detrital reef sediments. They also likely affected long shore sedimentary transport, resulting in new littoral deposition and erosion patterns. In the post- Western Contact period, when the fishponds were no longer utilized, they became obvious locations for the deposition of fill. These reclaimed areas provided valuable new land near the heart of growing urban Honolulu.

As stated above, Foote et al. (1972) show the *makai* (seaward) portion of the Mauka Area District as being fill (FL), described as:

> This land type occurs mostly near Pearl Harbor and in Honolulu, adjacent to the ocean. It consists of areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources.

The undeveloped natural condition of the Mauka Area District consisted of low-lying marshes, tidal flats, fishponds and reef areas. Beginning in the late nineteenth century, these low-lying area were filled in and then developed, which permanently changed the area into its present fully- urbanized character. While fill materials have been found in several portions of the Mauka Area District during previous archaeological investigations, Jaucas Sand (JaC) was also discovered underneath much of land surface. Foote et al. (1972) describe Jaucus sand as:

> The slope range of this soil is 0 to 15 percent, but in most places the slope does not exceed 7 percent. Included in mapping were narrow strips of Beaches and areas of Pulehu, Mokuleia, and Keaau soils.
>
> In a representative profile the soil is single grain, pale brown to very pale brown, sandy, and more than 60 inches deep. In many places the surface layer is dark brown as a result of accumulation of organic matter and alluvium. The soil is neutral to moderately alkaline throughout the profile. Permeability is rapid, and runoff is very slow to slow. The hazard of water erosion is slight, but wind erosion is a severe hazard where vegetation has been removed. The available water capacity is 0.5 to 1.0 inch per foot of soil. In places roots penetrate to a depth of 5 feet or more. Workability is slightly difficult because the soil is loose and lacks stability for use of equipment.

The *mauka* (inland) portion of the Mauka Area District is mainly Ewa silty clay loam, 0-2 percent slopes (EmA) (see Figure 5). The Ewa series consists of well-drained soils in basins and on alluvial fans, which developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from near sea level to 150 feet. The soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of native grasses and ‘*uhaloa* (*Waltheria indica* var. *americana*); historic introductions common to the area prior to its wholesale development include *kiawe* (*Prosopis pallida*) and *koa haole* (*Leucaena leucocephala*).

In the southwestern section of the Mauka Area District is an area covered with Makiki clay loam, 0 to 2 percent slopes. The Makiki series consists of well-drained soils on alluvial fans and terraces, which formed in alluvium mixed with volcanic ash and cinders. The soils are used almost entirely for urban purposes.

In this area of the Honolulu District, rainfall averages less than 30 inches per year (Juvik and Juvik 1998). Northeasterly trade winds prevail throughout the year, although their frequency varies from more than 90% during the summer months to 50% in January; the average annual wind velocity is approximately 10 miles per hour (Wilson Okamoto 1998). Vegetation within the Mauka Area District is limited to a few ornamental trees in grass parking lot dividers and along the Mauka Area District margins.

1.4.2 Built Environment

The Mauka Area District is located within central Honolulu and is surrounded by modern urban development including streets, sidewalks, utility infrastructure, and commercial, industrial, and residential structures. There are also a number of historic cemeteries, buildings and other structures within the Mauka Area District (e.g., Kawaiaha‘o Church).

Section 2 Methods

Historical documents, maps and existing archaeological information pertaining to the historic properties in the vicinity of this project were researched at the CSH library. Information on Land Commission Awards was accessed through Waihona ‘Aina Corporation’s Māhele Data Base (www.waihona.com). The State Historic Preservation Division, the Office of Hawaiian Affairs, the O‘ahu Island Burial Council, and community and cultural organizations on O‘ahu were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Mauka Area District and the surrounding vicinity. The names of potential community contacts were also provided by colleagues at CSH and from the authors’ familiarity with people who live in or around Kaka‘ako. The cultural specialist conducting research on this assessment employed snowball and judgment sampling methods, an informed consent process and semi-structured interviews according to standard ethnographic methods (as suggested by Bernard 2005). A discussion of the consultation process can be found in Section 6 on Community Consultations. Please refer to Table 6, Section 6 for a complete list of individuals and organizations contacted.

Section 3 Mythological and Traditional Accounts

3.1 Overview for Kaka‘ako

The current urban district known as Kaka‘ako is significantly larger than the traditional area of the same name, which is described in mid 19th century documents and maps as a small *‘ili* (traditional land unit) within the *ahupua‘a* of Honolulu. In addition to Kaka‘ako, the Mauka Area District also includes lands once known as Ka‘ākaukukui, Kukuluāe‘o, and Kewalo, and even smaller areas—portions of *‘ili*—called Kawaiaha‘o, Kō‘ula, Honuakaha, Pu‘unui, and ‘Auwaiolimu, as shown on several late 19th century maps (Figure 6 and Figure 7).

The original location and extent of an area called Kaka‘ako is ambiguous. The ethnographer Henry Kekahuna (1958:4), who was born in Hawai‘i in 1891 and was a long-time resident of O‘ahu, placed it “on the Ewa side of Kuloloia Stream where the Honolulu Iron Works and Fort Armstrong are now,” an area now covered by One Waterfront Plaza (between South and Punchbowl Streets). Only four LCA claims list their location as within the *‘ili* of Kaka‘ako. These are also generally located adjacent to the sea, east of Punchbowl Street between Pohukaina Street and Reed Lane. The 1884 map of the “Kewalo” section of Honolulu by S. E. Bishop (Figure 6), does not show an area named Kaka‘ako at all. On a 1897 map of Honolulu by M. D. Monsarrat, the area adjacent to the coastal wharfs is labeled Kaka‘ako (Figure 7). These maps and documents all place Kaka‘ako at the extreme western boundary of the Kaka‘ako Mauka Area. The only late nineteenth map that has a mark for Kaka‘ako east of this general area is an 1872 C. J. Lyons’ map of Ka‘ākaukukui and Pu‘unui, which has a coastal point (marked by a triangle) labeled Kaka‘ako, between Cooke Streets, ‘Ohe Lane, and Ala Moana Boulevard. This is probably a triangulation station used by surveyors for mapping, rather than a point marking the central section of Kaka‘ako (Figure 8).

Until fairly recently, Kaka‘ako was considered to be something of a wasteland, or empty space, between the better-known locations of Kou (modern-day Honolulu) and Waikīkī. Several recent archaeological projects, in support of development and construction in the area, have documented several large cemeteries dating from the earlier historic period and perhaps late pre-Contact times. Otherwise, the place is known and famous in a traditional sense for its low-lying marshes, fishponds and salt making. Cultural Surveys Hawai‘i’s research suggests that the Kaka‘ako Mauka Area District is located in a region less extensively populated than the nearby centers of Waikīkī and Honolulu by the Hawaiians inhabiting the southern coast of O‘ahu before the nineteeth century. However, extensive deposits in cultural layers found during testing of the Ward Villages Project indicate permanent settlement in Kaka‘ako.

3.2 Place Names

Place name translations presented without attribution in this subsection are from *Place Names of Hawai‘i* (Pukui et al. 1974), unless indicated otherwise. The researchers for this place name book based their interpretations not only on literal (phonetic) translations of the words, but also on oral traditions and historic documents. In this work, the place names of geographic features

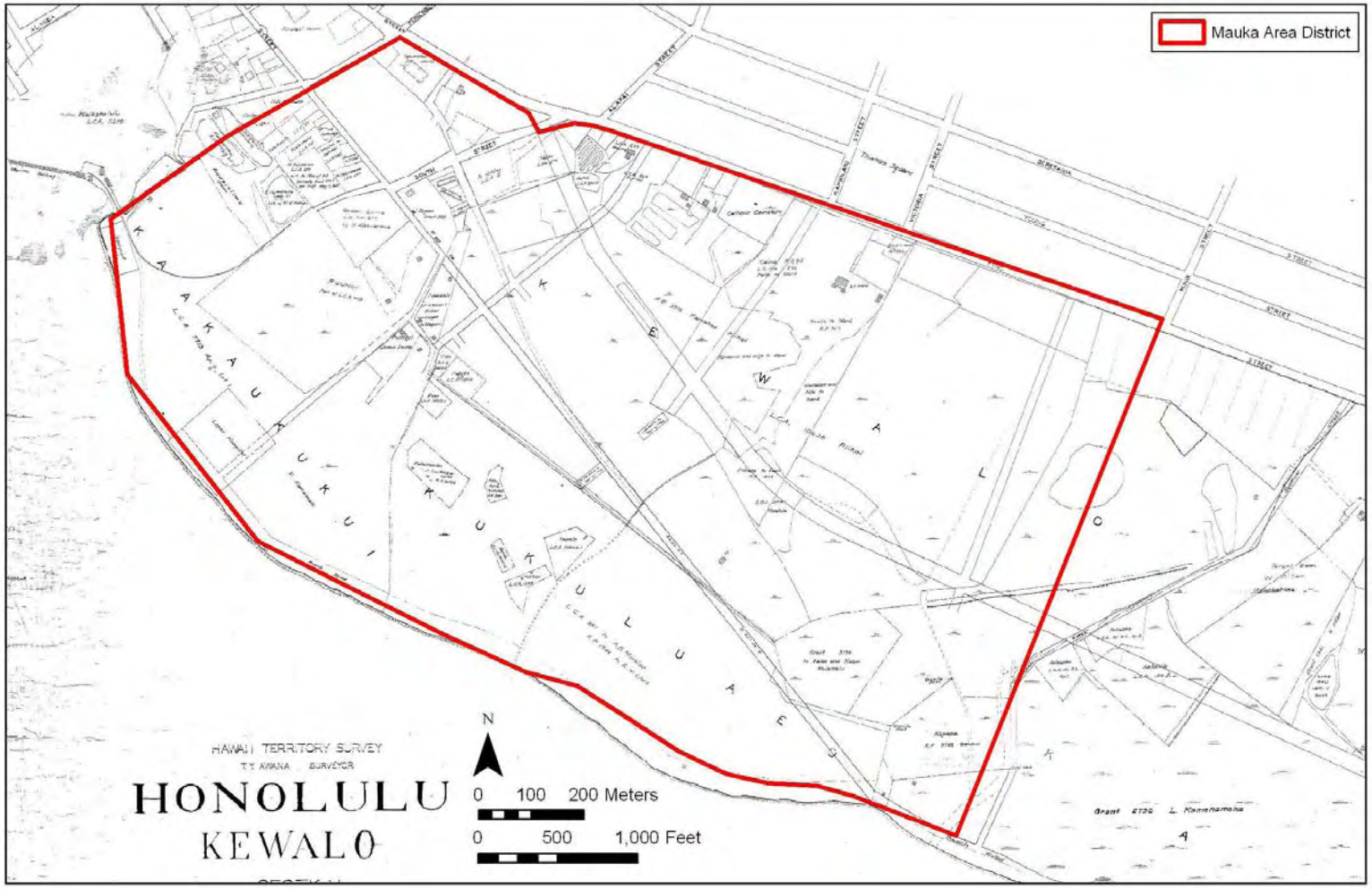


Figure 6. 1884 map by S. E. Bishop of the Kewalo section of Honolulu, showing Mauka Area District (outlined in red); also note place names Kawelo, Kukuluāeʻo, Kaʻākaukui, Puʻunui, and ʻAuwaiolimu (the last two are just *mauka* of the Kaʻākaukukui label) (Hawai‘i Land Survey Division, Reg. Map 1090)

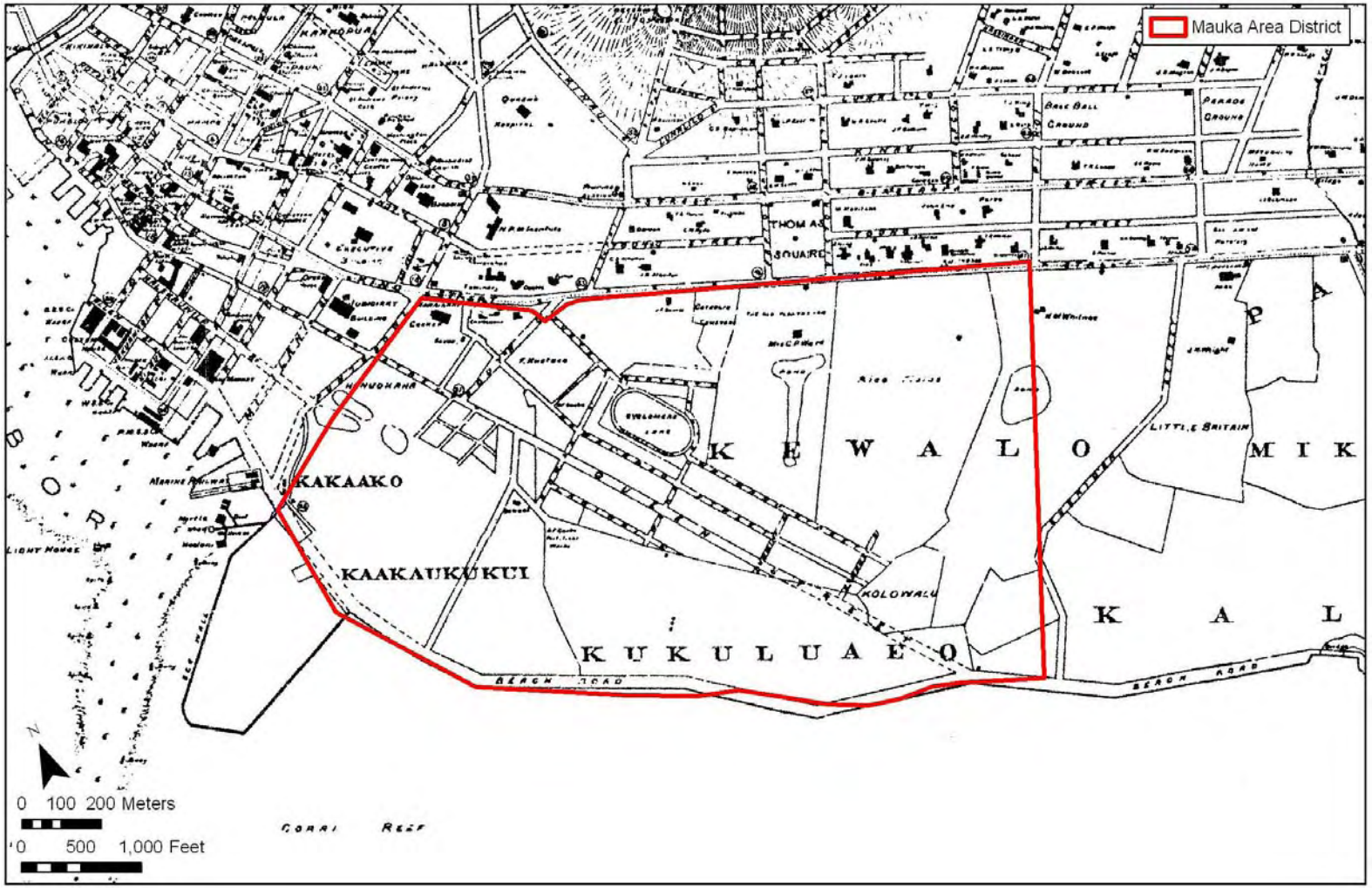


Figure 7. 1897 map of Honolulu by M. D. Monsarrat, showing the Mauka Area District (outlined in red); also note place names Kewalo, Kukuluāe‘o, Ka‘ākaukukui, Kaka‘ako, and Honuakaha (smaller print just *mauka* of the Kaka’ako label) (Hawai‘i Land Survey Division, Reg. Map No. 1910)

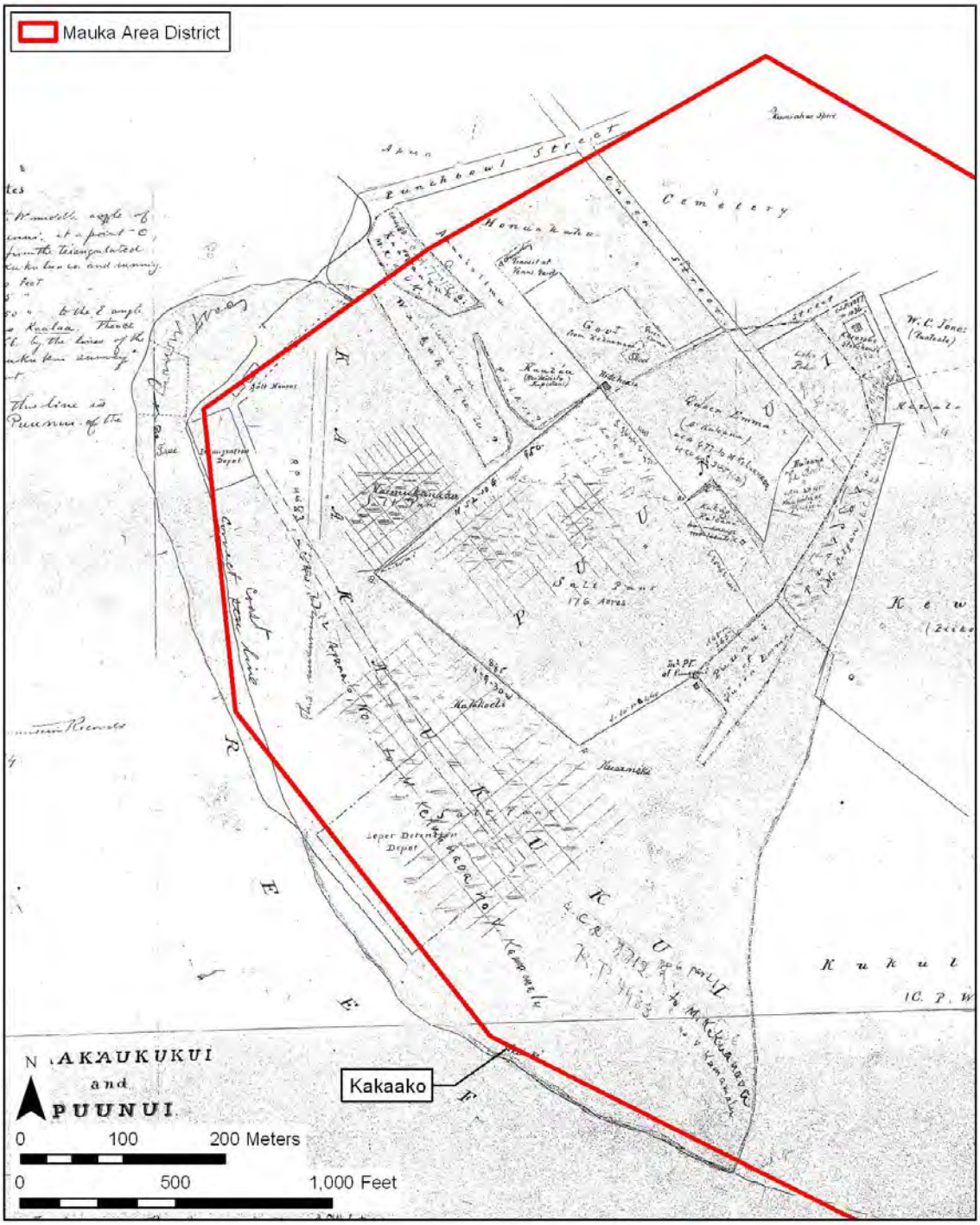


Figure 8. 1876 map by C. J. Lyons of Ka‘ākaukukui and Pu‘unui, showing place names Honuakaha, ‘Auwaiolimu, Pualoalo, Queen Emma’s lot (once owned by Kinau), salt Pans, Immigration Depot, Leper Detention Depot, Kerosene Storehouse, and Transit of Venus Station; note triangle marked “Kakaako” along the coast (Hawai‘i Land Survey Division, Reg. Map 611)

and *ahupua‘a* names are translated; however, *‘ili* names (small land divisions within *ahupua‘a*) are not usually presented. Many of the place names listed below are associated with specific *mo‘olelo* (oral histories) and *wahi pana* (legendary or storied places), which are presented in Section 3.3 (below).

Thomas Thrum also published a short paper on place names in the 1922 edition of Lorrin Andrews A *Dictionary of the Hawaiian Language*, based only on the phonetic translations of the place names. This work does have a large number of translated *‘ili* names. Because there are no oral or written documents to confirm Thrum’s interpretations, Mary Pukui (Pukui et al. 1974:136) cautioned that Thrum’s translations were sometimes “unreliable.” Thrums’s translations will be presented here since it is our only source for many *‘ili* names, but Pukui’s cautionary note for these interpretations should be kept in mind.

Pukui et al. (1974) do not give a meaning for the place name **Kaka‘ako**, but the Hawaiian word *kākā‘āko* can be translated as “dull, slow” (Pukui and Elbert 1986:110); it is possible that this place name refers to the abundant standing water characteristic of this once marshy place. Thrum (1922:639) translated the word as “prepare the thatching” (*kākā*=to chop, beat, or thresh; *ako*=thatch). If Thrum’s translation is correct, it could be related to the fact that salt marshes, such as areas like Kaka‘ako, were excellent places to gather tall *pili* grass, which the Hawaiians traditionally used to thatch their houses (see Legend of Kewalo, next section).

Kewalo literally means “the calling (as an echo).” Land Commission Award and other historic-era documents identify it as the area between Cooke and Sheridan Streets, *mauka* of Queen Street. According to Pukui et al. (1974:109), “outcasts (*kauwā*) intended for sacrifice were drowned here” (see *mo‘olelo* below). Kekeahuna said that at one time, it also had a sand beach as a part of the area, where various sports, such as surfing, were held. An 1866 map (Hawai‘i Land Survey Division, Reg. Map No. 111), shows this small thin coastal section adjacent to the east side of Kolowalu Pond, east of the Mauka Area District.

Kukuluāe‘o, translates literally as the “Hawaiian stilt (bird),” *Himantopus himantopus*, and from the word *kukuluāe‘o*, which means “to walk on stilts.” Pukui et al. (1974) describe the area as “formerly fronting Ke-waloBasin” and “containing marshes, salt ponds, and small fishponds,” an environment well suited for this type of bird (Griffin et al. 1987:36). The ethnographer Henry Kekahuna (1958:4) described it as an area where salt was formerly made.

Pu‘ukea, literally “white hill” (but not listed as an O‘ahu place name by Pukui et al. 1974), is the name of a *heiau* and a small land division within Kukuluāe‘o.

According to Kekahuna (1958:4), **Ka‘ākaukukui** was “a beautiful sand beach that formerly extended along Ala Moana Park to Kewalo Basin, a quarter mile long reef extended along the shore.” Bishop’s 1884 map (Figure 6)shows it extending from Punchbowl to Cooke Street *makai* of Queen Street. Lyons’s 1876 map (see Figure 8) shows several place names in Ka‘ākaukukui and along the coast. Ka‘ākaukukui means “the right (or north) light,” and it may have previously been a maritime navigation landmark. Pukui et al. (1974:59) describe Ka‘ākaukukui as a “[f]illed-in reef.”

The area around One Waterfront Plaza was the location of a pond called **Umukanaka,** or Kaimukanaka, as seen on the 1876 Lyons map (see Figure 8). Griffin et al. (1987:39) suggested

that this pond may have been the same as a place called **Ka-imu-hai kanaka**, which means “the oven of human sacrifice.” However, Henry Kekakuna (1958:6, 20), states that Kaimuhaikanaka was actually the original name for the Honolulu Fort, built by Kamehameha I in 1816, which is located at the corner of Queen and Fort Streets, west of the Mauka Area District. Honolulu Fort was adjacent to the main temple of Honolulu, Pākākā Heiau, which was used for human sacrifice. One claim was made for the ‘*ili* of Kaimukanaka (LCA 8057 to Ehu) in the Kaka‘ako area, but it was not awarded. Three other names in the salt pan area are **Kalokoeli,** “the dug pond” (Pukui et al. 1974:78), ‘**Āpua** (“fish basket”), and **Kuaimeki (**unknown meaning; *meki* may mean “pit.”) These may be ‘*ili* or pond names, or both.

Ka‘ākaukukui was a *lele*, or jump land. That is, it had several non-contiguous parcels; one of these was at the coast and two others were inland. It was adjacent on the *mauka* side to several other small ‘*ili* and *lele* lands, including portions of **Pu‘unui** (“big hill”), **Ka‘ala‘a** (“sacred radiance”) (Thrum:1922:635), **Honuakaha** (“flat land” Thrum 1922:633), **Pualoalo** (“hibiscus *kokio*”) (Thrum 1922:667), and **‘Auwaiolimu** (“ditch of moss”).

A canoe landing in Ka‘ākaukukui was called **Kūāi** (meaning unknown), “where the Honolulu Iron Works is now, to where the former point of Fort Armstong was [Ka‘ākaukukui Reef on the Honolulu waterfront], in Kākā-‘ako, before the land was filled in” (Kekakuna 1958:5). Two canoe landings west of the Mauka Area District were **Māmala** (“to protect”) and **Pākākā.** Māmala was also used as the name for Honolulu Bay and a surf and Pākākā was also the name of an important *heiau*, once located at the foot of Fort Street (Griffin et al. 1987:39).

3.3 Mo‘olelo Associated with Place Names

The Mauka Area District is located mainly in a region known as Ka‘ākaukukui, Kukuluāe‘o and Kewalo on early historic maps and presently known as part of the Kaka‘ako District. The names Ka‘ākaukukui, Kukuluāe‘o and Kaka‘ako do not appear in any legends in the *Hawaiian Island Legends Index* or in the index to *Fornander’s Collection of Hawaiian Antiquities and Folklore*. Although there are some legends associated with the *lele* of Pu‘unui and ‘Auwaiolimu, the legends refer to the *mauka* sections of these lands, not the coastal sections. There are several mentions of the area known as “Kewalo” in various legends, and Kaka‘ako and Kukuluāe‘o are mentioned in some post-Contact chants.

From these legendary accounts it can be seen that Ka‘ākaukukui, Kewalo and Kukuluāe‘o, were traditionally noted for their fishponds and salt pans, for the marsh lands where *pili* grass and other plants could be collected, for ceremonial sites such as Pu‘ukea Heiau, Kewalo Spring, and Kawailumalumai Pond at which sacrifices were made, and for their trails that allowed transport between the more populated areas of Waikīkī and Honolulu. Important chiefs were born in the area and conducted religious rites, and commoners traveled to the area to procure food and other resources; some commoners probably also lived in the area, possibly adjacent to the ponds and the trails.

3.3.1 Kaka‘ako

Kaka‘ako is mentioned in Thrum’s version of the legend of Kū‘ula, the god presiding over the fish, and his son ‘Ai‘ai, who was the first to teach the Hawaiians how to make various fishing

lines and nets, the first to set up a *ko‘a kū‘ula*, a rock shrine on which the fishermen would place their first catch as an offering to Kū‘ula, and the first to set up *ko‘a ia*, fishing stations where certain fish were known to gather. Leaving his birthplace in Maui, ‘Ai‘ai traveled around the islands, establishing *ko‘a kū‘ula* and *ko‘a ia*. On O‘ahu, he landed first at Keana Point, then traveled around the island.

> Aiai came to Kalia [Waikīkī] and so on to **Kakaako**. Here he was befriended by a man named Apua, with whom he remained several days, observing and listening to the murmurs of the chief named Kou. This chief was a skillful haiku [*Katsuwonus pelamis*; bonito] fisherman, his grounds being outside of Mamala until you came to Moanalua. There was none so skilled as he, and generous withal, giving akus to the people throughout the district.
>
> As Aiai was dwelling with his friend **Apua** at Kakaako, he meandered off one day along the shore of Kulolia and so on to Pakaka and Kapapoko. (Thrum 1998:242).

This story mentions several place names near the Kaka‘ako area, including the Kuloloia (Kulolia) shore, Pākākā, an‘*ili* or *heiau* at Honolulu Harbor, and Kapapoko, an eating house near the harbor used by Ka‘ahumanu, wife of Kamehameha I (‘Ī‘ī 1959:66). In Hawaiian legends, the names of people often point to the place where they resided. Thus, the friend Apua may have lived at ‘Āpua, a small ‘*ili* in the Kaka‘ako area.

3.3.2 Kewalo

Kewalo once had a freshwater spring in the central portion (current location unknown), as recorded in the proverb "*Ka wai huahua‘i o Kewalo*," which translates as "The bubbling water of Kewalo." Two springs are mentioned in a traditional story of the Waters of Ha‘o. This legend tells of two children of the chief Ha‘o who ran away from their cruel stepmother. They stayed for a time with the caretakers of Kewalo Spring, which may have been located close to the trail that connected Waikīkī and Honolulu. The children then left when they heard that the chiefess had sent men to look for them. The two children followed the moonlit trail across the plain toward Kou (Honolulu), but finally collapsed from weariness and thirst. In a dream, the boy's mother told him to pull up a plant close to his feet. When he did, he found a spring under the plant, which was called the Water of Ha‘o, or Kawaiaha‘o. This spring is located at the western end of the trail, near Kawaiaha‘o Church (Pukui 1988:87-89).

The Kewalo area also once had a famous fishpond that was used to drown members of a pariah caste (*kauwā*) or *kapu* (taboo) breakers as the first step in a sacrificial ritual known as *Kānāwai Kaihehe‘e* (Kamakau 1991:6) or *Ke-kai-he‘ehe‘e*, which translates as "sea sliding along," suggesting the victims were slid under the sea (Westervelt 1991:16). Kewalo is described as:

> A fishpond and surrounding land on the plains below King Street, and beyond. It contains a spring rather famous in the times previous to the conversion to Christianity, as the place where victims designed for the Heiau of Kanelaau on Punchbowl slopes, was first drowned. The priest holding the victim's head under water would say to her or him on any signs of struggling, "Moe malie i ke kai o

> ko haku." "Lie still in the waters of your superiors." From this it was called Kawailumalumai, "Drowning waters." (Sterling and Summers 1978: 292)

Kō‘ula (meaning "red sugar cane") is the area around Thomas Square and the *mauka* portion of the Ward estate, suggesting that the Kawailumalumai Pond may have been east ("beyond Kō‘ula") of the Ward estate. It may be part of the pond complex (5 ponds) awarded to Koalele as LCA 3169, which is pictured on the 1884 Bishop map (see Figure 6) just to the southeast of the Ward/Booth estate (LCA 274) and generally *mauka* and north of the Mauka Area District.

Kewalo is mentioned in a legend as a marsh near the beach, where tall *pili* grass was growing. A man named Kapoi went to this area to get thatching for his house. While there, Kapoi found seven owls eggs and took them home to cook for his supper. An owl perched on the fence surrounding his house and cried out "O Kapoi, give me my eggs!" After several such pleas, Kapoi returned the eggs. In return, the owl became his *aumakua* (family god) and instructed him to build a *heiau* (pre-Christian place of worship) named Mānoa. Kapoi built the *heiau,* placed some bananas on the altar as a sacrifice, and set the *kapu* days for its dedication. The king of O‘ahu, Kākuhihewa, who was building his own *heiau* in Waikīkī, had made a law that if any man among his people erected a *heiau* and set the *kapu* before him, that man should die. Kapoi was seized and taken to the *heiau* of Kūpalaha, at Waikīkī. Kapoi's ‘*aumakua* owl asked for aid from the king of the owls at Owl's Hill (Pu‘u Pu‘eo) in Mānoa, who gathered all of the owls of the islands. They flew to Kūpalaha and battled the king's men, who finally surrendered. From this time, the owl was considered a powerful *akua* (god). The battle area was known as Kukaeunahio-ka-pueo, which means "the confused noise of owls rising in masses" (Westervelt 1991: 135-137; Thrum 1998: 200-202).

Kewalo was the birthplace of the great chief Hua-nui-ka-la-la‘ila‘i, as mentioned in this *mele* (story) chanted by Kamakau (1991 24):

‘O Hua-a-Kamapau ke ‘li‘i	Hua-a-Kamapau the chief
O Honolulu o Waikīkī	O Honolulu, of Waikīkī
I hanau no la i kahua la i ***Kewalo****,*	Was born at **Kewalo**,
‘O Kālia la kahua	Kālia was the place [the site]
O Makiki la ke ēwe,	At Makiki the placenta,
I Kānelā‘au i Kahehuna ke piko,	At Kānelā‘au at Kahehuna the navel cord,
I Kalo i Pauoa ka ‘a‘a;	At Kalo at Pauoa the caul;
I uka i Kaho‘iwai i	Upland at Kaho‘iwai, at
Kanaloaho‘okau . . .	Kanaloaho‘okau. . .

3.3.3 Kukuluāe‘o

The chief Hua, born in Kewalo, was famous for his love of cultivation and his care for the people. His *heiau,* called Pu‘ukea, was in Kukuluāe‘o in Honolulu; it is mentioned in a traditional *wānana* (prophecy) recorded by Kamakau (1991:24-25).

[*Ka makaua ua kahi o ‘Ewa*]	[The increasing "first rain" of ‘Ewa]
Ua puni ka i‘a o Mokumoa,	Overcomes the fish of Mokumoa,

Ua kau i‘a ka nene;	Washes up fish to the nene plants;
Ua ha‘a kalo ha‘a nu;	Lays low the taro as it patters down;
*Ha‘a ka i‘a o **kewalo**,*	Lays low the fish of **Kewalo**,
Ha‘a na ‘ualu o Pahua,	Lays low the sweet potatoes of Pahua,
*Ha‘a ka mahiki i **Pu‘ukea**,*	Lays low the mahiki grass at **Pu‘ukea**,
Ha‘a ka unuunu i Pele‘ula,	Lays low the growing things at Pele‘ula
Ha‘a Makaaho i ke ala.	Lays low Makaaho [Makāho] in its path
E Kū e, ma ke kaha ka ua, e Kū,	O Kū, the rain goes along the edge [of the island], O Kū
[*I ‘ai ‘na ka i‘a o Maunalua*] . . .	[Eating” the fish of Maunalua] . . .

The chant mentions the *mahiki* grass of Pu‘ukea Heiau. The Hawaiian term *mahiki* means “to peel off” (Andrews 2003:369). The word was also used to describe a rite to exorcise an evil spirit, as the skilled *kahuna* (priest) “peeled” the malicious spirit from the afflicted. Used in the ritual was a shrimp called *mahiki* or a native grass called *mahiki*. *Mahiki*, or *‘aki‘aki*, is a tufted rush (*Sporobolos* sp.) found near the seashore. The ethnologist, Mary Pukui, states that even during her youth, parents put “*tī* leaves, or *hala*, or *‘aki‘aki* grass, in a little sea-salt water and [would] have the child drink it” (Pukui et al. 1972:163) to rid them of badly-behaving spirits. The use of this grass in a ritual may explain its association with a ceremonial *heiau*, or it may simply be that the Kukuluāe‘o coast was a good habitat and thus a favored place for healers to collect this type of grass. The literal meaning of Pu‘ukea is “white hill” (although it may have alternate meanings). Pu‘ukea is also the name of a small land division within the *‘ili* of Kukuluāe‘o, mentioned in at least two Land Commission Awards (LCA 1502 and 1504). LCA 1504 was located near the junction of Halekauwila Street and Cooke Street. It is possible that the *heiau* platform or the area that it was built on was one of the few “high spots” in the flat, low-lying swamp that surrounded it, and thus gained the name *pu‘u kea* (white hill).

Thomas Thrum (1906a), who made several lists and surveys for *heiau*, does not mention Pu‘ukea Heiau. In his report on the survey of O‘ahu sites conducted in the early 1930s, McAllister (1933:80) says of Honolulu: “Information regarding former sites within the present limits of Honolulu must come entirely from literary sources.” He does mention Pākākā Heiau, once the main royal temple in Honolulu; this *heiau* would have been located around the foot (*makai end*) of Fort Street. He does not list Pu‘ukea Heiau, which Kamakau placed in Kukuluāe‘o, but he does note that Peter Corney, a visitor to the island in 1819, saw several *heiau* (*morai*) along the Honolulu shore:

> There are several morais, or churches in the village, and at new moon the priests, chiefs and hikanees (aikane) [counselors] enter them with offerings of hogs, plantains, and cocoanuts, which they set before the wooden images. The place is fenced in, and have pieces of white flags flying on the fences. (Corney 1896:101)

3.3.4 Ka‘ākaukukui

Ka‘ākaukukui is briefly mentioned in the legend of Hi‘iaka, one of the beloved sisters of the Hawaiian volcano goddess, Pele. Hi‘iaka and her companions have been traveling around O‘ahu on the land trails, but decide to travel from Pu‘uloa (Pearl Harbor) to Waikīkī by canoe. At Pu‘uloa, Hi‘iaka met a party who were planning on traveling to the house of the chiefess Pele‘ula

in Waikīkī. Hi‘iaka recited a chant, telling the people that, although they were going by land and she was going by sea, they would meet again in Kou, which is the ancient name of Honolulu. One portion of the chant mentions the place Ka‘ākaukukui, with reference to a pool, possibly a reference to the salt ponds of the area:

And what of me, O Honoka‘upu, my love	*A pehea lā au, e Honoka‘upu, ku‘u aloha*
Upon the crest of the surf at Uhi and ‘Oā	*I ka welelau nalu kai o Uhi, o ‘Ōa*
Eyes in the living realm (night) of oblivion	*‘O nā makai ke ao (pō) o poina*
Where am I, O my love	*Ma hea lā wau, e ke aloha lā*
Kou is the coral flat	*‘O Kou ka papa*
Ka‘ākaukukui is the pool	*‘O **Ka‘ākaukukui** ka loko*
Some *‘alamihi* indeed	*‘O ka ‘alamihi a‘e nō*
Wait all day until night	*‘O ka lā a pō iho*
Friends shall meet in Kou.	*Hui aku i Kou nā maka.*

(Ho‘oulumāhiehie 2006a:277; Ho‘oulumāhiehie 2006b:297)

The word *alamihi* in this verse may refer to a small black Hawaiian crab (*Metopograspsus thukuhar*), a scavenger often associated in Hawaiian poetical associations with corpse-eating (Pukui and Elbert 1986:18). Alamihi is also a place name used in O‘ahu, meaning “path [of] regret.”

In this verse Ka‘ākaukui is referred to as a pond. As previously noted, there was a pond in Kaākaukukui called Kaimukanaka (possibly translated as “the oven of men.”) According to Kekahuna (1958:6, 20), there was a place called Kaimuhaikana near Pākākā Heiau west of the Mauka Area District. This place name is mentioned twice in the chant “The Battle of Nu‘uanu,” which concerns the 1795 invasion and conquer of O‘ahu by Kamehameha I. One section of the chant describes locations in Honolulu, possibly listing them from east to west:

75 *Lauwili i Pūkē (**Pu‘ukea**), i **Ka-imu-hai-kanaka**,*
76 *I Kai-kua, i **Kakaako**, i **Mamala**,*
77 *I ke kai o **Kuloloia**, **Pakaka**,*
78 ***I ka-imu-hai-kanaka**, i ka-wai-apuka-Kanē*

(Kala‘ikuahulu 1880:131)

Pu‘ukea is a *heiau* in Kukuluāe‘o, east of Ka‘ākaukukui, Mamala is a surf area and bay west of Ka‘ākaukukui, and Pākākā was a *heiau* near downtown Honolulu. It is possible that there were two ponds named *Ka-imu-hai-kanaka*, one in Ka‘ākaukukui within the Mauka Area District and one near Pākākā (at the foot of Fort Street), west of the Mauka Area District.

3.4 Settlement and Subsistence

In traditional times, as evidenced by recent archaeological findings, Kaka‘ako was a location of permanent settlement and agriculture. Although there appears to have been limited numbers of wet-taro-growing plots, the general physiographic characteristics of low-lying marshy environments offered favorable conditions for fishpond construction in the inland portions and salt-making along portions of the shore. There was one early pre-historic (and

possibly pre-contact) settlement cluster in the Mauka Area District, in the ‘*ili* of Honoukaha, at the junction of Punchbowl and Queen Streets. In historic times, after much of the social fabric of the traditional Hawaiian lifestyle had been altered, and after the introduction of Hawai‘i into the world market economy (of which Honolulu was an important component in the Pacific), settlement and subsistence patterns in and around Kaka‘ako changed. Fishponds, which required a substantial input of labor and careful management, largely fell into disrepair, and lands previously dedicated to raising fish were infilled. Salt making areas along the coast were used for other purposes as land-use pressures from the adjoining areas of Honolulu and Waikīkī increased. As discussed in more detail in Section 5, archaeological evidence gathered in the past decade or so has also shown that during historic times portions of the lands in Kaka‘ako were used to bury large numbers of people in unmarked cemeteries.

3.5 Trails

John Papa ‘Ī‘ī mentions some of the lands of Kaka‘ako while discussing early nineteenth century trails in the Honolulu/Waikīkī area (Figure 9 and Figure 10). The fact that a trail traversed this region – characterized by ponds, marshlands and *lo‘i* – suggests that the trail, especially as it neared the coastline at Kālia, must have run on a sand berm raised above surrounding wetlands and coral flats. On the *makai* trail (probably close to the current alignment of Queen Street), walking from Waikīkī to Honolulu:

> The trail from Kalia led to **Kukuluaeo**, then along the graves of those who died in the smallpox epidemic of 1853, and into the center of the coconut grove of **Honuakaha**. On the upper side of the trail was the place of Kinau, the father of Kekauonohi.
>
> From the makai side of Kaoaopa was a trail to the sea at **Kakaako**, where stood the homes of the fishermen. Below the trail lived Hehehewa and his fellow kahunas . . . (‘Ī‘ī 1959:89)

3.6 Burials and Historic Cemeteries

A total of 274 historic burials have been recorded in some way (recorded *in situ* or disinterred) in the Kaka‘ako Mauka Area.

Historic burials were documented at the grave site resulting from the smallpox epidemic of 1853 referred to by ‘Ī‘ī (see Section 3.5, above). This site is the Honuakaha Cemetery at the *makai* corner of Halekauwila and South Streets, *makai* of Kawaiaha‘o Church, in the land division called Kawaiaha‘o. Honuakaha was a settlement located generally between Punchbowl and South Streets, on the *makai* side of Queen Street. In this settlement lived Kinau, a daughter of Kamehameha I and mother of Kamehameha IV and V and Victoria Kamāmalu. This lot was later inherited by Queen Emma, as can be seen on an 1876 map of Ka‘ākaukukui and Pu‘unui by C. J. Lyons (see Figure 8) Hewahewa was the *kahuna nui* (high priest) for Kamehameha I, but became an early Christian convert and repudiated his ancient religion. King Kalākaua and Queen Kapi‘olani later had a residence in Kaka‘ako, as can be seen on the 1884 Bishop map (see

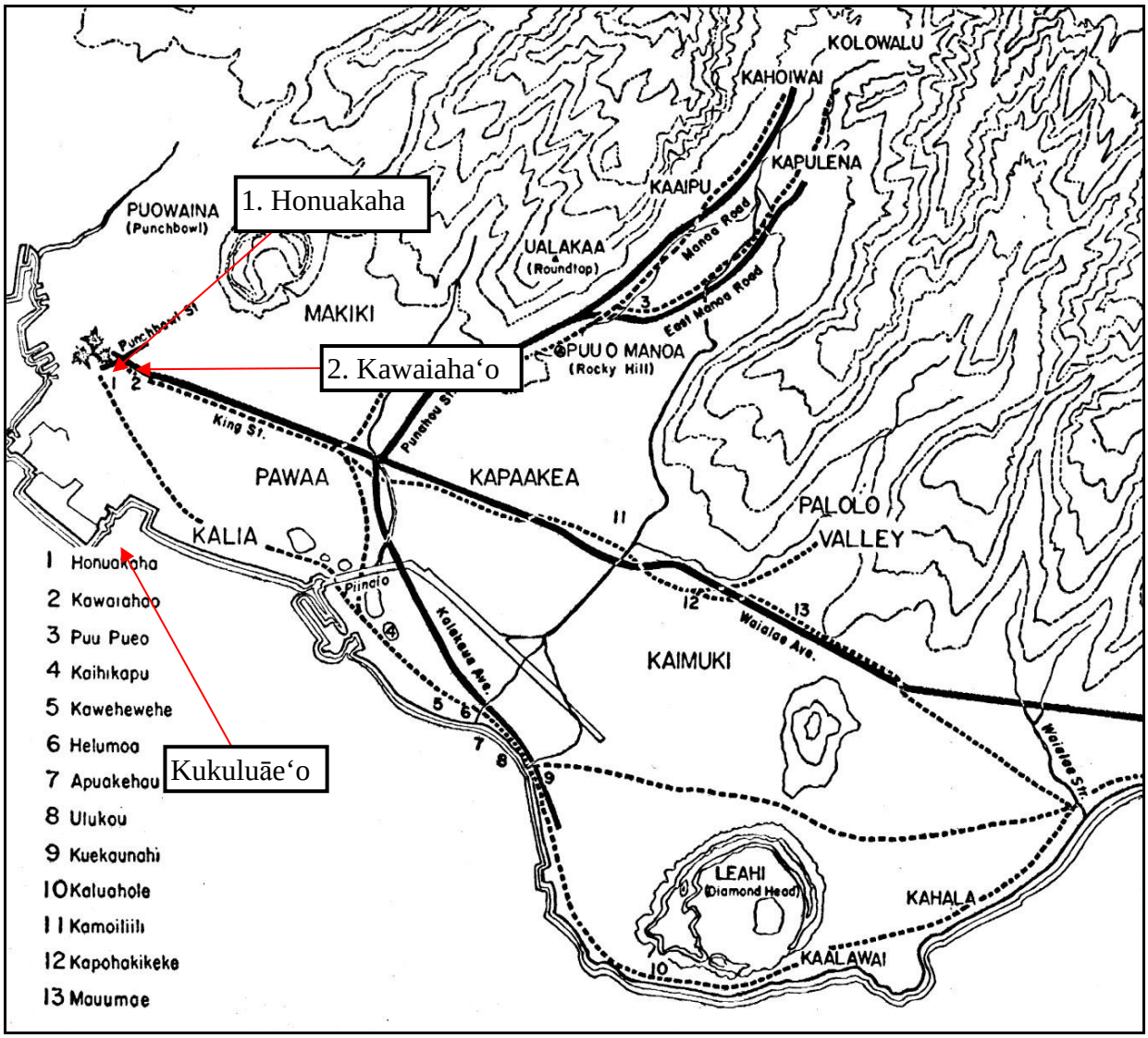


Figure 9. Upper trail in Honolulu (about 1810), showing the location of Honuakaha, Kawaiaha‘o, Kalia, Pawa‘a and Kukuluāe‘o; the present alignment of King Street and Wai‘alae Avenue follows this early trail (illustration from ‘Ī‘ī 1959:93; map not to scale)

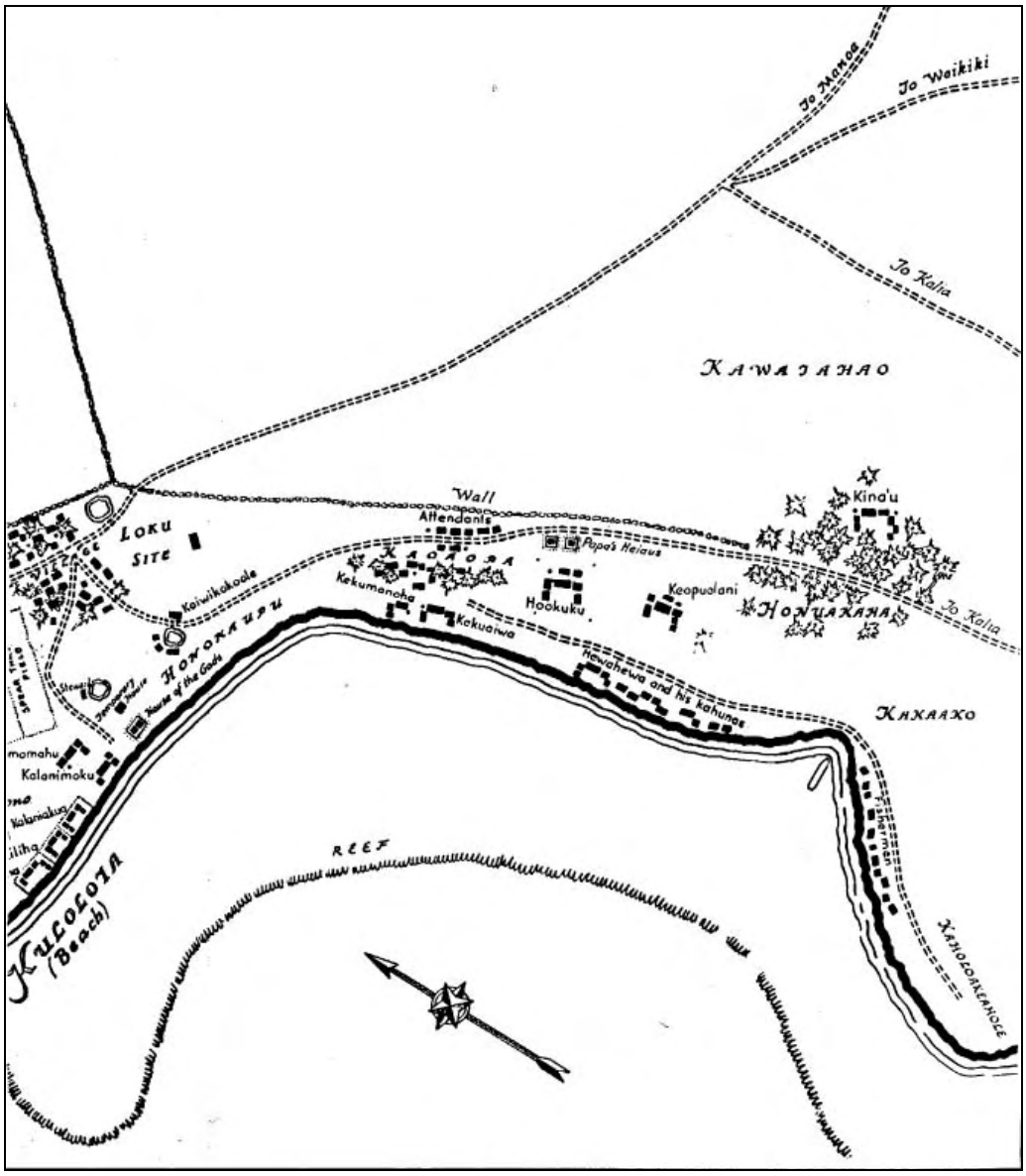


Figure 10. Middle and lower trails (about 1810), ‘showing location of Kuloloia, Kawaiaha‘o, Honuakaha, and Kaka‘ako (illustration from ‘Ī‘ī 1959:90; map not to scale)

Figure 6). Other small land areas shown on the historic maps are Pu‘unui and ‘Auwaiolimu, which are between the lands of Kawaiaha‘o and Ka‘ākaukukui.

There is also a cluster of at least 28 historic coffin burials at the Kaka‘ako ID 10 area (SIHP # -6658) a cluster of 16 coffin burials at the Ko‘olani Condominium Mauka Area District (SIHP # -6911), two coffin burials at the Kaka‘ako ID-4 area (SIHP # -5598), and two historic burials (one coffin and one with historic grave goods) at Kaka‘ako ID-3 area (SIHP # -5280). There is no historic documentation on these small burial areas and their extent and time of use is unknown.

A total of 66 burials found in the Kaka‘ako Mauka Area were not buried in coffins, or do not have associated historic grave goods, or consist of partial, previously disturbed, burials. Some skeletons were found in a traditional flexed position, suggesting a traditional Hawaiian burial practice. These may date to the pre-Contact period or the early post-Contact period (before the mid-19th century), when most Hawaiians adopted Western-style burial practices (usually extended within a coffin). Most of these burials can not be assigned to a specific time period.

3.7 Traditional Salt Pans

As noted in the LCA documents, much of the land in the modern-day area known as Kaka‘ako was used to produce *pa‘akai* (salt). The Hawaiians used salt for a variety of purposes: to flavor food, to preserve fish and other meat, for medicines, and for ceremonial purposes. David Malo described the traditional method:

> *O ka paakai kekahi mea e pono ai, he mea e ono ai, ka ia, a me ke koekoe o ka paina ana, he mea hana ia ka paakai, ma kekahi aina, aole i hana a ma kekahi aina, o ke kai makai, e kii aku no ka wahine, a lawe mai ma ke poi, a ke kai hooholo ia mai kekahi ma kauwahi mai.*
>
> *E waiho kela kai ma kekahi poho paha, he ekaha paha, he kahe ka paha, a liu malaila, alaila lawe ana kauwahi e, a paakai iho la no ia, o ka papa laau ka mea kui poi.* (Malo 2006:73)
>
> Translation
>
> Pa‘akai [salt] is another beneficial item. It is used to make fish delicious and tasteless foods edible. Pa‘akai is made at a particular place, [but] it [salt] is not actually made from this spot, rather it [salt water] came from the sea. A woman went to get some when the sea crashed [upon the rocks] and she ran back [the salt water] to this particular spot.
>
> That salt water (kai) is placed in, perhaps, a depression (poho) or a “Bird’s nest” (ēkeha) or rock basin (kāheka) and allowed to evaporate (liu). Then it is taken to another spot and is formed into pa‘akai. Wooden boards (papa lā‘au) are used to pound poi (mashed cooked kalo corms) on. (Malo 2006:95)

In 1903, Nathaniel Emerson translated David Malo’s articles on early Hawaiian life. In his publication, the translations are not literal, but include information that Emerson added to clarify the accounts. In Emerson’s translation:

> Salt was one of the necessities and was a condiment used with fish and meat, also as a relish with fresh food. Salt was manufactured in certain places. The women brought sea water in calabashes, or conducted it in ditches to natural holes, hollows and shallow ponds (*kekaha*) on the sea coast, where it soon became strong brine from evaporation. Thence it was transferred to another hollow or shallow vat, where crystallization into salt was completed. (Malo 1951:123)

Captain James Cook was the first to document the more complicated method of making salt in prepared “saltpans.”

> Amongst their arts, we must not forget that of making salt, with which we were amply supplied, during our stay at these islands, and which was perfectly good of its kind. Their saltpans are made of earth, lined with clay; being generally six or eight feet square, and about eight inches deep. They are raised upon a bank of stones near the high-water mark, from whence the salt water is conducted to the foot of them, in small trenches, out of which they are filled, and the sun quickly performs the necessary process of evaporation. . . Besides the quantity we used in salting pork, we filled all our empty casks, amounting to sixteen puncheons, in the Resolution only. (Cook 1784:151)

In the years after the discovery of the islands by Captain Cook in 1778, most visitors to the islands were British or American fur traders, who stopped at Hawai‘i on their way to China. One reason for their visit was to stock up on food and water, but the main concern was to buy or trade for salt, which was used to cure the seal and mammal pelts collected from the Northwest Coast. During Otto von Kotzebue’s visits in 1816 and 1817, he noted that “Salt and sandalwood were the chief items of export” (in Thrum 1905:50):

> The journals of none mention the object of call other than for refreshments, though one, 3 some years later, records the scarcity and high price of salt at the several points touched at, with which to serve them in the curing of furs obtained on the coast. In all probability salt was the first article of export trade of the islands and an object, if not the object, of these pioneer furtraders’ call. (Thrum 1905:46)

The missionary William Ellis, on a tour of the Hawaiian Islands in 1822 and 1823, also noted these salt pans and recorded the final step of crystallization.

> The natives of this district (Kawaihae) manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity. They have generally one large pond near the sea, into which the water flows by a channel cut through the rocks, or is carried thither by the natives in large calabashes. After remaining there for some time, it is conducted into a number of smaller pans about six or eight inches in depth,

> which are made with great care, and frequently lined with large evergreen leaves, in order to prevent absorption. Along the narrow banks or partitions between the different pans, we saw a number of large evergreen leaves placed. They were tied
>
> up at each end, so as to resemble a narrow dish, and filled with sea water, in which the crystals of salt were abundant. (Ellis 1827:403-404)

In the testimony for a lot with a salt pond in Kukuluāe‘o, the awardee claimed two *ālia* (salt beds), 15 *ho‘oliu* (drains), two *poho kai* (depressions where salt is gathered) and one salt *kula* (dryland or wasteland). Four separate types of salt features are mentioned: the ponds near the shore that fill with salt water at high tide (*ālia*), the drains (*ho‘oliu*) where the salt water is transferred to smaller clay-lined or leaf-lined channels, the natural depressions (or modified depressions) in the rocks along the shore where salt formed naturally, and the salt *kula*, which was waste land, that is, land that could probably not be used for agriculture as it was so impregnated with salt. Some Hawaiians also had a house lot near their salt pans, probably a simple grass hut, similar to those shown on an 1838 sketch entitled” Honolulu Salt Pans, Near Kakaako” (Figure 13).

Figure 11. 1838 sketch of “Honolulu Salt Pan, near Kaka‘ako” drawn by a French visitor, Auguste Borget (original sketch at Peabody Essex Museum, Salem, Mass; reprinted in Grant 2000:64-65)

Section 4 Historical Background

4.1 Late Pre-Contact and Early Historic Era

The modern urban area known as Kaka‘ako is located between two longtime centers of population: Honolulu, known as Kou in older times, and Waikīkī. In Waikīkī, a system of irrigated taro *lo‘i* fed by streams descending from Makiki, Mānoa, and Pālolo valleys covered the coastal plain, and networks of fishponds dotted the shoreline. Similarly, Kou - the area of downtown Honolulu surrounding the harbor - possessed shoreward fishponds and irrigated fields watered by ample streams descending from Nu‘uanu and Pauoa Valleys. The pre-Contact population and land-use patterns of the Kewalo and Kukuluāe‘o area may have derived from its relationship to these two densely populated areas; it may have participated in some of the activities associated with them. Thus, the attempt to reconstruct the Ka‘ākaukui, Kukuluāe‘o, and Kewalo region as it existed for the Hawaiians during the centuries before western contact and the modern urbanization that has reconfigured the landscape must begin with accounts of Kou and Waikīkī.

Waikīkī is actually the name of the large *ahupua‘a* encompassing lands stretching from Honolulu to Maunalua Bay. Within that *ahupua‘a*, by the time of the arrival of Europeans during the late eighteenth century, the area today known as Waikīkī had long been a center of population and political power on O‘ahu. According to Beckwith (1940:383), by the end of the fourteenth century, Waikīkī had become “the ruling seat of the chiefs of O‘ahu.” The pre-eminence of Waikīkī continued into the eighteenth century and is confirmed by the decision of Kamehameha I, in the midst of unifying control of the islands, to reside there after wresting control of O‘ahu by defeating the island’s chief, Kalanikūpule. The nineteenth century Hawaiian historian John Papa ‘Ī‘ī, himself a member of the *ali‘i* (chiefly class), described the king’s Waikīkī residence:

> Kamehameha’s houses were at Puaaliilii, makai [seaward] of the old road, and extended as far as the west side of the sands of Apuakehau. Within it was Helumoa where Kaahumanu *ma* [i.e., Kamehameha’s people or followers] went to while away the time. The king built a stone house there, enclosed by a fence. (‘Ī‘ī 1959:17)

‘Ī‘ī (1959:17) further noted that the “place had long been a residence of chiefs. It is said that it had been Kekuapoi’s home, through her husband Kahahana, since the time of Kahekili.”

Chiefly residences were only one element of a complex of features sustaining a large population that characterized Waikīkī up to pre-Contact times. Beginning in the fifteenth century, a vast system of irrigated taro fields was constructed, extending across the littoral plain from Waikīkī to lower Mānoa and Pālolo valleys. This field system, an impressive feat of engineering, the design of which is traditionally attributed to the chief Kalamakua, took advantage of streams descending from Makiki, Mānoa, and Pālolo Valleys, which also provided ample fresh water for the Hawaiians living in the *ahupua‘a*. Water was also available from springs in nearby Mō‘ili‘ili and Punahou. Closer to the Waikīkī shoreline, coconut groves and fishponds dotted the landscape. A continuous zone of population and cultivation, from the

shoreline of present day Waikīkī Beach, extended north well into Mānoa Valley. The western and eastern bounds of this zone are less clear, and there are no specific references to Waikīkī's abundance reaching into the Kewalo region.

A basic description of Honolulu, or Kou, up to western contact, is given by E. S. Craighill and Elizabeth Handy:

> What is now Honolulu was originally that flatland area between the lower ends of Nu‘uanu and Pauoa Valleys and the harbor. Westervelt . . . wrote that "'Honolulu' was probably a name given to a very rich district of farm land near what is now . . . the junction of Liliha and School Streets, because its chief was Honolulu, one of the high chiefs at the time of Kakuhihewa. . . . It is probable that the chief referred to by Westervelt took his name from the harbor and adjoining land. The original name of the land where the town grew when the harbor became a haven for foreign ships was Kou. . . . The number of *heiau* in this area indicates that it was a place of first importance before the era of foreign contact. (Handy and Handy 1972:479)

Rev. Hiram Bingham, arriving in Honolulu in 1820, described a still predominantly native Hawaiian environment - still a "village" - on the brink of western-induced transformations:

> We can anchor in the roadstead abreast of Honolulu village, on the south side of the island, about 17 miles from the eastern extremity. . . . Passing through the irregular village of some thousands of inhabitants, whose grass thatched habitations were mostly small and mean, while some were more spacious, we walked about a mile northwardly to the opening of the valley of Pauoa, then turning southeasterly, ascending to the top of Punchbowl Hill, an extinguished crater, whose base bounds the northeast part of the village or town. . . . Below us, on the south and west, spread the plain of Honolulu, having its fishponds and salt making pools along the seashore, the village and fort between us and the harbor, and the valley stretching a few miles north into the interior, which presented its scattered habitations and numerous beds of kalo (arum esculentum) in its various stages of growth, with its large green leaves, beautifully embossed on the silvery water, in which it flourishes. (Bingham 1981:92-93)

The Mauka Area District would have been in Bingham's view as he stood atop "Punchbowl Hill" looking toward Waikīkī to the south; it would have comprised part of the area he describes as the "plain of Honolulu" with its "fishponds and salt making pools along the seashore.

Another visitor to Honolulu in the 1820s, Capt. Jacobus Boelen, hints at the possible pre-Contact character of Honolulu and its environs, including the Kewalo area:

> It would be difficult to say much about Honoruru. On its southern side is the harbor or the basin of that name (which as a result of variations in pronunciation [sic] is also written as Honolulu, and on some maps, Honoonoono). The landlocked side in the northwest consists mostly of taro fields. More to the north there are some sugar plantations and a sugar mill, worked by a team of mules. From the north toward the east, where the beach forms the bight of Whytetee, the

> soil around the village is less fertile, or at least not greatly cultivated. (Boelen 1988:62)

Boelen’s description implies that the Kaka‘ako and Kewalo areas are within a “not greatly cultivated” region of Honolulu perhaps extending from Pūowaina (Punchbowl Crater) at the north through Kaka‘ako to the Kālia portion of Waikīkī in the east.

Kewalo is named in John Papa ‘Ī‘ī’s account of the death in 1810 of Isaac Davis, an American sailor who had settled in the Hawaiian Islands, becoming a confidant of Kamehameha:

> Many chiefs and notables mourned Davis, including Kamehameha and the company of warriors who watched over him. The funeral procession went from Davis’ dwelling at Aienui to Kewalo, where his body was deposited on the land of Alexander, a haole who had died earlier. At the time of his death, Davis was an old man with white hair and other signs of age.(‘Ī‘ī 1959:85)

An article about Davis in *The Friend* of February 1862 mentions only that his grave was “in a burying place of the Europeans, near Hana-rura,” suggesting that the Kewalo region and the ‘burying place’ were outside the limits of Honolulu both at the time of Davis’s death and 42 years later when the article was written. Robert Schmitt (2000) has extensively researched all of the documentation on this cemetery and has concluded that the cemetery was probably on the corner of Pi‘ikoi and King Streets, inland of the Mauka Area District.

An early, somewhat generalized, depiction of the pre-Contact native Hawaiian shaping of Waikīkī, Kou (Honolulu) and the Kaka‘ako area is given on an 1817 map (Figure 12) by Otto von Kotzebue (1821), commander of the Russian ship *Rurick*, who had visited O‘ahu the previous year. The map shows taro *lo‘i* (the rectangles, representing irrigated fields) massed around the streams descending from Nu‘uanu and Mānoa valleys. The depicted areas of population and habitation concentration (illustrated by the trapezoids) probably reflect early historic-era patterns unlike those of pre-Contact times influenced by the post-Contact shift of Hawaiians to the area around Honolulu harbor - the only sheltered landing for large western-sized vessels on O‘ahu and the center of increasing trade with visiting foreign vessels. Kamehameha himself had moved from Waikīkī to Honolulu in 1809.

Kotzebue’s map illustrates that the land between Pūowaina (Punchbowl Crater) and the shoreline - which would include the Kewalo and Kukuluāe‘o area - formed a “break” between the heavily populated and cultivated centers of Honolulu and Waikīkī; the area is characterized by fishponds, salt ponds, trails connecting Honolulu and Waikīkī, and occasional taro *lo‘i* and habitation sites.

A clearer picture of Kaka‘ako/Kewalo and Kukuluāe‘o and the present study area develops with accounts of other visitors to, and settlers of, Honolulu during the first half of the nineteenth century. Gorman D. Gilman, who arrived in Honolulu in 1841, recalled in a memoir the limits of Honolulu during the early 1840s:

> The boundaries of the old town may be said to have been, on the makai [seaward] side, the waters of the harbor; on the mauka [inland] side, Beretania street; on the Waikīkī side [i.e. the area just beyond Punchbowl Street], the barren and dusty plain, and on the Ewa [west] side, the Nuuanu Stream. (Gilman 1904:97)

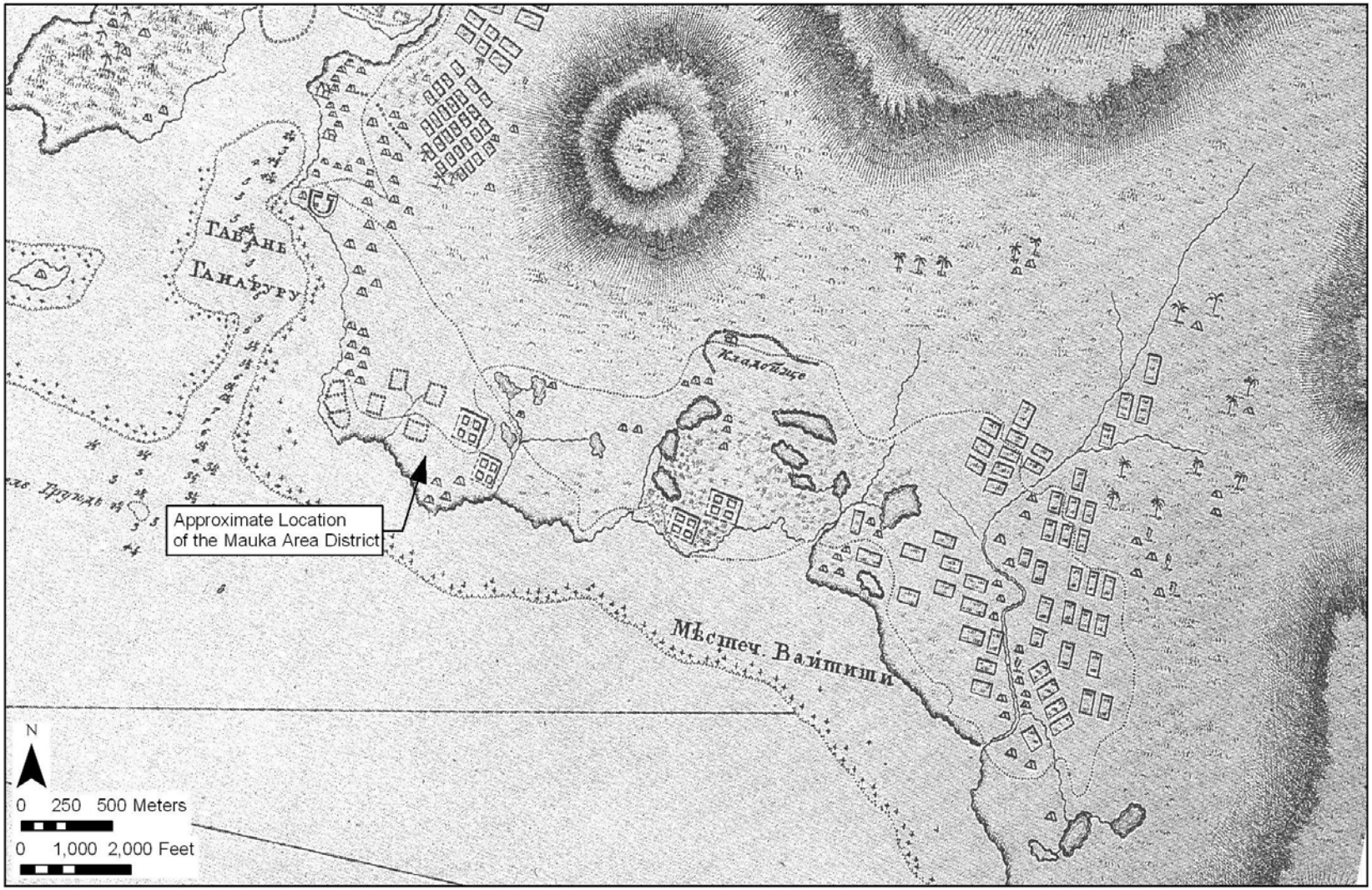


Figure 12. 1817 map by Otto von Kotzebue, commander of the Russian ship Rurick, showing taro lo‘i, fishponds and salt pans in Honolulu and Waikīkī; note the lack of habitation in the Mauka Area District along the shore

Gilman further describes the “barren and dusty plain” beyond (east of) Punchbowl Street:

> The next and last street running parallel [he had been describing the streets running mauka-makai, or from the mountains to the shore] was that known as Punchbowl Street. There was on the entire length of this street, from the makai side to the slopes of Punchbowl, but one residence, the two-story house of Mr. Henry Diamond, mauka of King Street. Beyond the street was the old Kawaiahao church and burying ground. A more forsaken, desolate looking place than the latter can scarcely be imagined. One, to see it in its present attractiveness of fences, trees and shrubbery, can hardly believe its former desolation, when without enclosure, horses and cattle had free access to the whole place. (Gilman 1904:89)

That the environs of the missionary enclave and Kawaiaha‘o Church were indeed “forsaken” and “desolate looking” in the 1820s when the missionaries first settled there is also noted in the memoirs of the American missionary C. S. Stewart who, arriving on Maui after living at the mission, declared Lahaina to be “like the delights of an Eden” after “four weeks residence on the dreary plain of Honoruru” (Stewart 1970:177). It is likely that these descriptions of the Honolulu plain, if they are accurate, also apply to the Kaka‘ako area. The barrenness of the Kaka‘ako area is also illustrated in two sketches, one made in 1834 when Kawaiaha‘o Church was still a long grass-thatched building (Figure 13), and one made in 1850 after the grass hut had been replaced by a large coral stone structure with a steeple (Figure 14). Between Kawaiaha‘o Church and the sea are only a few scattered huts along the shore and aligned along the inland trail (now covered by King Street). The Mauka Area District would be from the church (within the northwest corner) and *makai* and left (east) of the church along the shore. An 1887 photograph of the area (Kawaiaha‘o Church in foreground) also shows the undeveloped area *makai* of the church (Figure 15).

4.2 Mid 19th Century and the Māhele

Among the first descriptions of Ka‘ākaukukui and Kukuluāe‘o by the Hawaiians themselves are the testimonies recorded during the 1840s in documents associated with Land Commission Awards (LCA) and awardees of the *Māhele*. The LCA records indicate that the traditional Hawaiian usage of the region and its environs may have been confined to salt making and farming of fish ponds, with some wetland agriculture in those areas *mauka* or toward Waikīkī at the very limits of the field system descending from Makiki and Mānoa valleys. However, the testimonies do indicate that the area was lived on and was shaped by Hawaiians before the nineteenth century. The LCA records also reveal that, midway through the nineteenth century, taro cultivation, traditional salt making and fishpond farming activities continued within Ka‘ākaukukui/Kukuluāe‘o area. These activities and the land features that supported them would be eliminated, or buried, during the remainder of the nineteenth century by the urbanization of Honolulu. The LCA records and historic maps and archival photographs document more precisely traditional Hawaiian settlement and subsequent historic land usage within and around Kaka‘ako.

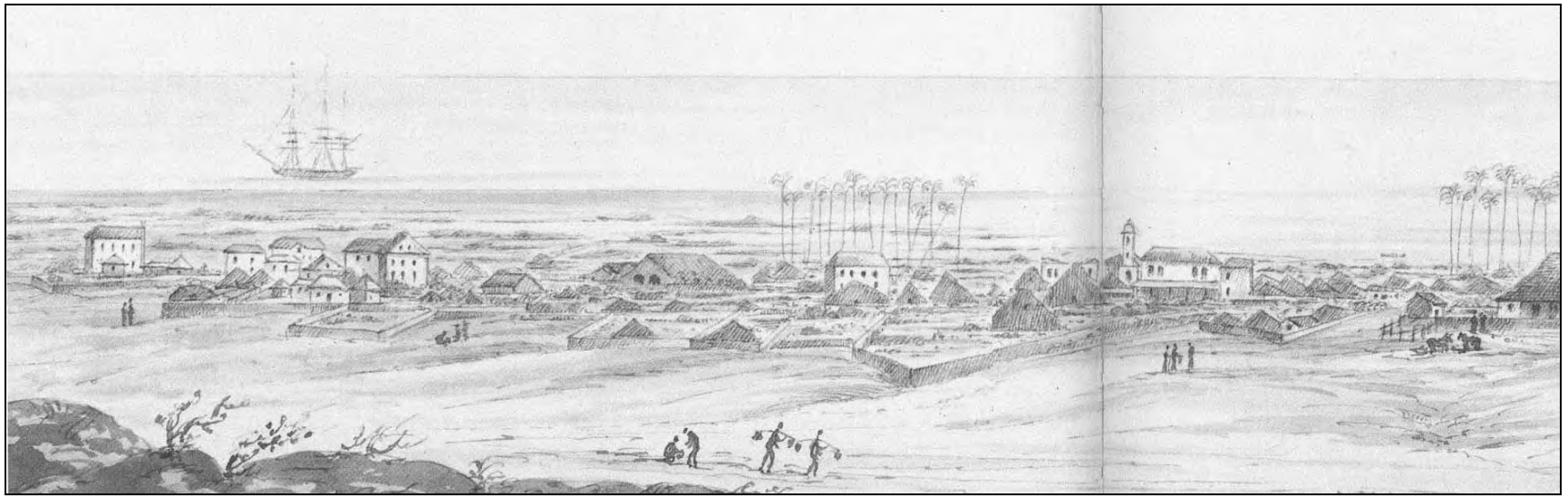


Figure 13. Portion of 1834 sketch by anonymous illustrator entitled “Town of Honolulu: Island of Woahoo: Sandwich Islands” (original sketch at Bernice P. Bishop Museum; reprinted in Grant 2000:64-65)

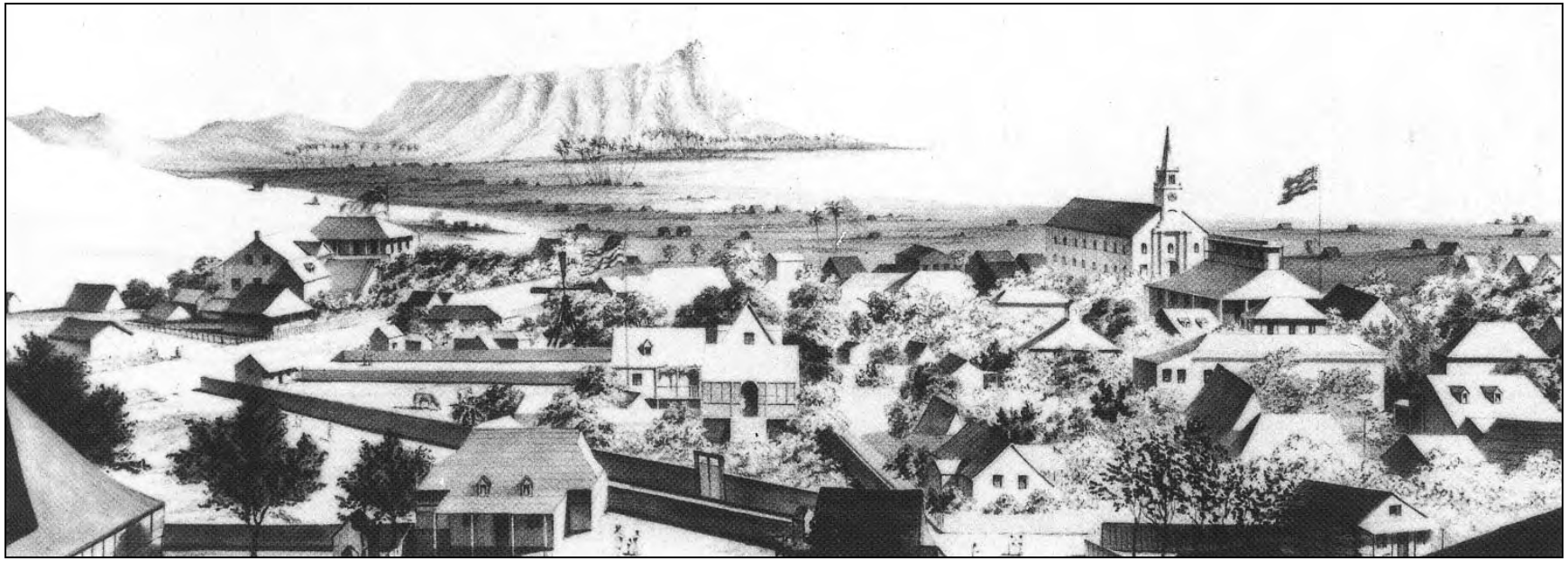


Figure 14. 1850 Sketch by Paul Emmert (original sketch at Hawaiian Historical Society; reprinted in Grant 2000:5)

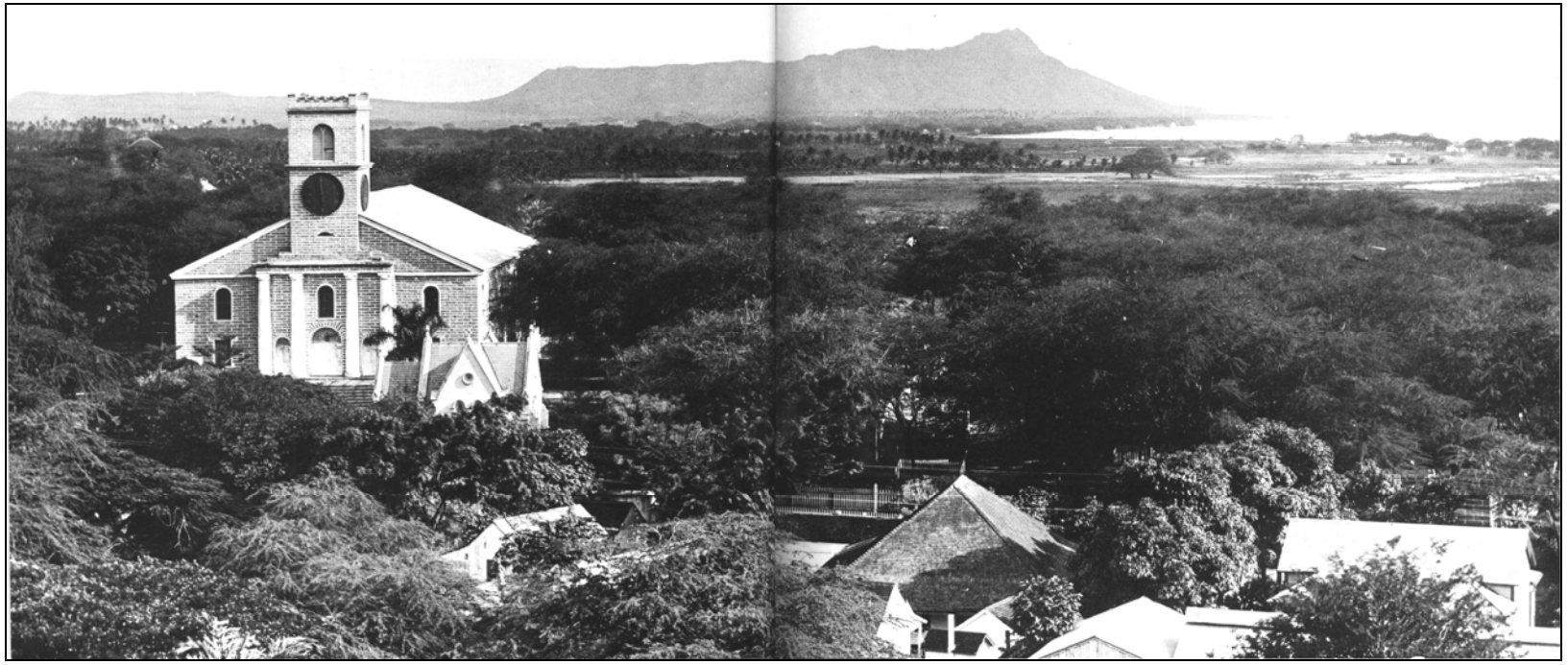


Figure 15. Circa 1887 photograph of Honolulu and Waikīkī; Kawaiaha‘o Church in left foreground; the Mauka Area District is within the marshlands seen in the right upper background (original photograph at Hawai‘i State Archives, Henry L. Chase Collection; reprinted in Stone 1983:84-85)

The Organic Acts of 1845 and 1846 initiated the process of the Māhele – the division of Hawaiian lands – which introduced private property into Hawaiian society. In 1848, the crown, the Hawaiian government, and the *ali‘i* (chiefs) received their land titles.

The *‘ili* of **Kewalo** was awarded to Kamake‘e Pi‘ikoi, wife of Jonah Pi‘ikoi, as part of LCA 10605, *‘āpana* (lot) 7. Pi‘ikoi was an *ali‘i*, a retainer of Kauikeaouli (Kamehameha III), and he held several government posts. He divided his award between himself and his wife (Kame‘elehiwa 1992:269).

The *‘ili* of **Kukuluāe‘o** (Figure 16) was awarded to the American Board of Commissioners for Foreign Missions (i.e., the original missionary families who arrived in the islands in 1820). Initially this land (LCA 387) was associated with Punahou School in Mānoa Valley, as Chief Boki gave the Punahou lands to Hiram Bingham, pastor of Kawaiaha‘o Church in 1829 (DeLeon 1978:3), as stated in the LCA testimony (full text in Appendix A).

> The boundaries of that part which lies on the sea shore we cannot define so definitely, but presume there will be no difficulty in determining them as it is commonly known as pertaining to Punahou. This part embraces fishing grounds, coral flats & salt beds. (Land Commission Award 387)
>
> The above land was given by Boki to Mr. Bingham, then a member of the above named Mission and the grant was afterwards confirmed by Kaahumanu (Foreign Register, Vol. 2:33). The Makai part of Punahou is bounded Mauka by “Kewalo” and “Koula”, Waititi side by “Kalia”, seaward it extends out to where the surf breaks. Honolulu side by “Honolulu.”
>
> This land was given to Mr. Bingham for the Sandwich Island Mission by Gov. Boki in 1829. . . . From that time to these the S. I. Mission have been the only Possessors and Konohikis of the Land. . . .
>
> The name of the Makai part is Kukuluaeo. There are several tenants on the land of Punahou whose rights should be respected. (Foreign Testimony, Vol. 3:115)

In the Māhele, however, this sea land became “detached” from the Mānoa award and was instead given to the pastor of the Kawaiaha‘o Church, as noted in a history of the Punahou School.

> There belonged in former times, as an appurtenance to the land known as Kapunahou, a valuable tract of salt-ponds, on the sea-side to the east-ward of Honolulu harbor, called Kukulaeo, and including an area of seventy-seven acres. At the time of the settlement of land claims before the Land Commission, application was made for it by the successor of Mr. Bingham in the pastorate of Kawaiahao Church—he believing it to be a glebe land for the support of that church. His claim was resisted by the then Principal of Punahou School, but without success, and a Royal Patent was issued, severing it from the Punahou estate, and awarding it to the applicant as his private property. (Punahou School and Oahu College 1866)

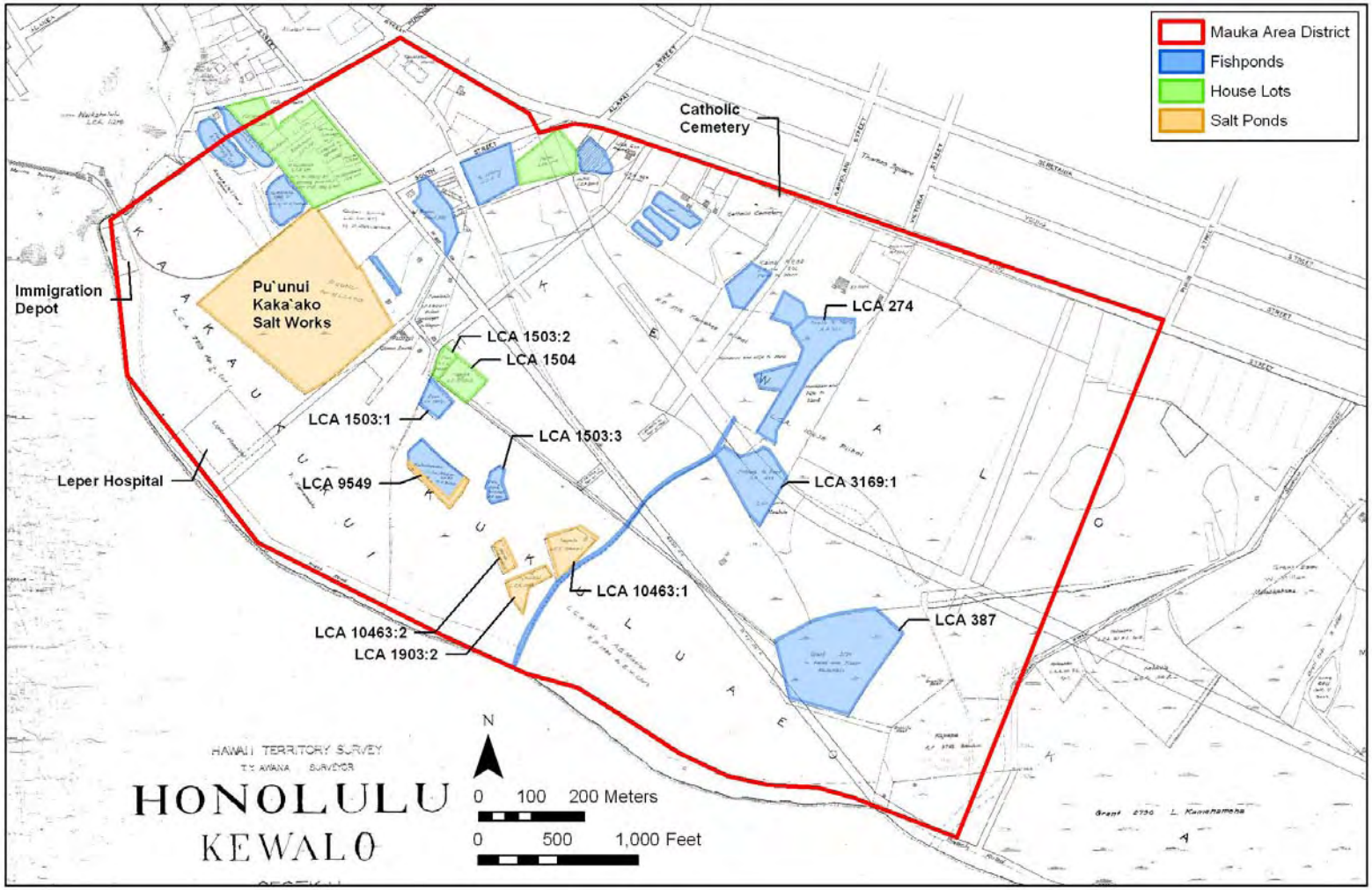


Figure 16. 1884 map by S. E. Bishop of the Kewalo section of Honolulu, showing lots, fishponds, and salt ponds mentioned in testimony from the Land Commission Awards (Hawai‘i Land Survey Division, Reg. Map 1090)

The ‘*ili* of **Ka‘ākaukukui,** LCA 7712 (Figure 17) was awarded to Victoria Kamāmalu, the sister of Kamehameha IV and Kamehameha V. The lands were administered by her father and guardian Mataio Kekūanaoa, who inherited his daughter’s lands at her death. Ka‘ākaukukui consisted of three non-contiguous sections, a type of ‘*āina* (land) called a *lele*. An early surveyor for the Hawaiian Government Survey office explains about *lele* in general, and Ka‘ākaukukui in particular:

> There were two features of the ili, referred to by the terms *lele* . . . the ili often consisted of several distinct sections of land—one, for instance, on the seashore, another on dry, open land, or *kula*, another in the regularly terraced and watered kalo patch or *aina loi* district, and another still in the forest, thus again carrying out the equable division system which we have seen in the ahupuaa.
>
> These separate pieces were called, *lele*, i.e., “jumps,” and were most common on Oahu. . . . Kaakaukukui held Fisherman’s Point and the present harbor of Honolulu; then kalo land near the present Kukui street, and also a large tract of forest at the head of Pouoa [Pauoa] Valley. . . .
>
> These different pieces were called variously, either by their own individual name or by that of the whole ili, thus puzzling one sadly when attempting to obtain information with respect to them. (Lyons 1894:1697)

There are no smaller *kuleana* awards to commoners within the Ka‘ākaukukui award. The award also included the southern portion of the ‘*ili* of Pu‘unui and a large fishpond (labeled Loko Ka‘ākaukukui) surrounded by land in the ‘*ili* of ‘Auwaiolimu. Loko Ka‘ākaukukui was probably a fishpond fed by spring-water, but the other ponds in Kamāmalu’s award, Loko Kaimukana, Loko Kalokoeli, and possibly Loko Kuimeki, were probably salt ponds filled by tidal waters. There are no houses within this award shown on the 1874-1891 maps. There are two structures labeled “Salt Houses,” presumably for drying or storing salt, and a few other structures associated with the wharfs and the Marine Railway leading to the reef.

In the ‘*ili* of **Kaka‘ako,** there are three LCA Awards shown on maps on the northwestern border of Ka‘ākaukukui.

LCA 4457 to Ana Kaloa was inhabited by her family since the days of Kamehameha I; it had four fishponds, an ‘*auwai* and a house enclosed by a fence.

LCA 3455 to Kaule for Liliha, a houselot (*pahale*) bound by the sea and the mouth of a stream (*muliwai*), was inherited from Kamehameha I.

LCA 247, a house lot, was claimed by Charles Kana‘ina for W. C Lunalilo, who received his land before the Māhele from his mother (*mamua loa*). Kana‘ina was a friend to Kamehameha II and married his fifth wife Kekauluohi. Their son was Lunalilo, who became the sixth monarch of Hawai‘i.

The ‘*ili* of **Pualoalo,** or Puaaloalo, (LCA 10605-A) was awarded to Iona (Jonah) Pi‘ikoi. It consisted of three *lele* lands, two in Nu‘uanu valley and the parcel shown on the 1876 Lyons

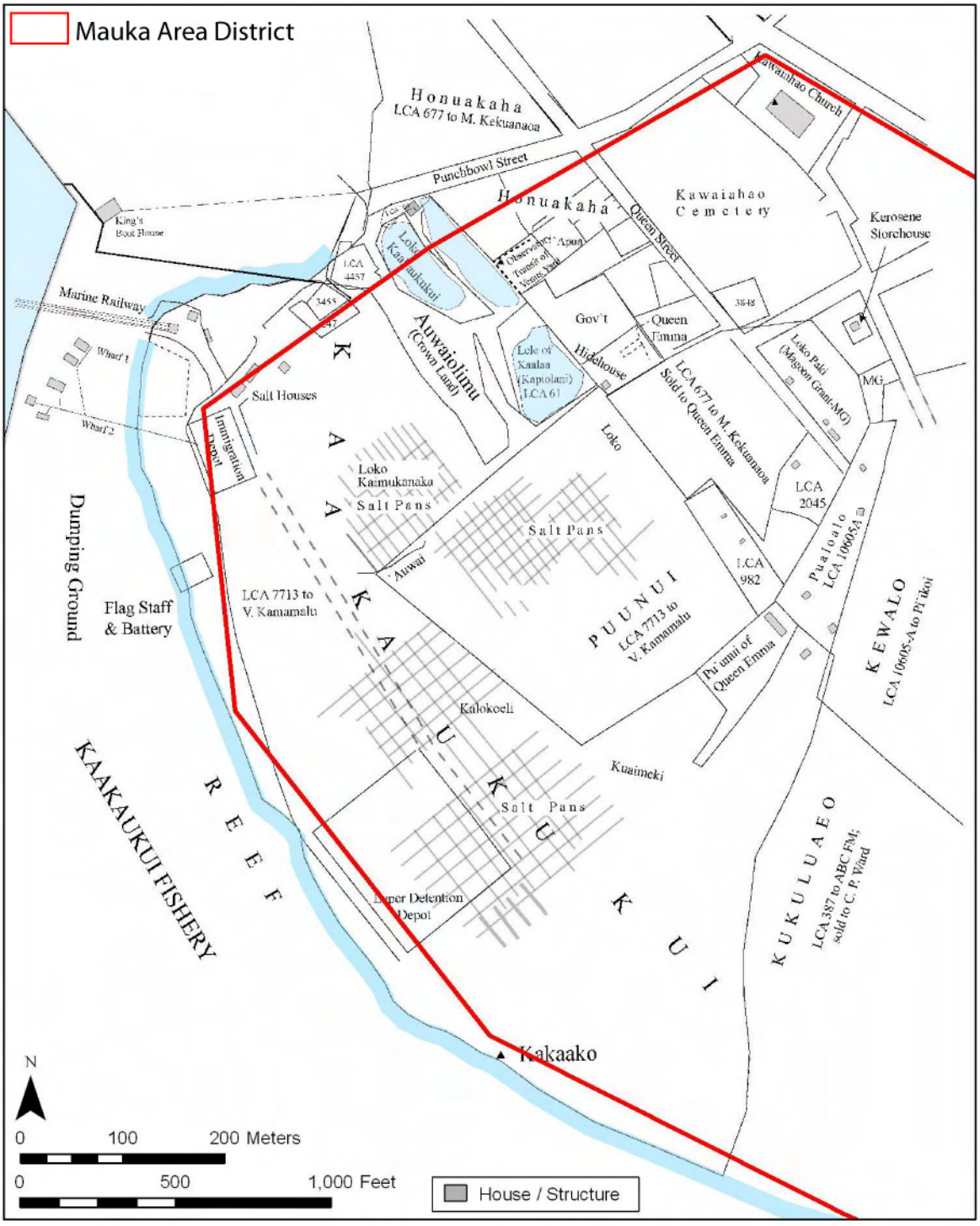


Figure 17. Tracing of 1876 Lyons map, with additional information from 1891 map of Ka‘ākaukukui, Kaka‘ako Section, by F. S. Dodge (Bishop Estate Map # 145), showing *‘ili* and LCA parcel locations

map (see Figure 8) bordering the northeast corner of Ka‘ākaukukui. On the 1884 Bishop map (see Figure 6), there are four houses on this property.

The ‘*ili* of **Pu‘unui**, which also had several *lele* lands, including the large rectangular section in the center of the 1874 Lyons map. The upper portion was part of LCA 677 to Matio Kekūanao‘a, father of Victoria Kamāmalu. He was a high *ali‘i* who was a close friend to Kamehameha II and was married to Kinau, the daughter of Kamehameha I**.**

On the 1867 Lyons map (see Figure 8), LCA 2045 is shown within Pu‘unui. This lot was awarded to Kauwahi, who received the parcel in the time of Kamehameha I. An 1891 map shows a house on this parcel.

The ‘*ili* of **Ka‘ala‘a**, northwest of Pu‘unui, was awarded to Beneli (Bennett) Nāmakehā (LCA 7260), a member of Kamehameha II’s privy council. He was the uncle of Queen Emma (wife of Kamehameha IV) and the first husband of Kapi‘olani, who later married King Kalākaua, the seventh Hawaiian monarch (Kame‘eleihiwa 1992:276.) Late 19th century maps Ka‘ākaukukui maps identify this parcel as “Kaalaa Her Majesty Kapiolani.” In his will, Nāmakehā gave the *lele* of Ka‘ala‘a to his widow Kapiolani. In a legal suit concerning the property, the *lele* is described as:

> . . . a piece of land situate at Honuakaha, Honolulu, and containing an area of 1.6 acres. The property consisted formerly of a fishpond and its banks and, perhaps, a small piece, additional, of dry land, and was a lele of the Ili of Kaalaa . . .
>
> . . . from 1852 or, perhaps, 1850, (Kapiolani and Namakeha married in 1850) Kapiolani at various times had the pond cleaned out, that her servants by her direction fished therin and delivered the fish to her for her use, that she sometimes gave them some of the fish, that she erected a small building on the bank of the pond or on the kula adjoining, that a man employed and directed by her to care for and the care of the pond occasionally lived in that building, and that she at times objected to horses being pastured on the kula of the pond because the animals might enter the pond and cause injury to it. (Hawaii Reports 1903:321, 324)

The ‘*ili* of ‘**Auwaiolimu,** which consisted of several *lele*, was awarded to Kalaeokekoi, but he returned it to the government, and it became Crown Land. Kalaeokekoi was married to the Kaulahua, who is believed to be the niece of Charles Kana‘ina (awarded LCA 247 in Kaka‘ako).

A large section of the ‘*ili* of **Honuakaha** was awarded to Matio Kekūanao‘a (LCA 677), but the rest of the ‘*ili* was divided into small lots. This was the main habitation area to the east of central Honolulu and is noted as a village as early as 1810 (‘Ī‘ī 1959:92). The waihona ‘āina database notes seven awards in the ‘*ili* of Honuakaha, but there are additional awards in this ‘*ili*, which extended on both sides of Punchbowl Street. In many of the awards, the ‘*ili* name is not given, only the address on Punchbowl or Queen Street.

The entire ‘*ili* of ‘**Āpua** was not awarded to one person, but LCA 704, between the two long fishponds in the northwest of the study parcels, was within the ‘*ili* of ‘Āpua. The claim is for a houselot to Honaunau, which he received prior to the death of Kinau in 1837.

Table 1 is a list of LCA parcels in the Mauka Area District based on the 1884 Bishop map, the 1876 Lyons map, and the Waihona ‘Aina database. There may be additional LCA awards in the area not shown on the two maps, especially those that are listed by their street address in the LCA testimony, rather than by the ‘*ili* name. A sample of some of the LCAs is presented in Appendix A.

Table 1. Land Commission Awards in the Mauka Area District

LCA	Awardee	‘Ili	Comments
2	Robert Kilday	Kula, Pualoalo	Two fishponds in Kukuluae‘o
61 - MA	Namakeha	Kaalaa (Halekauwila St.)	--
63	Namauu, Nueku	Honuakaha	--
129	Kinimaka	Queen & Punchbowl Sts.	Houselot, bordered by a pond
195	Kamahiai	Kawaiahao	Houselot
200	Kaina, M.	Kawaiahao; Koula	Houselot
247	Lunalilo, W.C. by C. Kanaina	Punchbowl St. in Kakaako	Houselot
255	Hakau, wahine	Honuakaha	--
274	Joseph Booth	Koula	Royal Patent 306 to Joseph Booth
387	ABCFM (Mission)	Beretania St., Punahou, Kawaihao, Kukuluaeo, Kamakapili	--
569	Puniwai	King St.	Houselot with salt beds at makai end
603	Hoonaulu	Waiahao; King St.	Houselot
635	ABCFM	Kawaiahao	Lot for Kawaiaha‘o Church and cemetery
673	Naiwi	Kawaiahao	Houselot
677	Kekuanaoa for Kamamalu	Honuakaha	Three lots on Queen St. borded by salt pans on the *makai* side; parcel 2 included Honuakaha pesthouse and cemetery
685	Pehu	Kawaiahao	--
704	Honaunau	Punchbowl St.	Ponds, ditches
728	Holualoa	Kawaiahao	Houselot
729	Kekuhaupio	Queen St.	Three houses, bounded on makai side by fishpond of H. Kalama
735	Kaahumanu	Honuakaha	Two houses
805	Kaahuea	Honuakaha	One house on fenced lot
824 - B	Naiu	Kawaiahao, King St.	--
982	Kukao	Koula, Kukuluaeo	--
1082	Kekuanui	Honuakaha, Puunui	One house

LCA	Awardee	‘Ili	Comments
1366	Wahiena	Kukuluaeo, Puunui°	--
1499	Kapalu	Kewalo, Kukuluaeo	--
1503	Puaa	Kukuluaeo, Kewalo	Houselot and three fishponds
1504	Pahika	Kukuluaeo, Kewalo	Houselot, fishpond, salt bed
1592	Kauo	Kaakopua, Kukuluaeo°	--
1903	Lolohi	Kukuluaeo	Two salt beds, 15 drains, two *poho kai*, one salt *kula*
2019	Pupule	King St., Kakaako	--
2045	Kauwahi	Puunui	Houselot
3169	Koalele	Kewalo	Makai ponds
3455	Kaule	Kakaako	--
3848	Puhalahua	Honuakaha	--
3951	Niau	Puohalulu, Kakaako	--
4457	Kaloa, Ana, wahine	Kakaako	Four fishponds
6489	Kaihiwa	Honuakaha	--
7712	Kekuanaoa for Kamāmalu	Kaakaukukui, Puunui	--
7713	Kamāmalu, Victoria	Honolulu	Retained
8515	Keoni, Ana	Puunui; Queen St.	--
9549	Kaholomoku	Kukuluae‘e	Fishpond and four salt pans on Waikiki side of pond
10463	Napela	Kukuluae‘e	House site, two ponds, one ditch, and salt lands
10605	Piikoi, Iona (Jonah)	Kawelo, Puaaloalo, Koula, Punchbowl St.	Ponds; four structures
10811	Hana Puhikakaino	Kawaiahao	--
--	Kalaeokekoi	Auwaiolimu	Returned to Crown
--	Kamehameha, Lot (Kapuaiwa)	Kukuluaeo	Returned to government
--	Kamamalu	Puunui 1, 2, 3	Returned to government

4.3 Late 19th and Early 20th Century Land Use

4.3.1 Kaka‘ako Salt Works and the Salt Pans of Kewalo and Kaka‘ako

In an article on Hawaiian salt works, Thomas Thrum (1924) discusses the large salt works at Alia Pa‘akai (Salt Lake in Moanalua) and at Pu‘uloa on the western loch of Pearl Harbor. Kamakau (1961:409) reported “The king and Isaac of Pu‘uloa are getting rich by running the salt water into patches and trading salt with other islands.” The salt was sent to Russian settlements in the Pacific Northwest, where it was used to pack salmon (*Hawaiian Gazette,* January 29, 1897). Thrum also mentions a salt works in Kaka‘ako.

> Honolulu had another salt-making section in early days, known as the Kakaako salt works, the property of Kamehameha IV., but leased to and conducted by E. O. Hall, and subsequently E. O. Hall & Son, until comparatively recent years. This enterprise was carried on very much after the ancient method of earth saltpans as described by Cook and Ellis. (Thrum 1924:116)

The export of salt declined in the late nineteenth century. Thrum (1924:116) states that the apex of the trade was in 1870; by 1883, he noted, “pulu [tree-fern wool once used to stuff mattresses and pillows that was formerly exported to California], salt and oil have disappeared entirely” from the list of yearly exports (Thrum 1884:68). By 1916, only one salt works, the Honolulu Salt Co., was still in operation. Salt continued to be manufactured for local use; the Kaka‘ako Salt Works appears on maps as late as 1891, and a page in Victoria Ward’s ledger for 1883 notes a yearly income of $651.50 received from her “Salt Lands” in Kukuluāe‘o (Hustace 2000:50). A 1902 photograph (Figure 18) shows the extensive salt beds of the Kewalo area, in an area probably east of the Mauka Area District.

Figure 18. 1902 photograph of Kewalo Brine Basins (reprinted in Scott 1968:579), showing salt pan area east of the Mauka Area District

The Chinese were involved in salt production, usually in concert with their management of fishponds. One son of a Chinese resident remembered (around 1900) the Chinese method of salt production from salt pans bordering the sea, which were fed continually with seawater by the tides.

> Both the natural tides and the Chinese method of peddling a wooden wheel that transported water upward, helped to keep the salt beds damp with about three inches of water. After a few months, the senior Mau would drain off the remaining water and use a wooden rake with deep prongs to break up the salt. When the bed was dry a flat rake was used to flatten and smooth out the salt. Later it was raked into piles, packed in cloth bags and distributed. (Chong 1988:108)

In a 1906 article, Rev. Westervelt (1906:43-46) explained the Chinese method of salt evaporation for the Honolulu salt beds. The Chinese worker first uses a water pump to draw the seawater from the larger ditch below to the salt-evaporation beds above. The man moves the two handles back and forth to work the pump. The evaporation beds are lined with clay, wet with sea water, and tramped and pounded down. Each pan is about 20 feet square, covered with about two inches of water, and bound by an earth dyke, so that the area looks like a large grid. After allowing the sun to evaporate some of the water, the worker steps into the evaporation pan and scrapes the salt into a pile in the center with a simple wooden scraper. He then throws a large basket shaped like a scoop into the brine and uses a tin dipper to move the salt to the basket. Two baskets, one on each side of a pole, are then carried on the back of a worker across the thin earth dykes between the salt pans. The baskets are dumped into large drying piles, where the remaining water seeps out into the ground. The salt is then sewn into gunny sacks and sent to the market for sale.

By 1901, most of the fishponds and salt pans *makai* of Queen Street were reported as abandoned. In that year, the Hawai‘i Legislature (1901:185) proposed to build a ditch to drain away the “foul and filthy water that overflows the Kaka‘ako district at the present time.”

> The district makai of King St. and the Catholic Cemetery, Ewa of Mrs. Ward’s (the Old Plantation), mauka of Clayton St., and Waikiki of the land from King St., leading to the Hoomananaauao Church, consists of six large abandoned fish ponds and a large number of smaller ones, all in filthy condition, fed by springs and flowing into Peck’s ditches. Just makai of these ponds, at the end of Clayton street, next to Mr. Ward’s, is Peck’s place. An artesian well flushing the wash houses flows into two foul ditches, thence to the big pond which is Waikiki of what used to be Cyclomere and next to Mrs. Ward’s line [ditch] extending down to Waimanu St.
>
> The rear portion of Mrs. Ward’s property down to Waimanu St. used to be fish ponds all connecting to the sea by a ditch which is fed by an artesian well. These ponds, with the exception of three, are abandoned.

4.3.2 The 1874 Transit of Venus Observatory at ‘Āpua

On the 1876 map of Ka‘ākaukui, an area labeled “Transit of Venus” yard and “Observatory” is labeled for a lot northwest of the study areas (see Figure 8). On other historic maps, this land section is called ‘Āpua. This lot was used to house a large portable observatory in 1874, an event of so much interest that the lot continued to be labeled as the Transit of Venus yard many years after the portable observatory had been dismantled.

In 1874, several astronomical teams from Great Britain traveled to different parts of the world to observe a rare transit of the planet Venus across the sun. The “purpose of the observations was to better determine the value of the astronomical unit (AU)—the Earth-sun distance—and thereby the absolute scale of the solar system” (Chauvin 2004:xii). This project attracted enormous interest in Hawai‘i, and the workers of the Hawaiian Government Survey worked with the Hawai‘i team, who set up observatories on Hawai‘i, Kaua‘i, and O‘ahu. Each station needed an equatorial telescope, other telescopes, a transit instrument, an altazimuth (surrounded by a portable wooden observatory with a revolving dome), and several clocks, chronometers, compasses, micrometers, reflecting circles and artificial horizons (Chauvin 2004:51, 60).

On reaching Honolulu, the British team of seven astronomers temporarily moved into the Hawaiian Hotel in downtown Honolulu, and began to look about for a proper place to set up their O‘ahu observatory. King Kalākaua, who strongly supported the project, give them permission to use a piece of land in the ‘*ili* of Āpua. Captain Tupman, head of the expedition wrote:

> Difficulty was experienced in finding a suitable place of observation, as I considered it of great importance that the observers should be lodged very close to the instruments; and house accommodation is rather limited. However we have been enabled to rent a cottage belonging to the Princess Ruth, Governess of Molokai, capable of accommodating the Head Station observers, and adjoining some land owned by His Majesty the King who had kindly given us permission to erect our instruments Etc. and enclose as much land as may be necessary. (cited in Chauvin 2004:76-77).

The land in question was an 0.3-acre “open piece of grass land in the district called ‘Āpua. south of Punchbowl street, and west of Queen Street” (see Figure 17 for location) Several buildings were erected, included a barracks and workshop, a cookhouse, a photo hut thatched with grass, the stages (platforms) for the instruments, and a wooden palisade to enclose the lot. The observations of the transit of Venue on December 8, 1874 in Honolulu were a great success, and the British party was feted by the king and other prominent families of Hawai‘i. All that was left was to dismantle the temporary buildings at ‘Āpua. Tupman wrote:

> Mar. 13. The sale. Our household goods sold well, many friends desiring to obtain a memento of our visit. The long shed, Cook house, walls of huts, transit hut complete, water pipes & taps, 6-foot fencing and a large pile of lumber were knocked down to His Majesty the King for a very small sum, as no one would bid against him We were not altogether sorry for this as His Majesty has given us the land rent free & had aided us in many ways tending to save expense to the British Government. (cited in Chauvin 2004:124).

4.3.3 Kaka‘ako’s Role as a Human Quarantine Center and Cemetery Area

During the 1853 smallpox epidemic, patients were isolated at a temporary quarantine camp and hospital in Kaka‘ako (Thrum 1907:98) and buried at the Honuakaha Cemetery near the modern junction of Quinn Lane and South Street (Griffin et al. 1987:13).

Hansen’s Disease (leprosy) was first reported in 1840, and first definitely identified in 1853. In the next 25 years (1853-1878), there were 160 cases per year (about 4000) and 80 cases (about 4000) per year in the next 50 years (1878-1928), steadily decreasing to 60 cases a year in 1931 and 20 cases a year by 1951 (Arnold 1956:317). In 1865, a receiving hospital in Kalihi, west of Honolulu town, was set up to examine suspected lepers. If the diagnosis was confirmed, the patients were forcibly exiled to the Kalaupapa colony on Moloka‘i. In cases where it was uncertain if the patient had leprosy or some other type of skin disease, the stay at the hospital could extend into weeks while the doctors waited for definite symptoms of leprosy to develop.

A branch hospital and receiving station for cases of Hansen’s Disease was opened in Kaka‘ako, in a block now bound by Ala Moana, Auahi, Coral and Keawe Streets (Griffin et al. 1987:55) in 1881, with 48 patients tended by Dr. George L. Fitch (Hanley and Bushnell 1979:112). One of the main purposes of the Kaka‘ako Detention Center was to keep suspected lepers isolated from the general pubic. Sister Leopoldina, a Franciscan sister, described the Kaka‘ako Hospital in 1885 as like a prison, enclosed by:

> . . . . a high close board fence and large strong locked gates. . . . . A large building [sat] over those gates where the lepers were allowed to talk with their relatives through prison bars. No one was allowed to enter without a permit from the Board of Health. (cited in Hanley and Bushnell 1979:114).

As the complex was on a former salt marsh near the sea, it was subject to flooding at high tide. The salt water killed all vegetation and made it impossible to landscape the complex with grass or plants; the water swept away stone-bordered paths, corroded metal, and destroyed the whitewash on the buildings. Even so, the Board of Health expected the patients to help feed themselves by growing their own vegetables in gardens on the center’s grounds. Overcrowding was also a problem. The hospital, built to house 100 patients, had over 200 residents by 1883. Dr. Fitch was in favor of making the Kaka‘ako station a permanent leprosarium, and often delayed sending confirmed lepers to Molokai.

In 1883, Walter Murray Gibson, minister in King Kalākaua’s government, and head of the Board of Health, sent out a plea for a religious order to care for the sick of Hawai‘i, especially the lepers. The call was answered by the Franciscan Sisters of Syracuse, New York, led by Mother Marianne Cope. The seven sisters arrived in Honolulu and made their first visit to the Kaka‘ako Leper Detention Center in November of 1883. They were appalled with what they saw: tumble-down cottages, filth and flies in the dining area, and the stench of the leper’s unwashed sores. The hospital steward, J. J. Van Geisen, took them on a tour.

> “Now let me show you the most interesting place,” he announced, leading the group to a narrow building that teetered on pilings over the surf. The structure had bee divided into three dingy cubicles, with warped floors and windows ghosted by salt spray. The first of the rooms was the “morgue.” Van Geisen explaining that

> when a patient’s condition reached a certain point, he was forced into the morgue and remained there until dead. The body was then dragged to the second cubicle, where Fitch performed an autopsy. Finally the remains were moved to the third room, to await a burial team. (Tayman 2006:143)

The sisters built a convent at the hospital in November to live near their patients. The convent was a two-story house with a hall, parlour, and refectory on the ground floor, and five bedrooms upstairs. A small chapel was attached to the rear of the structure, dedicated to St. Philomena. The sisters soon took the running of the hospital in hand, cleaning and whitewashing the cottages, separating the males and females into two wards, and setting up new landscaped areas and gardens (Figure 19).

In 1884, Mother Marianne built a home at Kaka‘ako for the non-leprous daughters of the patients from Kaka‘ako and the exiled lepers of Molokai (Figure 20). The girl’s home was named after Queen Kapi‘olani, who supported the plan by raising funds. A two-story dormitory for the girls was built near the sister’s chapel (Hanley and Bushnell 1980:222).

In 1888, the Board of Health decided to close the Kaka‘ako Branch, moving the receiving station to Kalihi, and determined that “The buildings at Kakaako should be entirely removed” (Hanley and Bushnell 1980:275). The hospital and several other of the larger buildings were dismantled and transported for use at Molokai (Daws 1984:xxiii), but a few buildings remained, and Kaka‘ako continued to be used as a temporary leprosy receiving station. Thrum (1897:101) reports that victims of the cholera epidemic of 1895 were treated at the Kaka‘ako Hospital, so the remaining buildings were modified or a new hospital was built during this time. In 1889, the Kapiolani School for Girls was also moved to Kalihi (Hanely and Bushnell 1980:326). The girl’s dormitories were torn down and the new immigration station was built on the former grounds of the home.

In 1899, the first case of bubonic plague was identified in Hawai‘i, and spread rapidly through the crowded tenements of Chinatown. The government decided that the best way to eradicate the disease was through “controlled burning” of the wooden buildings. Infected patients were moved to a quarantine camp at Kaka‘ako. Some people, not necessarily patients, whose houses were burned were housed at the barracks of the Kaka‘ako Rifle Range, and their belongings were stored in the cellars of Kaumakapili Church. In January 20, a fire was set in Block 15 between Kaumakapili Church and Nu‘uanu Avenue, which quickly got out of control. No one was killed in the fire, but Chinatown was destroyed. Many people were homeless, and also bereft of all belongings, which were lost when Kaumakapili Church burned to the ground (Iwamoto 1969:122-124, 130-131).

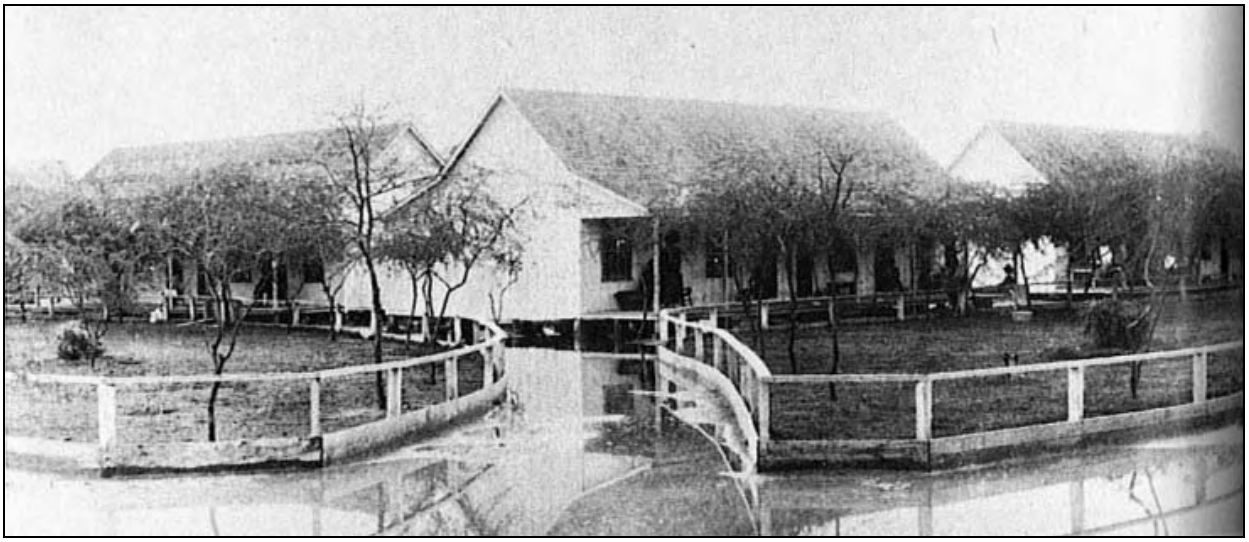


Figure 19. 1886 photograph of patient’s oceanside cottages at the Kaka‘ako Leper Detention Center (reprinted in Hanley and Bushnell 1980:photograph section)

Figure 20. 1886 photograph of the Kapi‘olani Home for Girls within the Kaka‘ako Leper Detention Center; Mother Marianne Copeland is the second woman from the right (reprinted in Haneley and Bushnell 1980: photograph section)

In 1905, the Kaka‘ako area was used for the incineration of the waste from urban Honolulu. Thomas Thrum reported

> Early in the year was completed the long projected garbage crematory for the disposal, daily, of the city's refuse by a patent and sanitary process. It is located on the shore of Kakaako, adjoining the sewer pumping station; is two stories in height and built of brick. (Thrum 1906b:177)

> The dredging of Honolulu harbor and its channel is completed as far as planned for the present, and excavations for the Alakea and Kinau slips finished, the material therefrom being used to fill in a large area of Kakaako and the flats in the vicinity of the sewer pumping station and garbage crematory. The amount of material removed by the Federal dredging was a million and a half cubic yards. (Thrum 1907:148-149)

4.3.4 Military Works at Kaka‘ako, Ka‘ākaukukui, and Kukuluāe‘o

During the monarchy, the point at Kaka‘ako was the location for a battery, with three cannon used to salute visiting naval vessels, which responded with their own cannon salutes. Other saluting batteries were at the top of Punchbowl Crater and at the Honolulu Fort (Dukas 2004:163). The *Hawaiian Annual and Almanac for 1887* (Thrum 1887a:37) reported that $4,500 had been spent to build the battery, which was used for gun salutes up to at least the end of the monarchy in 1893 (Judd 1975:57), as shown on a 1887 map (see Figure 7 and Figure 17) and an 1887 photograph (Figure 21).

In 1887, a secret organization called the Hawaiian League was formed to push for reform in the government of King Kalākaua. The men wanted to take away much of Kalākaua’s power and form a constitutional monarchy, with the Hawaiian king a mere figurehead. The main power would reside in a new cabinet, dominated by the members of the Hawaiian League, who were mainly *haole* (white, non-native) businessmen. In 1884, a volunteer military company, called the Honolulu Rifles, was organized. In its first few years it operated mainly for drill exhibitions, often attended by Kalākaua himself, but it gradually became the military arm of the Hawaiian League. Pressured by the Hawaiian League, with the added threat of the Honolulu Rifles, in 1887 Kalākaua dismissed his cabinet, signed a new constitution, and established the Reform Government. An insurrection to the new reform government, led by Robert Wilcox, was attempted in 1889. A supporter of Queen Liliu’okalani for the throne, he organized a volunteer militia, mainly Hawaiians or part Hawaiians, called the Kamehameha Rifle Association. On July 30, they marched on ‘Iolani Palace, demanding that Kalākaua abrogate the 1887 constitution. The king was not at the palace, and Wilcox’s militia was soon boxed in on a structure in the palace yard. They came under fire when the Honolulu Rifles arrived at the palace, and eventually, they surrendered to government forces (Kuykendall 1967:347-352; 426-428).

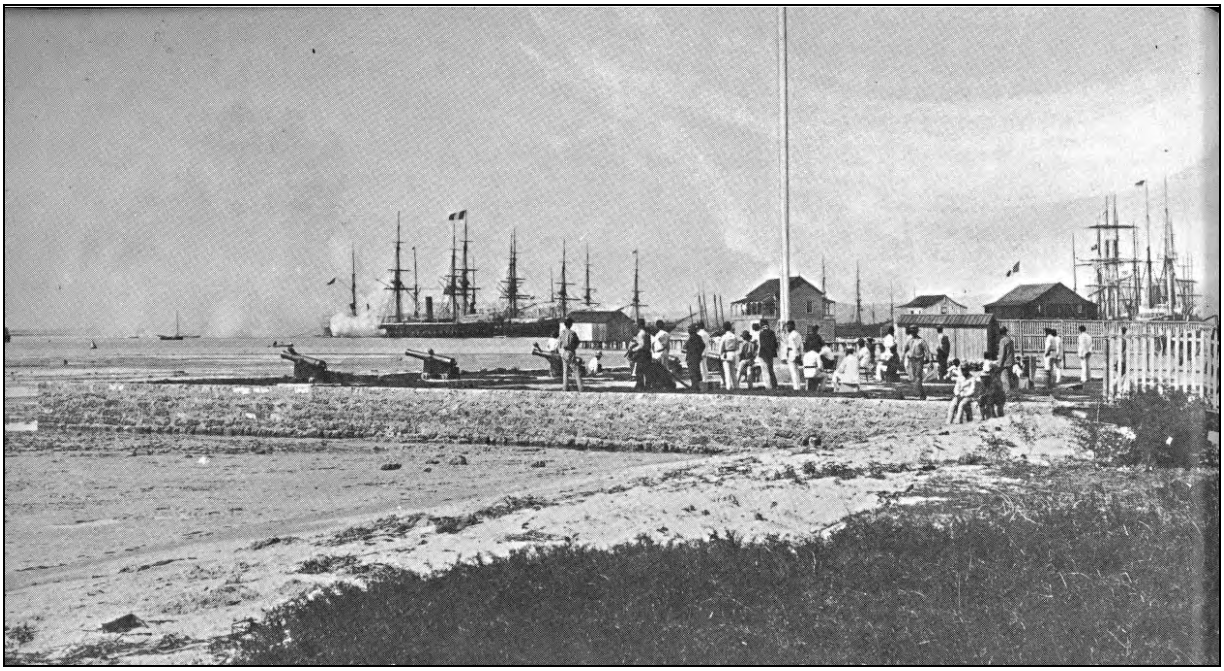


Figure 21. 1887 photograph of the Kaka‘ako Saluting Battery and flagstaff (photo reprinted in Scott 1968:176)

An 1893 map of Kewalo by Walter E. Wall (Figure 22) shows a narrow section of land labeled as the “Honolulu Rifle Assoc.” This land section was probably chosen for target practice based on the absence of any habitations in the area. The narrow portion is crossed by targets with the width of the strip noted as 200 yards. This rifle range is in the Kukulūae‘o portion of the Victoria Ward Estate, within the Mauka Area District. The Honolulu Rifle Association was organized in 1885, with J. Brodie, C. H. Nicoll, and J.H. Fisher as the officers (Thrum 1887b:98). J. H. Fisher was also the commander of Company C of the Honolulu Rifles in 1887 (Adler and Barratt 1973:162). It is not clear if the Honolulu Rifles and the Honolulu Rifle Association are two separate organizations, or they are two organizations with overlapping members. This rifle range may have been used by the National Guard of Hawai‘i in 1893, as mentioned by Judd (1971:187):

> There was considerable emphasis on practice firing [in the National Guard of Hawaii]. . . . A 100 yard rifle range was constructed behind Iolani Palace Barracks which was not only convenient for use but the length of the range approximated the firing distance envisioned for the defense of the government buildings. Accuracy increased from 43% to 57% in the first two weeks of use. (The noise of rifle firing disturbed and alarmed the downtown citizenry, three months later all firing was conducted at a 200 yard range built at the Kaka‘ako Battery.)

After the annexation of the islands by the United States in 1899, the U.S. Congress began to plan for the coastal defenses of their new islands. The major batteries were placed at Pearl Harbor and in Waikīkī, but a small reservation, named Fort Armstrong, was also set up on the

Figure 22. 1893 map of Kewalo by Walter E. Wall shows a narrow section of land labeled as the “Honolulu Rifle Assoc.,” a spot chosen for target practice probably based on the absence of any habitations in the area

Ka‘ākaukukui Reef as a station for the storage of underwater mines. Fort Armstrong is shown on an early (ca. 1911-1920) photograph (Figure 19). Battery Tiernon, with two 3 inch m 1903 guns, was built at this site in 1911, and took over the job of saluting visiting naval vessels once performed by the Kaka‘ako battery (Williford and McGovern 2003:15).

The fort does not seem to have been very impressive. William Castle in 1917 noted:

> Fort Armstrong is the saluting station for the port of Honolulu. It is built on the Kaakaukukui Reef, one mile from the centre of the city and at the entrance of the harbour. Its area is 64 acres, and it has as garrison the 104th Company (mine) of the Coast Artillery Corps. Both officers and men are wretchedly housed in temporary board and batten shacks, although the fort has been in use for three years. (Castle 1917:90)

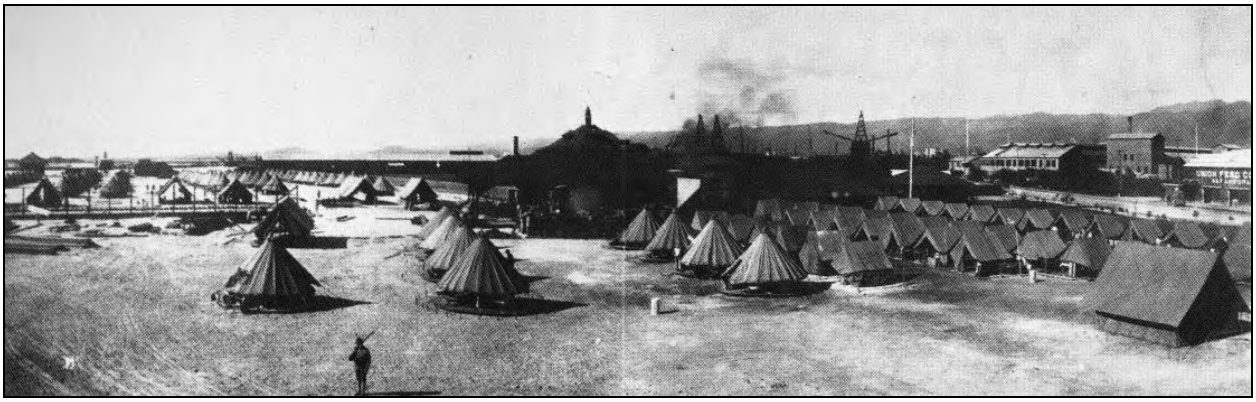


Figure 23. Photograph (ca. 1911-1920) of Fort Armstrong (Hawai‘i State Archives; reprinted in Wisniewski 1984:18)

The fort saw some small action during World War I when in October 1917, the military authorities closed Honolulu Harbor between sunset and sunrise. The steamer *Claudine*, which was sailing from Maui when the edict went into effect, sailed into Honolulu Harbor unknowingly after twilight. The coast artillery at Fort Armstrong shot a few shells across her bow, and the steamer quickly reversed her engines and went back out to sea, until the following morning, when she could safely and legally come to shore (Thomas 1983:147).

In the Japanese attack on the Hawaiian Islands in December 7, 1941, the fort escaped relatively unscathed; only one motor pool structure was hit. Antiaircraft shells were fired from the fort, but were ineffective; at least one hit the town rather than any aircraft (Richardson 2005:34). In the 1950s, the federal government returned most of Fort Armstrong to the Territory of Hawai‘i, which used the area to expand the shipping piers of the harbor.

4.3.5 Kerosene Storage Lot and the Magoon Block

On the 1876 map of Ka‘ākaukukui (see Figure 17, in the *‘ili* of Pu‘unui, is a lot marked “kerosene storage,” a government facility. The danger of locating this storage area so close to

downtown Honolulu was emphasized by the compiler of the *Hawaiian Annual*, Thomas Thrum, who noted fires at the kerosene storage in 1891, and then again in 1907:

> And, as if to emphasize the critical condition of the city, fires have been more numerous than usual, with more serious loss thereby than for years past, the principal one being the government Kerosene Warehouse in the early part of June last, with some 35,000 cases of oil and gasoline. (Thrum 1892:129)

> Early in August a small building at Kakaako of not much value was destroyed by fire. Shortly afterwards, by the prompt response to the firemen to a “still alarm” about 8 a. m. of Sunday, the 11th, an incendiary blaze in the Kerosene warehouse at Kakaako was quenched just in time to avert a serious explosion and conflagration. (Thrum 1908:180-181)

On later historic maps, this land section is referred to as the Magoon Grant or the Magoon Block. John Alfred Magoon was a prominent lawyer in Honolulu who married Emmeline Marie Afong, the daughter of a wealthy Chinese businessman in Hawai‘i (Dye 1997:211-212). Like many businessmen, Magoon bought properties as investments, for development or for sale for a profit at a later date. Under Kamehameha IV, he received Grant 3182 (.312 acres) in 1878 for $50, and Grant 3183 (1.89 acres) for $260. By 1914, he built on the Queen Street lot a two-story structure with shops on the ground floor and residential apartments on the top floor, described as “Hawaii’s First Apartment House” (Griffin et al. 1987:32, 65). Additional structures were built in the early twentieth century in the parcel called the “Magoon Block.” The apartments were generally low-rent and inhabited by bachelors, although some poorer families crowded into the larger apartments. All of the buildings on the lot were demolished in 1940 (Figure 24).

Figure 24. Destruction of “Magoon Block” structures, 1940, view from corner of Queen and Emily Streets (photograph from Griffin et al. 1987: plate 14).

4.3.6 Pohukaina School and Mother Waldron Neighborhood Park

North of Parcels KAK-5, KAK-25, and KAK-35 (No. 3, 12 and 15), between Pohukaina and Halekauwila Streets, and Coral and Cooke Street is Mother Waldron Neighborhood Park, which is associated with the early educational development of Honolulu schools. In 1874, the Pohukaina Girl's School, for parents who cared "about their girls being mixed up with boys at school on in school playgrounds" (Bowser 1880:451) was built on King Street. In 1907 the Hawai‘i Territorial Legislature passed an act to establish the Library of Hawai‘i. After evaluating several possible locations, the government committee decided that the King Street lot of the Pohukaina School would be the best location. Governor Frear wrote, "I arranged to have Pohukaina school moved to Kakaako- a more central location with reference to its constituency and with much more space for buildings and playgrounds" (Frear 1938, cited in Schilz 1991). The school was built in the lot to the west of Mother Waldron Neighborhood Park. Pohukaina School remained in operation in Kaka‘ako until 1980, by which time it had developed into a special education facility. The buildings were demolished, and in 1981, the Pohukaina School special education program was transferred to the campus of Kaimukī Intermediate School.

One of the teachers at the Pohukaina School, from 1922 to 1934, was Margaret Waldron. She was noted for her volunteer work in Kaka‘ako, and was "generally credited with being the individual who had most influence in transforming the so-called 'Kaka‘ako gangs' into law abiding groups and wiping out the unsavory reputation which at one time clung to this district" (*Honolulu Star-Bulletin*; May 8, 1936:A1). Mrs. Waldron died on May 8, 1936 and the following year, when a new playground was constructed across Coral Street from Pohukaina Elementary School, the Honolulu Board of Supervisors authorized the park's designation as "Mother Waldron Playground."

4.3.7 Curtis and Victoria Ward and "The Old Plantation"

In 1870, Curtis Ward, owner of a draying business in Honolulu, purchased at auction the 12-acre estate of Joseph Booth, Royal Patent 306, and additional contiguous lands in the Kō‘ula area. This constituted the *mauka* portion of the "Old Plantation" from Thomas Square on King Street to the *makai* border at Waimanu Street. By 1875, Ward's property comprised 30 acres; an article in the *Pacific Commercial Advertiser* (September 4, 1875) reported:

> In taking a drive out on the Kulaokahua continuation of King street, attention is attracted to the premises just beyond the Catholic cemetery, the property of Mr. C. P. Ward. The lot consists of some thirty acres, and is thickly planted with algaroba and, in rows, there are some seven thousand thrifty young cocoanut trees. . . The algarobas will certainly be valuable as firewood, and the cocoanuts alone will in a few years produce a handsome income. The property is well watered by means of pumps driven by windmills, there being an inexhaustible supply of water a few feet below the surface of the plains.

A few years later Ward added to his property with the purchase of 77 acres and 3,000 feet of ocean frontage in the *‘ili* of Kukuluāe‘o, *makai* of Queen Street. The Wards had a permanent easement for the *‘auwai* that extended from the long fishpond to the sea through the Kukuluāe‘o. The Wards had seven daughters, Mary (Mrs. Ernest Hay Wodehouse); Keakealani (Mrs. Robert

Booth); Annie (Mrs. Wade Armstrong); Mele Elizabeth (Mrs. Frank Hustace, Sr.); and the unmarried Kathleen, Lucy and Kulumanu Ward. In 1882, Cyrus Ward died, leaving the running of the large estate in the hands of his widow, Victoria Ward.

The Wards hired workers to clear the fishponds and ditches, plant taro in the fishponds, fence in pastures for the horses, plant 6,000 coconut trees, plant *kiawe* trees for firewood, and restore the salt pans near the shore (Hustace 2000:41). Income from the 111-acre estate was also generated by leasing the rights to the Kukuluāe‘o fishery, which was part of the Kukuluāe‘o LCA 387 award. After the death of her husband, Victoria derived much of her income from “eggs, bananas, firewood, ‘*awa*, taro leaf, *makaloa* grass, chickens, fish, hay, pigs, salt, white sand, *mānienie* grass, hides, butter, squid, and horses” (Hustace 2000:47) collected from the estate.

In 1930, Victoria Ward incorporated Victoria Ward, Limited, to manage the estate. In 1957, the City and County of Honolulu purchased the *mauka* portion of the estate to construct the new Blaisdell Civic Center (Hustace 2000:67, 77). The Ward Estate, until recently, still managed the *makai* portion in Kewalo and Kukuluāe‘o.

4.3.8 The Animal Quarantine Station and the Hawaiian Humane Society

The first animal quarantine station in the Hawaiian Islands was established in 1905. A veterinarian would check in all imported animals, checking for diseases such as cholera in hogs and tuberculosis in cattle. Kennels were added in the facility in 1909 for the quarantine of all dogs brought to the islands, to be kept at the station at the owner’s expense for a minimum of 120 days. During this long period, it would be possible to assure that the animal did not have rabies, thus preventing the introduction of this disease into the islands.

This quarantine station, “on the Beach Road between Ward avenue and Sheridan street” was described in the 1913 Report of Hawai‘i Board of Commissioners for Forestry and Agriculture (1913:213).

> The station is located on the beach, the foundation being coral and sand, with a very scant covering of soil, which is easily removed and replaced with white sand. When the tide is high the ground water rises to within 24” of the surface, thereby providing a universal sewer under the entire station and complete obviating any smell of dog.

Besides the quarantined dogs, which were returned to their owners after 120 days, homeless dogs were also kept at the station, but for a shorter period of time. The 1913 report has a photograph of the “lethal chamber” where gas was used to euthanize “mangy and homeless” dogs (Hawaii Board of Commissioners for Forestry and Agriculture 1913:214). It is probable that the euthanized dogs were also buried at the station.

The Hawaiian Society for the Prevention of Cruelty to Animals was founded in 1883. In 1905, women from several prominent families in Hawai‘i, including the Ward family, expanded the mission of this society to include the prevention of cruelty to children. They renamed the organization the Hawaiian Humane Society. The Ward family were natural backers of the society as Cyrus Ward had always championed the humane treatment of animals. He bought large tracts

of land in the Honolulu area, including Old Plantation, partly to provide pasture for the horses in his draying business. He was concerned over the overworking of horses common in Hawai‘i, especially for horses used to haul loads over the Pali Highway. Ward used his extensive pasturelands for the resting and recuperation for his horses, rotating them in and out of the pastures between jobs (Hawaiian Humane Society 1997:7-38). Lucy Kaiaka Ward, fifth of the seven daughters of Cyrus and Victoria Ward, worked as a volunteer at the Humane Society first, but later became an official of the society.

> Armed with her trademark bullwhip, a pistol and her special constable's badge, she made her round on horseback—and later in her Model T—rescuing injured cats and dogs, checking dray animals for abuse, hauling young girls out of bars and dance halls at all hours of the day and night. She served officially with the Hawaiian Humane Society from 1913 until 1932, first as human agent and later as its executive officer. (Hawaiian Humane Society 1997:38)

The Ward family also donated some of their land to the society to establish the first animal shelter. This land was at the corner of Pohukaina and Kō‘ula Streets; the facility for "all homeless, hungry animals" was completed in 1925. The Humane Society moved to a new and larger facility in Mō‘ili‘ili in 1938 (Hawaiian Humane Society 1997:44, 53).

4.4 19th and 20th Century Land Reclamation Projects

4.4.1 Kaka‘ako Reclamation

The first efforts to deepen Honolulu Harbor were made in the 1840s. The idea to use this dredged material, composed of sand and crushed coral, to fill in low-lying lands, was quickly adopted. Between 1857 to 1870, the "Esplanade" between Fort and Alakea streets was created on 22 acres of filled-in former reef and tideland. By 1874, Sand (Quarantine) Island, site of the first immigration station, had been created over "reclaimed" land on reefs.

By the 1880s, filling-in of the mud flats, marshes, salt ponds in the Kaka‘ako and Kewalo area had begun. This filling was pushed by three separate but overlapping improvement justifications. The first directive or justification was for the construction of new roads and improving older roads by raising the grade so the improvements would not be washed away by flooding during heavy rains. A report by the Hawaii Board of Health (1908:80) noted:

> I beg to call attention to the built-up section of Kewalo, "Kaka‘ako," where extensive street improvements, filling and grading have been done. This, no doubt, is greatly appreciated and desirable to the property owners of that locality, but from a sanitary point of view is dangerous, inasmuch as no provision has been made to drain the improved section, on which have been erected neat cottages occupied for the greater part by Hawaiian and Portuguese families, now being from one to three feet below the street surface, and which will be entirely flooded during the rainy season. Unless this is remedied this locality will be susceptible to an outbreak [of cholera] such as we experienced in the past.

As mentioned in the above section, the justification most frequently cited was driven by public health and sanitation, the desire to clean up rivers and ponds that were reservoirs for diseases such as cholera and that acted as breeding places for rats and mosquitoes. Thus as early as 1902 (Hawaii Board of Health 1902:80), it is reported that:

> The Board has paid a great deal of attention to low-lying stagnant ponds in different parts of the city, and has condemned a number of them. The Superintendent of Public Works has given great assistance to seeing that the ponds condemned by the Board are filled. In September a pond on South Street was condemned as deleterious to the public health.

The first areas to be filled were those areas closest to Honolulu town, then moving outwards to Kaka‘ako (Griffin et al. 1987:13). The first fill material may have been set down for the Kaka‘ako Leper Branch Hospital (between Coral and Keawe Streets), which had been built on a salt marsh. Laborers were hired to “haul in wagonloads of rubble and earth to fill up that end of the marsh” (Hanley and Bushnell 1980:113). In 1903, five more lots in Kewalo, on Lanaiwai, Queen, and Cooke streets, were condemned and order to be filled (Hawaii Board of Health 1903:6).

A main concern in this area was the Kaka‘ako Ditch, which originated from the large fishponds in the *mauka* portion of the Ward Estate and extended to the sea (see Figure 6). A Hawai‘i legislature report of 1901 asked for an appropriation to build a new drainage ditch through the Kewalo district to address problems with older ditches:

> The district makai of King St. and the Catholic Cemetery, Ewa of Mrs. Ward’s (the Old Plantation) . . . consists of six large abandoned fish ponds and a large number of smaller ones, all in filthy condition, fed by springs and flowing into Peck’s ditches. . . . The rear portion of Mrs. Ward’s property down to Waimanu St. used to be fish ponds all connecting to the sea by a ditch which is fed by an artesian well. These ponds, with the exception of three, are abandoned.
>
> When Desky opened Kewalo for settlement he dug a ditch from the pond on Peck’s place along Waimanu St. to Mrs. Ward’s ditch, and drained all the above described property. A law suit ensued, as the foul water drove away the fish, and the connecting ditch was torn out . . . and a dyke wall was build between Mr. Ward’s and Peck’s.
>
> The result was that as the Kakaako ditch, at the point of juncture with Peck’s ditch, was too high, the water in Peck’s ditch rose and backed up . . . and as it must necessarily go somewhere, it overflowed its banks and at present Ward avenue from end to end is a big pond with no footing for pedestrians, and a carriage driven through the other day sank to the body of the same in water and mud. (Hawaii First Legislative Assembly 1901:186)

Although public health and safety were prominently cited, according to Nakamura (1979), the main desire (and third justification) to fill in Honolulu, Kewalo, and then Waikīkī lands was to provide more room for residential subdivisions, industrial areas, and finally tourist resorts. In the

early part of the 20th century, Kaka‘ako was becoming a prime spot for large industrial complexes, such as iron works, lumber yards, and draying companies, which needed large spaces for their stables, feed lots, and wagon sheds. In 1900 (Thrum 1901:172), the Honolulu Iron Works, which produced most of the large equipment for the Hawaiian plantation sugar mills, moved from their old location at Queen and Merchant Street near downtown Honolulu to the shore at Kaka‘ako, on land that had been filled from dredged material during the deepening of Honolulu Harbor. Other businesses soon followed. Thrum (1902:168) noted:

> The Union Feed Co. is another concern whose business has outgrown the limits of its old location, corner of Queen and Edinburgh streets. Like the Iron Works Co. they have secured spacious premises at Kakaako, erecting buildings specially adapted to the needs of their extensive business at the corner of Ala Moana (Ocean Road) and South Street.

Private enterprises were not the only new occupants of Kaka‘ako. A sewer pumping station, an immigrant station, and a garbage incinerator were also built on “reclaimed land.” Thrum (1907:148-149) noted:

> The dredging of Honolulu harbor and its channel is completed as far as planed for the present . . . the material there from being used to fill in a large area of Kakaako and the flats in the vicinity of the sewer pumping station and garbage crematory.

For the incinerator, Thrum noted:

> The new station is built on piles on reclaimed land that is being filled in from the coral dredgings that is going on, and is gradually taking on a tropical appearance. . . . Adjoining its premises on the mauka side is the new building designed for the Planters’s Association for their labor bureau.

The new immigration station had seven large rooms for dormitories, surrounded by a breezy, open, *lanai*, where immigrant workers would stay while waiting for their clearance to go to their new work places on the sugar plantations. Adjacent to the dormitory was a hospital, which was used to check the new immigrants for any “loathsome or dangerous contagious disease” (Hawaii Governor 1905:77). The hospital was also used during epidemics to isolate contagious patients, suffering from such diseases as smallpox, cholera, or plague.

In 1900, a pond surrounded by a racing bicycle track, called the Cyclomere (built in 1897), in the Kewalo area was filled. This was located on the *makai* side of Kapi‘olani Avenue between Cooke Street and Ward Avenue. In 1904, the area around South Street from King to Queen Streets was filled in. The Hawaii Department of Public Works (1904) reported “considerable filling [was] required” for the extension of Queen Street, from South Street to Ward Avenue, which would “greatly relieve the district of Kewalo in the wet season.”

4.4.2 Kewalo Reclamation Project

Although the Board of Health could condemn a property and the Department of Public Works could then fill in the land, the process was rather arbitrary and piecemeal. In 1910, after an

epidemic of bubonic plague, the Board of Health condemned a large section of Kewalo, consisting of 140 land parcels, (including areas once known as Kukuluae‘o and Ka‘ākauukui), which had numerous ponds (Hawaii Department of Public Works 1914:196).

In 1914, the entire:

> . . . locality bounded by King street, Ward avenue, Ala Moana and South street, comprising a total area of about two hundred acres, had been found by the board of health of the Territory to be deleterious to the public health in consequence of being low and below ‘the established grades of the street nearest thereto’ and at times covered or partly covered by water and improperly drained and incapable by reasonable expenditure of effectual drainage, and that said lands were in an insanitary and dangerous condition. ([Hawaii Reports 1915:329)

The superintendent then sent a letter to all of the property owners, informing them that they must fill in the lands to the grade of the street level within sixty days. Only a few of the land owners complied, and filled their land with a variety of materials. Most of the land owners did not comply with this notice, and in 1912 the bid to fill in the land was given to Lord-Young Engineering Co. to fill in the land with “sand, coral and material dredged from the harbor or reef and the depositing of the same upon the land by the hydraulic method” (Hawaii Reports 1915:331). The recalcitrant land owners sued to stop the work, and in the suit, the method of hydraulic filling is described:

> By this [hydraulic] method the material dredged is carried in suspension or by the influence of water which is forced through large pipes and laid upon the lands and intervening streets, and afterwards is distributed and leveled, the water having drained off through ditches provided for the purpose. The work is done in large sections around which bulkheads have been constructed. A section can be filled in about thirty days, the dredger working about fifteen hours per day. And in about two months after a section has been filled the ground will have dried out so as to be fit for use as before. . . . The character of the material varies from very fine sand to coarse bits of coral . . .
>
> It appears in evidence that though the method employed the finest of the material which is carried upon the land settles when the water which transports it becomes quiet and as the water runs off a sludge or mud remains which forms a strata more or less impervious to water. This strata, however, is covered by the coarser and more porous material. . . . it appears that by mixing in to a depth of a few inches ordinary soil small plants will grow without difficulty. . . . The character of the locality must be considered. It is not adapted to agriculture, but is suited more particularly to such business purposes as it now partly used for, such as stables, laundries, warehouses, mills, etc., and for cottages with small yards for the accommodation of laborers engaged in connection therewith. Upon the whole, we are of the opinion that the material proposed to be used in the fill-in of the lands

> of the complainants is not of a character as should be held to be improper for any of the reasons urged. (Hawaii Reports 1914:351)

The first land to be filled in was the portion of the Ward Estate Kukuluae‘o property west of Ward Avenue, completely filled in by June of 1913. In July “25,000 cubic yards of sand and ground-up coral were deposited on the Bishop Estate in the vicinity of Ala Moana and Keawe street, the reason for shifting operations to this part of the district being that the Hawaiian Sugar Planter’s Association had erected a reinforced concrete building there and wished to have the lot brought to grade” (Hawaii Department of Public Works 1914:198). By August, the rest of the Ward Kukuluaeo‘ lands west of Ward Avenue had been completely filled, and by February 1914, all of the land from South Street to Ward Street, and from Ala Moana to Queen Street had been filled.

The expense of the suit did manage to shut down operations planned for the area from Ward Street to Waikīkī (Thrum 1916:159-160). This land was mainly owned by the Bishop Estate, who leased the land to small farmers growing taro and rice and raising ducks in the ponds. In 1916, the Bishop Estate announced that as soon as their present tenant leases expired, they planned to fill the lands and divide them into residence and business lots (Larrison 1917:148-149). In 1919, a portion of the coastal section of the Bishop Estate lands was secured by the government in order to expand the Kewalo Basin (Thrum 1920:148).

4.4.3 Kewalo Basin Dredging

In 1919, the Hawai‘i Government appropriated $130,000 to improve the small harbor of Kewalo for the aim of “harbor extension in that it will be made to serve the fishing and other small craft, to the relief of Honolulu harbor proper” (Thrum 1920:147). As the area chosen for the harbor area was adjacent to several lumber yards, the basin was initially made to provide docking for lumber schooners, but by the time the wharf was completed in 1926, this import business had faded, so the harbor was used mainly by commercial fishermen. The dredged material from the basin was used to fill a portion of the Bishop Estate on the western edge of Waikīkī and some of the Ward Estate in the coastal area east of Ward Avenue (Department of Interior 1920:52). In 1941, the basin was dredged and expanded to it’s current 55 acres. In 1955, dredged material was placed along the *makai* side to form an 8-acre land section protected by a revetment.

4.4.4 Waikīkī Reclamation Project

It was during the 1920s that the southeast O‘ahu would be transformed when the construction of the Ala Wai Drainage Canal - begun in 1921 and completed eight years later - resulted in the draining and filling in of the remaining ponds and irrigated fields of Honolulu and Waikīkī. The canal was one element of a plan to urbanize Waikīkī and the surrounding districts, first conceived in 1906. Dredging for the Ala Wai Canal began in 1921 and was completed seven years later. The final result was a “canal three miles long, with an average depth of twenty-five feet and a breadth of two hundred fifty feet” (*Honolulu Advertiser*, 17 October 1928:2:16).

Several claims were made against the dredging company, including compensation for destroyed crops and livestock by farmers. For instance, a Chinese tenant farmer named Chang

Fow, leasing lands in Waikīkī from the Bishop Trust Company wrote a letter of complaint indicating that the salt water that leached into his lands as a result of the dredging of the canal had devastated his fishponds and stocks of ducks and chickens (letter from Chang Fow to the Bishop Trust Company, 23 May 1922, cited in Nakamura 1979:100-101). His claims, along with those of other residents of the area, give an impression of the continuing agricultural subsistence base in Waikīkī that lasted into the 1920s, and rapidly became a thing of the past.

Information about the actual dredging and fill process, and the materials dredged-up and used for fill, is minimal. Statements and pictures regarding the event show that dredging was done both off-shore, on the ocean bed, and in the area slated for the canal. Information regarding the filling process of personal properties—with the excess dredge that became the property of the Hawaiian Dredging Company—is unclear. Numerous phases seem to have taken place.

Nakamura (1979:85) writes that the government of the Territory of Hawai‘i solicited bids, in 1920, for the dredge and fill project planned for the environs of Waikīkī. The plan was to create hundreds of acres of urban land—at the expense of wetland agriculture and aquaculture in the area. The advertisement, soliciting bids for the project put forward by Lyman H. Bigelow, masked the significance of the project by stating that “for Dredging a Drainage Canal and Filling and Reclaiming Certain Unsanitary Lands at Waikiki” (Nakamura 1979:85). He further writes that State laws were passed requiring property owners to pay for the filling in of their lands, which apparently was going to be done whether they wanted it or not. A lien would be fixed against their property and if all payment was not made on time, land would be foreclosed on. Nakamura points out that the cost was so high for some of the property owners that the bank lien could extend into a fifteen-year mortgage (Nakamura 1979:89).

Once land that the Territory of Hawai‘i government wanted filled in (for state buildings) was complete, any further dredged materials became the property of the dredging company—the Hawaiian Dredging Company—and they in turn could sell the materials to the property owners, who in turn were forced to buy the product. Walter F Dillingham, of the Hawaiian Dredging Company died in 1963. *Time* magazine, in their article about him and his involvement in the project stated that “. . . Walter Dillingham used the muck dragged up from the sea to fill in low, marshy areas around Honolulu, over the years created 5,000 acres of solid ground that now holds a full third of the city’s population” (cited in Nakamura 1979:112).

The land surface of modern Honolulu and Waikīkī is situated on the result of this decade long dredging and fill project of which the creation of the Ala Wai Canal was included. In Nakamura’s (1979:113) *The Story of Waikīkī and the Reclamation Project*, he writes that this land “reclamation” program changed the ecology of Waikīkī from a once viable and important agriculture and aquaculture center . . . destroyed by profit-seeking capitalist entrepreneurs . . . under the subterfuge of “drainage” and “sanitation.” Many of the original property owners lost their land or had serious damage to their property as a result of the reclamation activities and/or the costly expense for the mandatory filling in of their properties.

4.5 20th Century Urban Development

The 1884 Bishop map (see Figure 6) shows the nascent traces of the future development in the grid of roads stretching inland of the Mauka Area District in the late 19th century. Kaka‘ako

was considered outside the Honolulu town boundary and was used in the mid to late 19th century as a place for cemeteries, burial grounds, and for the quarantine of contagious patients. Then in the beginning of the twentieth century, the area was used as a place for sewage treatment and garbage burning, finally becoming an area for cheap housing, and commercial industries (Griffin et al. 1987:13). Other maps, photographs, and documents generated from the last decades of the nineteenth century up to the present reveal further characteristics of the original character of the Kaka‘ako lands and the disappearance of that landscape.

During the first half of the 20th century both rice fields and marshlands would be eliminated as Kaka‘ako lands were filled to accommodate the expanding urbanization of Honolulu. An 1897 map surveyed by M.D. Monsarrat (see Figure 7) shows a corridor of streets extending diagonally from Honolulu Town, including Queen Street that was planned to connect to the beach road to Waikīkī. The Queen Street alignment appears to follow the route of the traditional trail from Kou (Honolulu) to Waikīkī described by John Papa ‘Ī‘ī. As noted above, this trail likely ran on a sand berm raised above the surrounding marshlands and coral flats. The location of the northern boundary of the Mauka Area District immediately adjacent to the trail/Queen Street corridor suggests that at least the *makai* portion likely comprised a sandy dryland environment in the traditional Hawaiian landscape.

The 1919 War Department map (Figure 25) shows residences clustered around Queen Street and Ward Avenue. This map shows the location of the Animal Quarantine Station at the east end of the Ward property. There are still many ponds east of the Mauka Area District, especially in the area that will later be developed into the McKinley High School, and the area east along the coast, which will be developed into Ala Moana Shopping Center and Park. Poor people, mainly native Hawaiians, inhabited the area. In the 1920s, on the east side of Kewalo Basin they congregated at near a camp named “Blue Pond,” named after a large and deep pond near the shore. On the west side of the basin, in the Ka‘ākaukukui area (shortened to ‘Ākaukukui), they lived in shacks and sturdy houses in an area called “Squattersville,” named because they illegally lived without authorization on government land. This camp was generally around Olomehani Street near the shore, protected from the waves by a long sea wall. There were around 700 Hawaiians and part-Hawaiians living in these two camps in the mid-1920s, but by 1926 they were all gone. The government evicted the families and razed the houses (Clark 1977:64).

Clark further reports on the developments in the area after the demise of Squattersville:

> During the 1930’s and 1940’s, the Ka‘ākaukukui area continued to be heavily utilized as a fishing and swimming area, especially by children from the neighboring community of Kaka‘ako. The children surfed on redwood planks in the break they called “Stonewall.” Many varieties of fish were abundant. Younger divers were warned by the old-time residents to stay away from the large shark hole on the Waikīkī side of Kewalo Channel. Many people came to this area to pick limu [seaweed] and wana [sea urchin], and also to catch squid on the shallow reef. (Clark 1977: 64)

A 1927 U.S.G.S. map (Figure 26) shows the first buildings of the new McKinley High School campus and also illustrates that the eastern portion of the Mauka Area District is still undeveloped, with dotted lines showing unimproved or proposed streets. However, the land was

inhabited more than is evident from this map. The Ward family leased to the Japanese lands for camps, schools, playground, temples and shrines on their lands. Kaka‘ako was one of the first residential areas for working class families, housing people working at the laundries, the harbor, the Honolulu Iron Works, the Honolulu Brewery, and truck drivers, seamen, and fishermen. In 1940, Kaka‘ako population over 5,000 residents. Hawaiians, Portuguese, Chinese, and Japanese settled in camps based on their ethnic origins, but they came together for social and community functions.

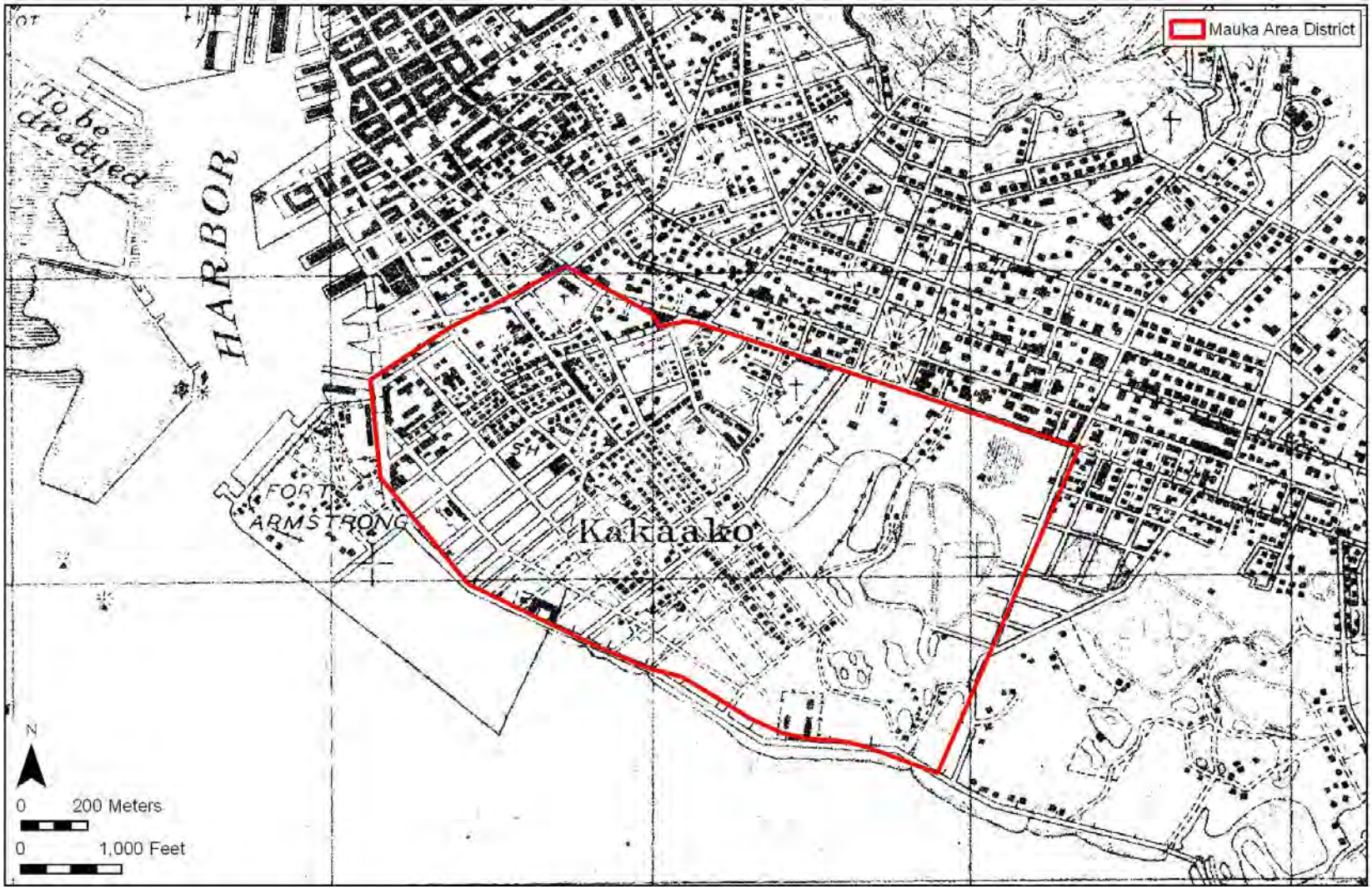


Figure 25. 1919 War Dept. Map; note location of Fort Armstrong at southwest corner of Mauka Area District; the site that will later be McKinley High School is still covered with ponds and march in the northeast corner of the Mauka Area District

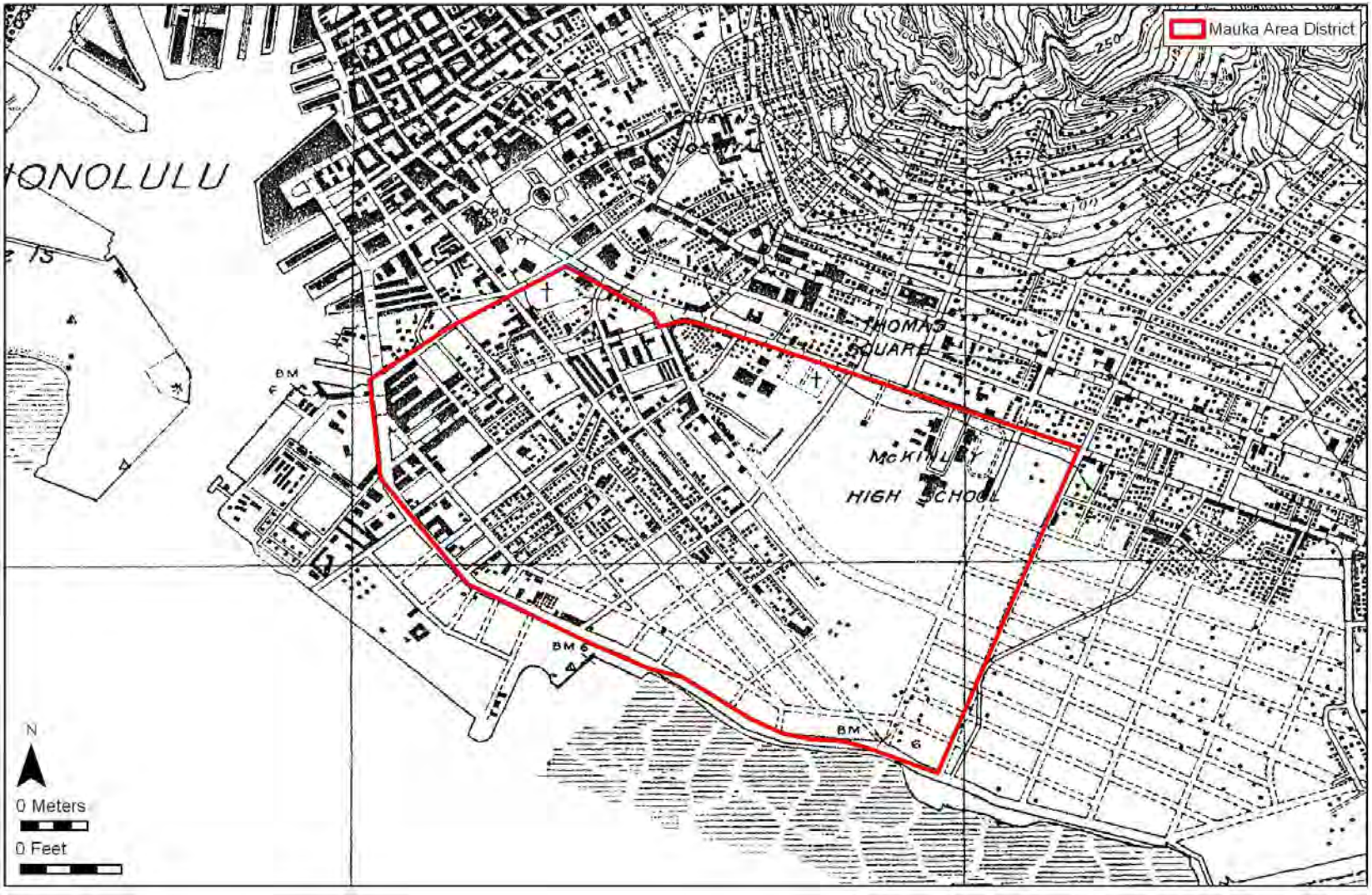


Figure 26. 1927 War Department map; note construction of McKinley High School in former pond area

On a 1943 War Department map (Figure 27), this eastern section is an area of open lumber yards and large warehouses. After World War II, the Kaka‘ako became increasingly industrialized, and residents moved out to the newer subdivisions away from the Honolulu central area. The 1943 map is the first to show the newly developed Kewalo Basin. The Kewalo Channel had been dredged in 1924 and the McFarlane Tuna Company (now Hawaiian Tuna Packers) built a shipyard there in 1929 for their fishermen’s “sampan fleet.” A new tuna cannery was built at the basin in 1933 and operated successfully. However, the entire cannery was taken over in 1941 by the military after the attack on Pearl Harbor. The cannery was converted to military use and used to make airplane gas tanks. Land in Kaka‘ako taken by the military was not returned until 1946.

The open areas of Kaka‘ako/Kewalo are in the process of being filled with material dredged from the Ala Wai Canal, Ala Moana Beach Park, and Kewalo Basin, and with material from the city incinerator at the Kewalo coastline. Historic photographs document and confirm the Mauka Area District as a dryland environment outside the filled Kaka‘ako lands as late as the 1930s. Ponds and associated buildings also continue to be present in the vicinity of the Mauka Area District. By the mid-20th century, however, Kaka‘ako was completely filled. A circa 1950 aerial photograph (Figure 28) of Kaka‘ako shows open lumber yards and warehouses, constructed on crushed coral and soil surfaces or on asphalt paving.

In summary, the study area was apparently outside the two most intensely populated and cultivated areas - Waikīkī and Honolulu (or Kou) - along this portion of O‘ahu’s southern shore during pre-Contact times. It was nonetheless well utilized by the Hawaiians for activities appropriate to the specific environment, salt making and farming of fishponds, along with some wetland agriculture. The study area was also among the last areas of urban Honolulu to be built on and developed.

Figure 27. 1943 War Department map, showing increased urban development in the Mauka Area District

Figure 28. 1950 Aerial photograph of the Mauka Area District, showing numerous warehouses

4.6 Prior Oral History Research in the Mauka Area District

4.6.1 University of Hawai‘i Ethnic Studies Department Oral History Project: *Remembering Kaka‘ako 1910-1950*

In 1978, The University of Hawai‘i Ethnic Studies Department conducted an Oral History Project of residents who lived the Kaka‘ako area from 1910-1950. The Oral History Project was done in response to the rapid changes developing in the area. It reflects Kaka‘ako’s rezoning from a residential area to an urban industrial area. Twenty-nine individuals were interviewed about their lives in Kaka‘ako in in-depth interviews. Participants in the study were:

> Henry Alves, Wallace Amioka, Lance Carreira, Charlie Correa, Edward Enos, Gloria Felix, Elmber Jenkins, Sam Kapu, Usaburo Katamoto, “Little” Joe Kekauoha, Jr., Yonoichi Kitagawa, Albert Like, Genevieve Magoon, Virginia Mansinon, Keisuke Masuda, Mary Naito, Maurice Naito, Hisao Nakano, Kenji Nobori, John Nunes, Jr., Kichisaku Takahashi, Esta Pung Tennis and Francis Zane.

Cultural Surveys Hawai‘i referenced the Oral History Project in preparation for the community consultation (UH 1978). CSH attempted to contact participants of the 1978 study, where possible. One of the participants, Henry Alves, sent a statement to CSH about the development in Kaka‘ako (see Section 7.3).

4.6.2 Consultation for the Kamehameha Schools Ethno-Historical Inventory Study of Kaka‘ako Ahupua‘a

Garcia and Associates (2008) conducted an ethno-historical inventory Study for Kaka‘ako in the Honolulu Ahupua‘a for Kamehameha Schools in May 2008. The following is the project description:

> The ethno-historical study included the general vicinity of Kaka‘ako, focusing on 47 parcels owned by Kamehameha Schools, encompassing 51.3 acres. The oral history interviews and archival research results highlight the dramatic transformation of Kaka‘ako from a modest fishing village to the urban cityscape that we know today. It includes details of traditional and historic land use, historic maps and photographs, Hawaiian language newspaper translations, and oral history interviews from consultants that lived and worked in the area in the 1920s and 1960s. Aside from surfing, there are currently no known traditional Hawaiian cultural practices carried out at Kaka‘ako. Informants in this and previous studies produced very little information concerning traditional Hawaiian land-use or lore. It is likely that much of this information passed out of the community in the mid-1920s with the breakup of Squattersville, which had a significant Hawaiian population. (McElroy et al. 2008).

Following are excerpts from the oral history interview section, pertinent to this CIA of Kaka‘ako:

4.6.2.1 Mikahala Turner and Lucia Whitmarsh

Mrs. Mikahala Turner was born in 1919. Her sister, Mrs. Lucia Whitmarsh was born in 1917. They spent considerable time in Kaka‘ako in the 1920’s when their mother was a teacher at Pohukaina Elementary School and their father was employed at The Honolulu Iron Works.

The following are excerpts from Mikahala Turner:

> [The plants growing were] mostly *‘ākulikuli* (*Sesuvium portulacastrum*). In the Ward area where their house was, they had interesting plants but I can’t remember. They had some rice fields. Diamond Head of Ward on the Ward Estate they had rice patches and high walls. They had their own rice and taro. I remember some fields of taro. They were along Ward. It depended on where the water was coming from, like Nu‘uanu. (Garcia et al. 2008: 96)

> Lana Lane was a popular place, too. There were a lot of Japanese families. There were a lot of Portuguese families around. And the Catholic Church. We were active in our Holy Ghost days. They had a very active Portuguese community. There were a lot of Japanese families, too. The Portuguese community was very active in that area. Not so much on the Diamond Head side of Ward Avenue but between Pohukaina School and Ward Avenue. There were a lot of Japanese and Portuguese who lived in that area. They had all kinds of community activities back then. Kaka‘ako in that particular area was a very community-minded place. There were Korean and Japanese enterprises. (Garcia et al. 2008: 100)

The following are excerpts from Lucia Whitmarsh:

> They had a lot of fishing off the inside [where Kaka‘ako Park is now]. That was beyond the end of Ward. There is Ala Moana now according to the map but in those days it wasn’t Ala Moana Boulevard or anything like it. [On the Ward Estate] they had gardens and ponds. They had a little boat area. That was between King and Kapi‘olani Boulevard. Diamond Head of Ward Avenue that was where there was a lot of taro growing. They were scattered, like in the back of someone’s yard they would have a little patch. There were a couple of poi (pounded taro) factories and a rice mill. They were growing the taro and rice for these mills. (Garcia et al. 2008: 96)

> [Cemeteries were] not designated but some people had a family plot in their own yard. (Garcia et al. 2008: 97)

> Where the school was [Pohukaina] and the surrounding areas they had stores. There were some little stores along by the Aloha Theater. They mention a soy

> factory there. The Soda Works is there. It was all within walking distance. It was a very active community. (Garcia et al. 2008: 97)

> The canoes were Diamond Head of Ward where Kewalo Basin is today. My great-great-grandfather had a house there on the water. The canoes were lined up there. When we were tiny, we used to visit him down there. A lot of us had mumps but they called it *hakui* in those days. When any of us had mumps, we would be down there. Friends would come visit us and they would get mumps, too. There was plenty of room for all the kids and we would line them all up, whoever got *hakui*. Our great-great-grandfather was part German and his father had come from Germany. He was the one who took care of Kuhio's canoes. They were right there, next to his little cottage on the waterfront. He was a great fisherman. He knew all about the water in there. There was no Ala Moana Park back then. It was the old city dump. (McElroy et al. 2008: 102)

4.6.2.2 Joe and Marty Kuala

Mr. Joe Kuala was born in Honolulu in 1943. Mrs. Marty Kuala was born in Seattle, Washington in 1939. Mr. Kuala and his wife Marty lived and worked in Kaka‘ako in the 1960's. Their Interisland surfboard shop, was across the street from The Honolulu Iron Works where Restaurant Row is today.

The following are excerpts from Joe Kuala:

> My first recollection of Kaka‘ako Street is when I was about 10 or 11 years old. My mom would have me go down every Friday and meet my dad. He was working at Peerless Roofing, which was on Ala Moana Boulevard several blocks down from Kaka‘ako Street. I would be with him. Every Friday they would go to the Harbor Lights and have a couple beers. Sometimes they would stay there for three or four hours. At times he would spend all or most of his money so my mom had me go with him hoping that me being there he wouldn't. He'd quit and come home earlier. That was my first recollection of Kaka‘ako Street and the Harbor Lights. When I was 17 and 18 years old, I was back at that same street but this time it was at the surf shop. I was familiar with that street and restaurant very well. The pool hall came in while I was gone. That was even better. (McElroy et al. 2008: 98)

> The Honolulu Dump area was right down there, which was where all the trash was taken and compacted and used for fill. The landfill was down there at the *‘ewa* side right by the beach area. There was a good surf spot outside of there where we used to go. It was the only place the flies would fly around you when you would be sitting in the water. I named that place Flies and I asked a friend recently if it was still called Flies. He said they still do. The reason was because of the dump area there. It is no longer there but it was at one time. There are other breaks along there that are real important to save and keep. It shouldn't be disturbed in any way. The entrance at Kewalo Harbor was a body surfing break

> called Point Panic. That’s a really beautiful spot for body surfing and that must be cared for. Like down at Ala Moana where there was a very nice break, once it’s gone, it’ll never come back. Across the channel at the entrance to Kewalo’s is the break called Kewalo’s. That’s a surfing spot, which is very important also. McElroy et al. 2008: 101)

The following excerpt is from Marty Kuala:

> I think the 1960’s were the last era of the Kaka‘ako area having life in it. People were beginning to move out. It was an area where people with small stores and businesses could get a really cheap place to rent. It was all slated for demolition. After that it did change. Buildings were torn down. The Federal Court building and Restaurant Row went up. I believe if you could find people with memories of the 1930s, 40s and 50s, they would have different memories of a more lively place. It was a place of growing businesses and people living there. In our time, people were beginning to move away. (McElroy et al. 2008: 102)

Section 5 Archaeological Research

The Kaka‘ako Community Development District was first designated as an area comprised by Punchbowl Street to the west, Ala Moana Boulevard to the south, King Street to the north, and Pi‘ikoi Street to the east. This development area is larger than the ancient Kaka‘ako, and extends into lands once known as Ka‘ākaukukui, Kukuluāe‘o, and Kewalo. During these studies a great deal of information has been recorded on the stratigraphy of the Kaka‘ako area. The following section reports not only on the discovery of pre-Contact and historic deposits, artifacts, and burials from various project areas, but also reports on the stratigraphy, as noted during previous Cultural Surveys Hawai‘i projects. This extensive discussion of stratigraphy is presented in order to aid the development plans for the area, especially indicating the portions of the Mauka Area District with a high potential for cultural and environmental deposits that may be still intact beneath modern fill layers and disturbed strata.

5.1 Geological Study of Kaka‘ako and Kewalo

For his doctoral thesis, Charles C. Ferrall (1976) synthesized all data from subsurface boring logs excavated in the Honolulu and Waikīkī areas to that time. The data was compiled from 800 borings made by the Hawai‘i Public Works, Board of Water Supply and other state/city engineering departments.

Most of the coastal plain of Honolulu formed during the Pleistocene, during several sea level fluctuations related to the advance and retreat of glaciers. These fluctuations produced reef deposits at various levels, some above the present sea level. The Kaka‘ako area coral shelf was mainly formed during the Waimanalo High Sea Stand, about 120,000 years ago, which reached a maximum of 25 ft (feet) above the present sea level. The Waimanalo Sea Stand was preceded by the Waipio Low and was followed by the Mamala Low. During the Mamala Low when the sea receded as much as 300 ft below present levels, deep alluvial channels dissected the former reefs, including one which Ferrall calls the HIC Channel. This channel was found in borings made within the Honolulu International Center (now called the Blaisdell Center), thus the name of the channel.

For bores excavated in the Kaka‘ako area, the coral shelf is found at three different levels, at +5 ft above sea level and at -15 and -30 ft below sea level. The +5, -15, and -30 coral ledges were all formed during the Waimanalo High Sea Stand (Figure 29). Ferrall notes that extensive coral “growth occurred during the Waimanalo High Sea Stand, probably as a result of the warmer climate of the interglacial stage” (Ferrall 1976:116). As the sea receded from a previous high of +25, it paused at +5 ft, long enough for the growth of corals that favor a high-energy reef flat environment. This reef was developed in about 20 ft of water. The -15 ft ledge probably developed after this during a regression of the sea from the Waimanalo High Stand to the Mamala Low Stand. The -15 coral shelf also developed within a high-energy zone, but was formed in a more shallow water environment, in only a few feet of water. The -30 coral shelf was composed of coral that grows in low-energy lagoonal environments. It may represent the “seaward (forereef) reflection” of one of the +5 or -15 coral ledges, rather than a separate time period (Ferrall 1976:125).

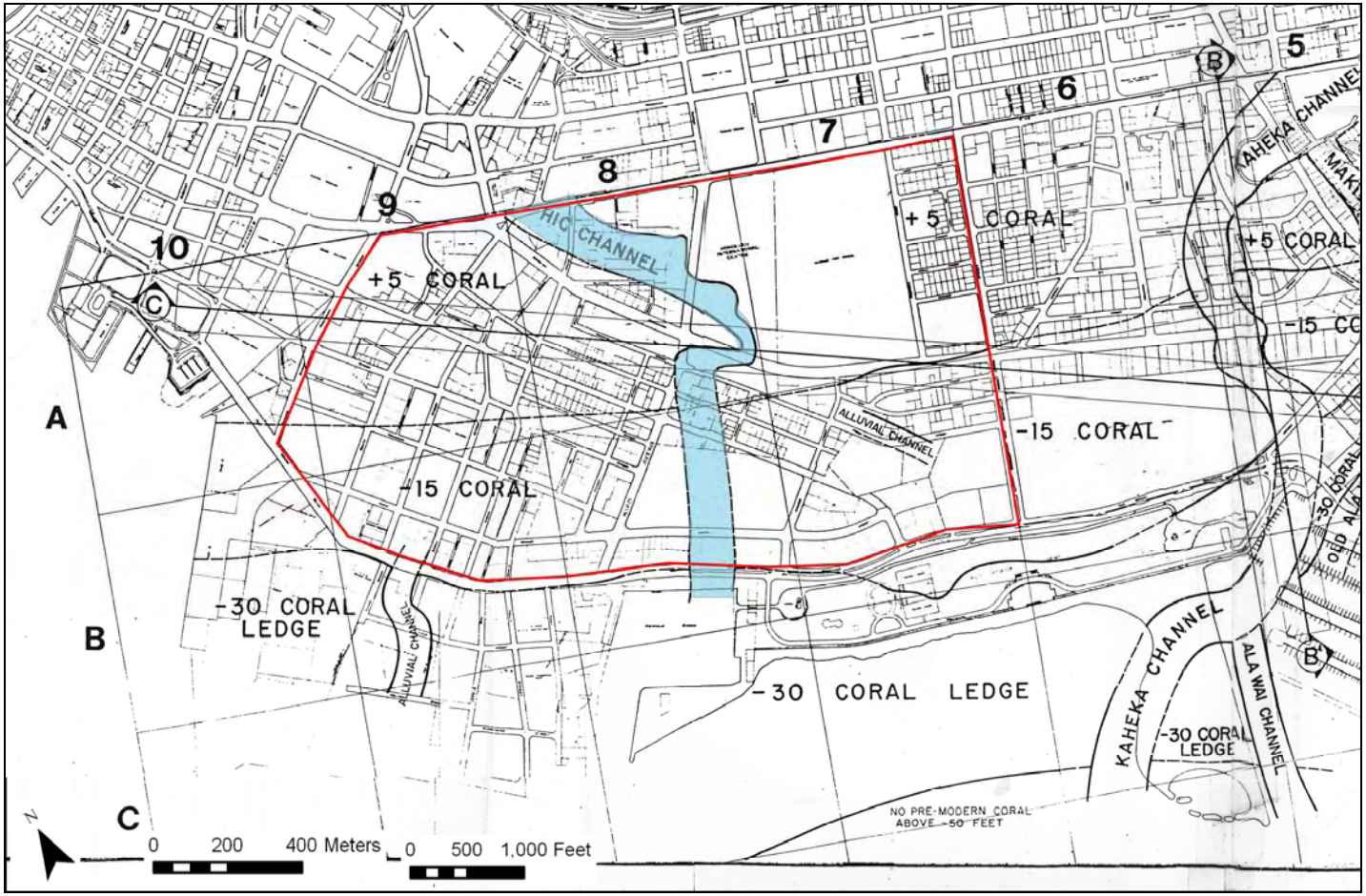


Figure 29. Coral shelf depth (+/- feet above or below sea level) and possible location of HIC channel through the Mauka Area District area (modified figure of outsize map in Ferrall 1976)

Ferrall (1976:135) remarks on the area with the -5, -15, and -30 coral ledges:

> . . . lagoonal deposits are widespread . . . overlying the -30 and -15 ledges, the alluvial channels, and the lower, seaward edge of the +5 ledge. In general, any area that was not above existing sea level prior to the [Mamala] transgression to the modern sea level became covered with lagoonal deposits. . . . After the sea more or less stabilized at its present level, the lagoon filled up and became a swamp. Swamp deposits, with peat layers are found from just below existing sea level, on top of the lagoonal deposits, to just above sea level. Even into historical time, much of the area seaward of the +5 ledge was dominated by swamp conditions.

In discussing the various areas of Kaka‘ako, Ferrall divided his area into Quads. The inland portion of the Mauka Area District above Queen Street falls within Quads A-7, A-8, and A-9; the *makai* portion is within Quads B-7, B-8, and B-9. According to Ferrall’s work, Mauka Area District is within the -15 coral ledge zone and the +5 coral ledge area, and *mauka* of the -30 coral ledge.

On the west side of Quad A-7, 900 ft south of King Street, nineteen borings were placed during the excavation of the Blaisdell Center. The coral reef ledge is at 5 ft (+5) above sea level at 4 to 8 ft below ground surface. Over the coral ledge is 2 ft or more of lagoonal deposits, covered with 2 ft or more of alluvium (Ferrall 1976:50). In Quad A-8, 75 borings were made for the Blaisdell Center construction. The coral shelf is 5 ft above sea level, 4-11 ft below ground surface. It is overlain by 4-5 ft of cemented coralline debris, 2 ft of swamp deposits, and 2-3 ft of fill. In a certain section, the layer of coralline debris has been eroded out by a former drainage channel, the HIC channel, and volcanic cinder sand has been deposited within this channel. Ferrall illustrates the location of this channel, based on boring logs, in Quads A-7 and A-8. He also illustrates the probable path of the channel in the seaward section (Quad B-8). However, no boring logs are available for this area, which is within the current Mauka Area District. Ferrall (1976:53) cautions “given the sinuous course of this channel in the area where control is available, it could be expected to meander considerably from the direct route to the sea which is shown.” In an area bound by Waimanu, Kamani, and Kawaiaha‘o Street, the coral ledge is at 5 ft above sea level, at 6 ft below ground surface, overlain with 2 ft of lagoonal deposits with lenses of cinder sand, and then with up to 4 ft of fill.

In Quads B-7 and B-8, the coral ledge is 15 ft (-15) below sea level. None of the borings in Quad B-7 are near the Mauka Area District. At the southeast corner of Quad B-8, there is 3 ft of fill over lagoonal deposits up to 49 ft thick over the coral ledge. Coralline debris is found in the lagoonal deposits, indicated that the -15 ft ledge may be uncemented in this area. The only other boring in this quad was at the intersection of Ward Avenue and Auahi Street. The coral ledge was 15-22 ft below the surface overlain with lagoonal deposits and 3 ft of fill. In Quad B-9, at the south side of Auahi Street, five borings were placed. The fill extends from the ground surface (5 ft above sea level) to sea level, underlain with lagoon deposits that extend down to the coral ledge at 17 to 21 ft below sea level.

5.2 Kaka‘ako Community Development District

In 1987, a report entitled, *Kaka‘ako: Prediction of Sub-surface Archaeological Resources, Detailing Archival Research and Archaeological Assessment of the Kaka‘ako Community Development District* (Griffin et al. 1987) provided background information and summarized the historical import of the area:

> Kaka‘ako - the Kaka‘ako Community Development District - is not the center of life in greater Honolulu that is, or was, either Waikiki or ‘downtown’ ewa of Punchbowl. It is, however, relatively rich in the remains of nineteenth century Honolulu, of prehistoric Hawaiian life, and of the ethnic influx from the late 1800's until 1940.
>
> Without doubt the single most striking archaeological deposit, and the one to which we assign the highest priority, is the 1853 Honuakaha Cemetery fronted by South Street and bisected by Quinn Lane. More than 1000 human burials are reportedly therein. . .
>
> Burials will be found throughout Kaka‘ako. Some will be in sand remnants, others intruding into the pumice deposited from ancient Punchbowl eruptions. Most will be prehistoric or early historic. We expect that, as in the case of the Ka‘akaukukui Cemetery, deaths from pre-1853 epidemics resulted in many burials throughout Kaka‘ako. The chance of high status burials, from residences in adjacent elite locations, is high.” (Griffin et al. 1987: 73)

Under HCDA’s improvement district (ID) program, 11 IDs have been established. These IDs consist mainly of adjacent road alignments, as the early work was conducted on sewers, electricity, and roads. The names of early archaeological project reports also followed this nomenclature, however, in recent years, development projects have taken place or are planned in many separate parcels. Many of the development parcels overlap with others or with road alignments. For ease of discussion, the projects will be discussed by general location, from the northwestern corner of the Kaka‘ako Mauka area at Punchbowl and King Street, to the southeast corner of the Kaka‘ako Mauka area at Ala Moana and Pi‘ikoi Streets.

The locations of archaeological projects that included some subsurface field work are shown in Figure 30. Table 2 lists all archaeological projects concerning the Kaka‘ako Mauka District, including background literature reviews and archaeological assessments in which no archaeological subsurface field work was involved.

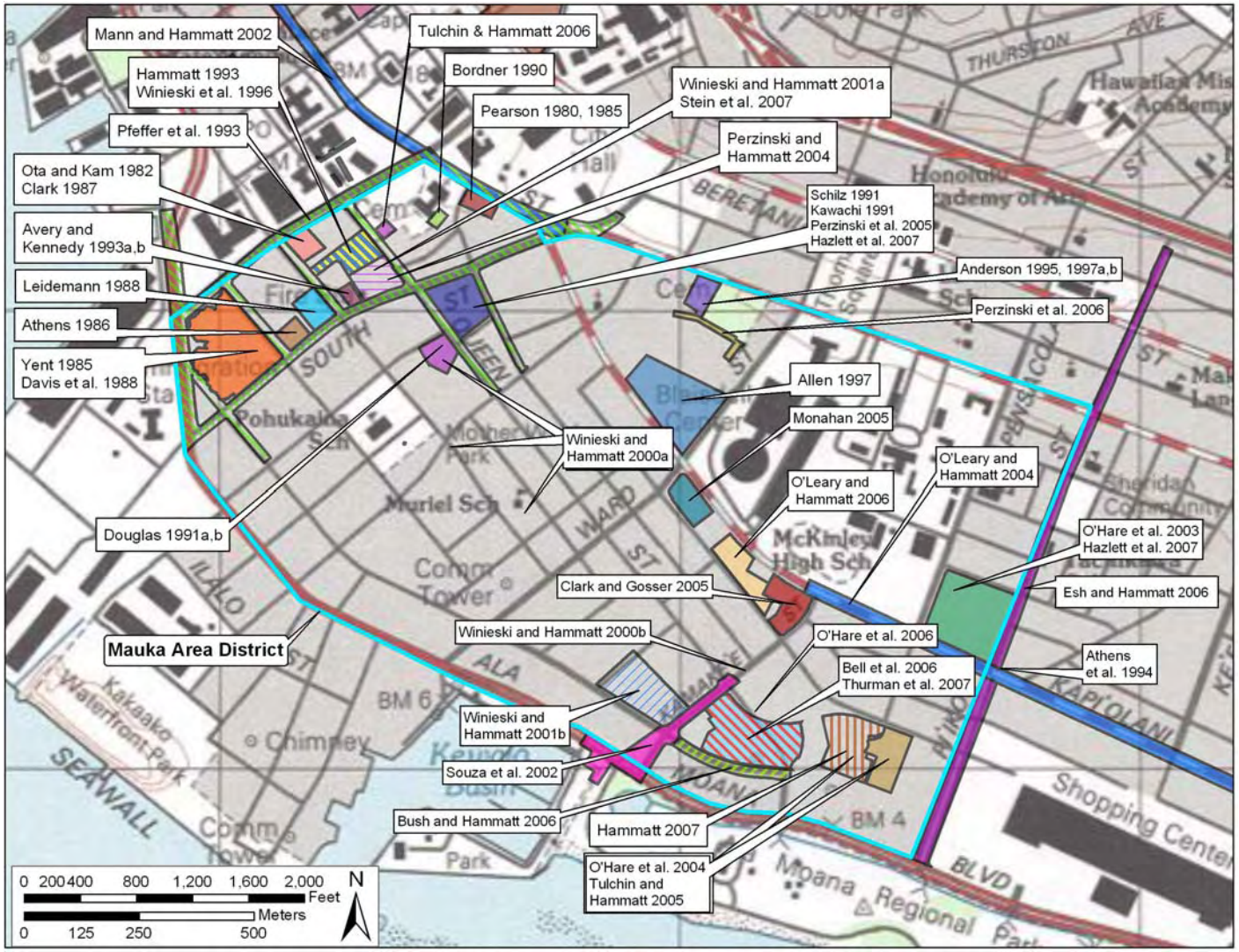


Figure 30. Previous archaeological work within the Kaka‘ako Mauka Area District

Table 2. Previous Archaeological Work in the Kaka‘ako Mauka Area District

Author	SIHP 50-80-14	Report Description and Findings
Allen 1997		Monitoring of geotechnical coring in Symphony Park; no site designations made.
Anderson 1995, 1997a, 1997b	-5373	Three reports on One Archer Lane project area (inventory survey, monitoring and burial disinterment); minimum of 30 historic human burials (-5373) recorded along western side of the Roman Catholic Cemetery on King St.
Athens 1986	-3984	Monitoring of Judiciary Parking lot, historic deposits (-3984) with artifacts dating late 19th-early 20th centuries.
Athens et al. 1994	-4847	Wetland environment on Kapi‘olani and Pi‘ikoi Sts.; 1 human burial (-4847) recorded.
Avery & Kennedy 1993a	-3712	Monitoring at 1853-1854 Honuakaha Smallpox Cemetery; 3 historic burials recorded.
Avery & Kennedy 1993b	-3712	Monitoring of South St. Building Complex, 6 burials associated with 1853-1854 Honuakaha Smallpox Cemetery were found.
Bell et al. 2006	-6854; -6855; -6856	Subsurface inventory survey for the Victoria Ward Village Shops Project; Site -6854 is a historic deposit with 5 burials; site -6855 is an active area with 6 burials; site -6856 is an historic fishpond remnant.
Bordner 1990	-9991	Test trenches were excavated in the Kawaiaha‘o Church grounds (-9991); Some historic artifacts were recovered.
Bush & Hammatt 2006		Monitoring for Hokua Tower Project; no cultural remains found.
Chiogioji & Hammatt 1992		Archaeological background research and brief surface field inspection at former lot of Kapi‘olani Community College adjacent to McKinley High School (site -9926). No findings.
Clark 1987	-2963	Monitoring at Makai Parking Garage; 7 burials (-2963) found probably dating to pre -1850.
Clark & Gosser 2005	-6636	Subsurface inventory survey of TMK 2-3-003:075, 085, 086. Previously described wetland area recorded (-6636).
Davis et al. 1988		During monitoring at the Honolulu Iron Works site, no additional human burials were found in the area surrounding Ka‘ākaukukui Cemetery (site -2918).

Author	SIHP 50-80-14	Report Description and Findings
Douglas 1991a	-4380	Coral and Queen Street area: 8 burials (-4380) recorded and 5 disinterred.
Douglas 1991b	-4380	Coral and Queen Street area: 1 burial recorded (-4380).
Esh and Hammatt 2006		Monitoring of Unit 5 B Streets; no cultural materials found.
Griffin et al. 1987	-2918	Background research and predictive models; reports on an additional 3 burials at Ka‘ākaukukui Cemetery (-2918).
Hammatt & Chiogioji 1995		Archaeological assessment of 20 parcels and background research; No field work conducted.
Hammatt & Chiogioji 1998	-1388	Archaeological Assessment of area that includes Mother Waldron playground (-1388) and Pohukaina Elementary School. No field work.
Hammatt 1993	-3712; -9917	Subsurface Inventory Survey; found 31 burial pits from the 1853 -1854 Honuakaha Smallpox Cemetery (-3712) and 3 refuse pits associated with the Honolulu Brewing Co. (-9917)
Hammatt 2007	-6910; -6911; -6912	Monitoring at Ko‘olani Condominium; 2 isolated burials (-6910, -6912) and cluster of 16 coffin burials (-6911) found.
Hazlett et al. 2007a	-1604	Monitoring at Queen Emmalani project; 2 human skeletal elements found and recorded as part of site -1604.
Hazlett et al. 2007b	-6637	Monitoring at Moana Pacific property; historic deposit recorded (-6637).
Heidel & Hammatt 1994	-1346	Background research on the Kaka‘ako Fire Station building and lot (-1346). No field work.
Kapeliela 1996	-5455	Burial find; 1 historic human burial (-5455) found on west side of Roman Catholic Church on King St.
Kawachi 1991	-1604	Monitoring at the Queen Emmalina Tower project; 1 human skull and 1 femur (-1604) were found in the back dirt pile
Leidemann 1988	-1973	Monitoring at Federal parking lot; historic deposits (-1973) found.
Mann & Hammatt 2002	-6371	Monitoring for King St. Alignment; 1 burial (-6731) found, possibly post-Contact due to presence of historic artifact.
Miyasaki and Ogata 1993	-9917	Environmental site assessment of the American Brewery Co. building (site -9917). No field work.

Author	SIHP 50-80-14	Report Description and Findings
Monahan 2005		Assessment of three parcels in Kewalo; no cultural materials found in nine trenches.
O’Hare et al. 2003	-6636; -6637	Subsurface inventory survey of Moana Pacific property; wetland deposit (site -6636), and one historic trash pit (site -6637) reported.
O’Hare et al. 2004	-6636; -6639; -6641	Archaeological inventory survey for the Ko‘olani Condominium Project; Original wetland surface of Kewalo (-site 6636) and three historic trash pits (sites -6639, -6641) reported.
O’Hare et al. 2006	-6658; -6659; -6660	Monitoring at Kaka‘ako ID-10; cluster of 28 historic burials (-6658), 2 isolated burials (-6659), and a historic trash dump (-6660) were recorded.
O’Leary & Hammatt 2004		Monitoring for Unit 9 streets; no cultural remains found.
O’Leary & Hammatt 2006		Archaeological inventory survey for the Moana Vista project area; no cultural materials found.
Ota & Kam 1982	-2963	Makai Parking Garage; 6 partial burial sets found. Tooth evulsion indicates probable pre-Contact to pre-1850 date
Pearson 1980, 1995	-9991	Test pits were excavated near the Mission Houses (-9991); 19th and 20th century artifacts were recovered.
Perzinski & Hammatt 2004		Monitoring of geotechincal borings at the Kaka‘ako Fire Station, no cultural material was found in 12 test trenches.
Perzinski et al. 2005	-1604; -6766	Inventory survey Queen Emmalina project; 2 isolated human bones (-1604) and remnants of historic occupation (-6766) were recorded.
Perzinski et al. 2006	-5455	Subsurface inventory survey of the Kewalo HECO Dispatch Center; 2 historic coffin burials found on south side of the Roman Catholic Cemetery (site -5455) on King St.
Pfeffer et al. 1993	-3712; -4532; - 4533; -4534	Monitoring for Kaka‘ako ID-1; 31 burials from 1853-1854 Honuakaha Smallpox Cemetery (-3712) at Quinn Lane, 1 burial from Punchbowl St. (-4532), 1 burial from Halekauwila St. (-4533), and 116 burials from Kawaiaha‘o Cemetery (-4534) at Queen St. (used from 1825-1920)
Pietrusewsky et al. 1989	-3712	Osteological study of 28 burials from the Honuakaha Cemetery (-3712), recorded during Pfeffer et al. 1993.

Author	SIHP 50-80-14	Report Description and Findings
Schilz 1991	-1604	Background research and property assessment of Queen Emmalina Tower project, a block formerly used for kerosene storage and for tenements (Magoon Block); in subsequent projects, human remains were found and designated site -1604.
Souza et al. 2002	-6376; -6377, -6378	Monitoring for Kaka‘ako ID-7; 3 isolated burials -6376, -6377, and -6378) were found.
Stein et al. 2007	-1346	Monitoring during demolition and construction of new structures at the Kaka‘ako Fire Station lot (-1346). No findings.
Thurman et al. 2007	-6854	Archaeological investigation of burials at site -6854, Victoria Ward Village Shops. Many burials have been found, and monitoring is still in progress.
Tulchin & Hammatt 2005	-6636; -6641	Addendum to an archaeological inventory survey for the Ko‘olani Condominium Project; wetland (-6636) and historic deposits (-6641) recovered.
Tulchin & Hammatt 2006	-4534	Two trenches excavated in the Kawaiaha‘o Cemetery (-4534) *makai* of Queen Street; 13 burial pits with coffins were recorded, but no burials were disinterred.
Winieski & Hammatt 2000a	-4380; -5320	Monitoring at Kaka‘ako ID-3 and other parcels, 9 burials found at the Pohulani Housing area (-4380) and 11 human burials found at Mother Waldron Park (-5280). At least two were interred in the post-Contact period.
Winieski & Hammatt 2000b	-5598	Monitoring of Kaka‘ako ID-4; 2 coffin burials (site -4498) were recorded.
Winieski & Hammatt 2001a	-1346	Monitoring for geotechnical sampling at Kaka‘ako Fire Station (-1346); no cultural remains found.
Winieski & Hammatt 2001b		Monitoring at Ward Theaters, no cultural deposits or other remains were found, but intact sand deposits were present.
Winieski et al. 1996	-3712	Monitoring at the Honuakaha Housing project; 27 burials from 1853-1854 Honuakaha Smallpox Cemetery (-3712) were disinterred (11 sets previously located in Hammatt 1993).
Yent 1985	-2918	Ka‘ākaukukui Cemetery at the Honolulu Iron Works project area; 5 burials (-2918) recorded.

5.3 Punchbowl to South Street

5.3.1 King Street Rehabilitation Project

Between August 2001 and June 2002, a CSH crew (Mann and Hammatt 2002) monitored trenching for the King Street Rehabilitation Project on sections of King Street between Dillingham and South Street. During the course of archaeological monitoring, one human burial, State Inventory of Historic Places (SIHP) # 50-80-14-6371) was recovered near the intersection of South King Street and Punchbowl Street. The burial was a single adult individual between the age of 15 and 21 years. The close proximity of several existing utility lines and the incomplete nature of the skeletal remains indicated that the burial was disturbed by earlier construction activities. Several historic artifacts, including a porcelain button and a blue glass marble, were recovered in the same strata, but their association with the burial could not be determined.

5.3.2 Kawaiaha‘o Church Grounds and the Mission House

Kawaiaha‘o Church was built in 1842, adjacent to the mission station to the east, where the first foreign resident missionaries made their home. The church, the church grounds containing two cemeteries, and the mission houses have been designated SIHP # 50-80-14-9991.

Between 1986 and 1987, students from Chaminade University (Bordner 1990) excavated eight test units and trenches on the Kawaiaha‘o Church grounds. Four test pits (TP 1-4) were placed around the old adobe schoolhouse, which was originally built in 1836. Test pit 1 revealed an old road surface at 6-14 cmbs cm below surface); this roadbed probably dates to c. 1860-1900. Test Pits 3 and 4 were placed near a series of concrete footings in the ground. This is the site of a structure that was on the ground in the 1950s, possibly moved from an earlier location on the corner of King and Kawaiaha‘o Streets, at the northeast corner of the church lot. Surprisingly, no historic debris was found in this area. Test pits near several crypts revealed a sophisticated construction covered by a layer of painted plaster. Several historic artifacts were recovered in the top layer of soil. Four test units were also placed at the northeast corner of the church lot (TP 5-8), where a 1900 photograph shows a building was once located, possibly the same one that was later moved close to the schoolhouse. No evidence for the house structure or any historic debris was found in these units; however, the test units excavated were very shallow.

In 1968 to 1970 (Pearson 1980; 1995), excavations were carried out at the Hawaiian Mission property east (Diamond Head) of Kawaiaha‘o Church. Excavations were conducted adjacent to the Bingham house. No human burials were found, although the early missionary Mrs. Loomis mentions in her diary (archived at the Mission Houses Museum, Honolulu) that a Hawaiian burial was found during the excavation of the framed house cellar in 1821. Excavations were also made adjacent to a bedroom unit. No burials were found, although, by tradition, a pre-Contact burial was found during the original construction of this building in 1841 (Pearson 1995:28). Bottles found in the trenches, units, and wells date the trash to late eighteenth and early nineteenth centuries.

In 1993 (Pfeffer et al. 1993), 116 burial sets were disinterred from below the pavement of Queen Street, which is adjacent to the southern boundary of Kawaiaha‘o Cemetery. This section of the cemetery was designated SIHP # 50-80-14-4534.

In 2006, CSH (Tulchin and Hammatt 2006) excavated two 18 meter long trenches in a 0.2-acre portion of the Kawaiaha‘o Cemetery adjacent to the *makai* side of Queen Street. The intent of the subsurface investigations was to locate coffin/burial pit outlines without directly disturbing human remains in an area for a proposed parking lot. Thirteen coffin burials were noted in one trench and 11 coffin burials were noted in the second trench. The burials were left in place. The stratigraphy of the trenches (Figure 31 and Table 3) showed an upper fill layer of recent construction debris overlay a buried A horizon of sandy loam, a C horizon of volcanic cinders from the Punchbowl eruption, and a lens of gravel associated with burial pits.

Figure 31. Photograph of trench at Kawaiaha‘o Church Cemetery, showing stratigraphy and burial pit outline

Table 3. Stratigraphy for trench excavated at Kawaiaha‘o Cemetery

Strata	Depth (cmbs)	Description
I	0-20	Fill; 10 YR 4/3, dark brown; sandy loam; structureless; mixed origin; abrupt boundary; wavy topography; contains historic trash & construction debris. Imported topsoil mixed with fill; compacted cinder & cement mix.
II	20-40	A Horizon; 10 YR 4/4, dark yellowish brown; sandy loam; weak columnar structure; dry weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; very abrupt boundary; wavy topography. A Horizon developed on Punchbowl cinder.
III	40-100	C Horizon; 10 YR 2/2, very dark brown; medium coarse sand; structureless; terrestrial origin; lower boundary not observed; smooth topography. Punchbowl cinder with weathered pockets.
Gravel Lens	40-140	Fill, 10 YR 5/1, gray; gravel; structureless. Imported fill associated with burial pits.

5.3.3 American Brewery Site (Honuakaha Smallpox Cemetery)

The proposed area for the Honuakaha Affordable Housing Area is a parcel bound by Queen Street on the north, Quinn Street to the south, and the Kaka‘ako Fire Station to the west (adjacent to South Street) (TMK 2-1-031:021). This lot was once occupied by the Honolulu Brewing and Malting Co., Ltd., brewers of Primo and Royal brand beers, who constructed their brewing facilities on the lot in 1900. The facility ceased brewing beer in 1920 due to the onset of prohibition. In 1933, the brewery was reoccupied by the American Brewery Co., Ltd., also known as the Royal Brewery (SIHP # 50-80-14-9917). It ceased operations in 1960, and the main building was put on the National Register of Historic Places in 1972 (Figure 32). An environmental site assessment for the study area was prepared (Miyasaki and Ogata 1993) to provide some background information and to report on the present condition for one building at the Brewery site between South Street and Punchbowl.

Figure 32. 1969 photograph of four-story Honolulu Brewing and Malting Company (established in 1898) and adjacent Royal Brewery complex (established 1900) (photograph reprinted in Sarhangi 2007:86)

In May of 1993, Cultural Surveys Hawai‘i (Hammatt 1993) conducted an inventory survey of the Brewery site. From background research, it was known that a portion of the Honuakaha Smallpox Cemetery covered the southeastern corner of this parcel, adjacent to Quinn Lane. The Honuakaha Smallpox Cemetery was utilized for burial only in the years 1853 to 1854. Over 1,000 victims of smallpox were interred in the cemetery during the course of the epidemic. It appears that the cemetery was not utilized following the epidemic and the burials were left in place.

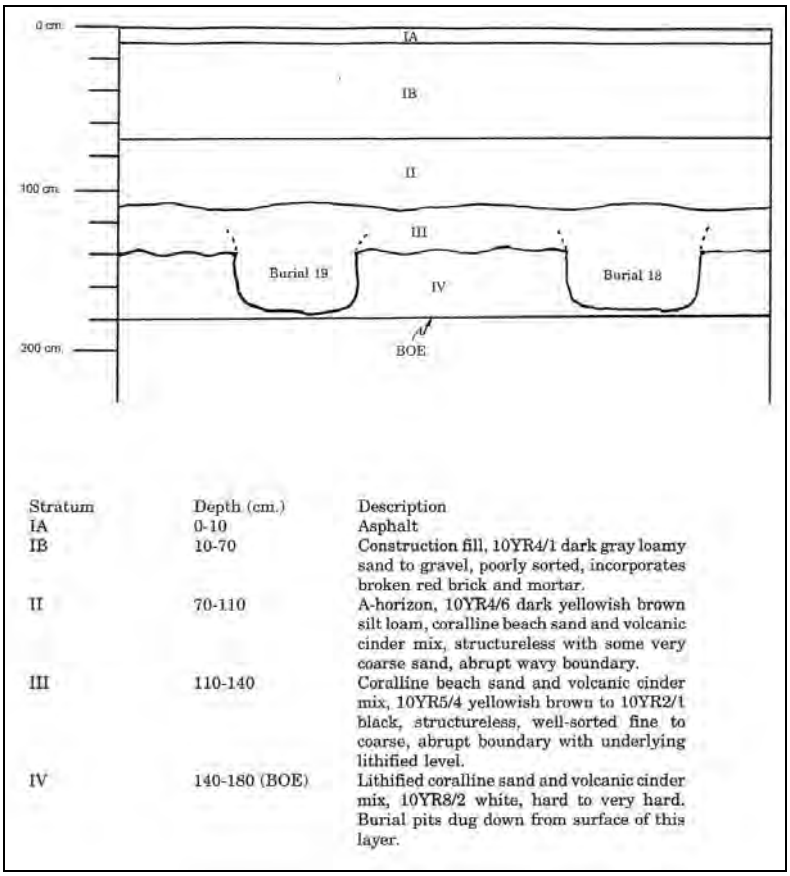
The primary goal of testing during the inventory survey was to determine an accurate boundary for the cemetery and to gain an accurate assessment of the number of burials within the

study parcel. From historical records and maps, the supposed boundary of the Honuakaha Cemetery (SIHP 50-80-14-3712) was plotted on the south portion of the American Brewery Co. lot. Twenty-four test trenches were then excavated around this plotted line to determine the actual boundary of the cemetery. Twenty-nine (29) burial pits were located with a backhoe and with hand shoveling; the burials themselves were not disturbed, but were left in place. The study estimated the presence of between 179 and 389 burials within the Brewery /Honuakaha Housing Project parcel. A secondary goal of the survey was to research subsurface traces of the brewery during the early 20th century. Three refuse pits associated with the brewery were also uncovered.

The identification of the extent of the cemetery was the primary factor in determining the boundary limits of the Honuakaha Memorial Park, where subsurface construction grading was to be avoided in order the preserve the burials intact. However, even with architectural modifications, it was impossible to place the proposed building foundations in such a way as to avoid impacting all the burials, while at the same time preserving the structural integrity of the building. Thus, it was decided to disinter 7 burials from the *mauka* limit of the cemetery. During the excavation of two burials, 2 additional burial pits were discovered, previously disturbed remains were encountered in pit fill, and one cranium was encountered in pit fill, resulting in a total of 11 burial disinterments.

Between October 1993 and September 1995, 25 sets of human remains (actually representing a minimum of 27 individuals) were recovered from construction activities associated with the Honuakaha Housing Project (Winieski et al. 1996). Of this number, eleven sets of remains had been previously located, as mentioned above. The remaining burials were inadvertent discoveries, 3 from the middle of Quinn Lane and the remaining 11 from an area along the Quinn Lane fence line. Findings were limited to the historic era in age, with burials associated with the 1853 Honuakaha smallpox cemetery (SIHP 50-80-14-3712), and archaeological materials (bottles, metal, etc.) ranging from the 1880s to after the construction of the Brewery Building at the turn of the 20th Century. The vast majority of the burials present on the property were preserved and commemorated as part of an open garden area on the property in a specially constructed crypt under the garden.

The stratigraphy of a representative of trenches from the Honuakaha Cemetery/Honolulu Brewery site is shown in Figure 33. The surface layer was composed of 10 cm. of parking lot asphalt (Stratum IA) overlying a 60 cm. thick historic-era fill layer (Stratum IB). Red brick and mortar fragments were common in the lower portion of Stratum IB, and are associated with the construction of the Brewery building in 1900. Below the fill layer, there is a 40 cm. thick A-horizon developed on mixture of cinder and coralline sand (Stratum II). This A-horizon represents the living surface of 19th century Honolulu predating the Brewery building. A 30 cm. thick lighter-colored coralline sand and cinder mix underlies the A-horizon (Stratum III). The layer is well sorted, fine grain size at the top, progressing to coarse grain size at the bottom of the layer. Stratum IV represents the lithification of the overlying coralline sand and cinder layer. Stratum IV began at 140-150 cm. below the asphalt surface. The burial pits originated at the top of Stratum III and were excavated down into this lithified layer.



Stratum	Depth (cm.)	Description
IA	0-10	Asphalt
IB	10-70	Construction fill, 10YR4/1 dark gray loamy sand to gravel, poorly sorted, incorporates broken red brick and mortar.
II	70-110	A-horizon, 10YR4/6 dark yellowish brown silt loam, coralline beach sand and volcanic cinder mix, structureless with some very coarse sand, abrupt wavy boundary.
III	110-140	Coralline beach sand and volcanic cinder mix, 10YR5/4 yellowish brown to 10YR2/1 black, structureless, well-sorted fine to coarse, abrupt boundary with underlying lithified level.
IV	140-180 (BOE)	Lithified coralline sand and volcanic cinder mix, 10YR8/2 white, hard to very hard. Burial pits dug down from surface of this layer.

Figure 33. Stratigraphic Context of Burials 18 and 19 within Trench 3B/C at Honuakaha Cemetery

5.3.4 Kaka‘ako Improvement District 1 (ID-1)

From April of 1986 through August of 1988, Cultural Surveys Hawai‘i (Pfeffer et al. 1993) conducted monitoring, data recovery, and excavation services within the Hawai‘i Community Development Authority’s Kaka‘ako Improvement District 1 (ID-1), which was bounded by Punchbowl Street (west), South Street (east), King Street (north), and Ala Moana Boulevard (south), including extensions east for Kawaiaha‘o Lane, Queen Street, and Auahi Street (TMK: 2-1-029 to 2-1-032; 2-1-046 to 2-1-048; and portions of 2-1-051, 2-1-054, and 2-1-055. Portions of Pohukaina Street, Quinn Lane, and Reed Lane are also within this district. This work was conducted almost exclusively underneath the streets in District 1 and very little in the way of private property was excavated. The stratigraphy generally consisted of an upper layer of asphalt, a layer of fill material for road grades, additional fill layers associated with construction, a burial A horizon of sand, which often contained artifacts and human burials, the underlying Tantalus/Sugarloaf cinder deposited thousands of years before human occupation of the Hawaiian Islands, and the coral shelf formed in the last inter-glacial period.

Four particularly sensitive areas were located, as shown in Figure 34. Four burial site areas were encountered: two cemeteries and two isolated burials, with a total of 149 burial sets. The cemetery on Queen Street (SIHP # 50-80-14-4534) contained 116 burial sets. These burials are associated with Kawaiaha‘o Cemetery, which was utilized from about 1875 to 1920. The cemetery section is on the southern border of the Kawaiaha‘o Church grounds. A total of 31 burials were recorded from the South Street/Quinn Lane (SIHP 50-80-14-3712) Cemetery. These burials are associated with the Honuakaha Smallpox Cemetery, which was utilized for burial only in the years 1853 to 1854. Over 1,000 victims of smallpox were interred in the cemetery during the course of the epidemic. It appears that the cemetery was not utilized following the epidemic and the burials were left in place. The two isolated burial sites – on Punchbowl Street (SIHP 50-80-14-4532) and Halekauwila Street (SIHP 50-80-14-4533) – each contained one set of remains.

A variety of other archaeological and historical features were noted, excavated, and recorded during the monitoring process, including historic trash, layers, historic cultural features, and fill layers associated with the urbanization of the Kaka‘ako area. No osteological analysis was conducted on the 116 sets of remains from the Queen Street area. These were reinterred in a special vault built on the grounds of the present Kawaiaha‘o Cemetery. Osteological analysis was conducted on the burial material from the South Street/Quinn Lane area (Pietrusewsky et al. 1989). These remains were later reinterred in a special vault built next to the Honuakaha Affordable Housing Area (Winieski et al. 1996:5-6). In 2004, a series of geotechnical borings were monitored on a portion of the site (Perzinski and Hammatt 2004). There were no findings.

5.3.5 South Street Building Complex

In March and April of 1993, during sewer line excavation by Mouse Construction, three burials were inadvertently discovered at 614 South Street in the central portion of the lot (TMK 2-1-31:20) on the southwest corner (TMK 2-1-31:20) of South Street and Quinn Lane. “It was determined that these burials were situated in the Honuakaha cemetery (SIHP 50-80-14-3712)” (Avery and Kennedy 1993a:9). Subsequent monitoring of the site by Archaeological Consultants

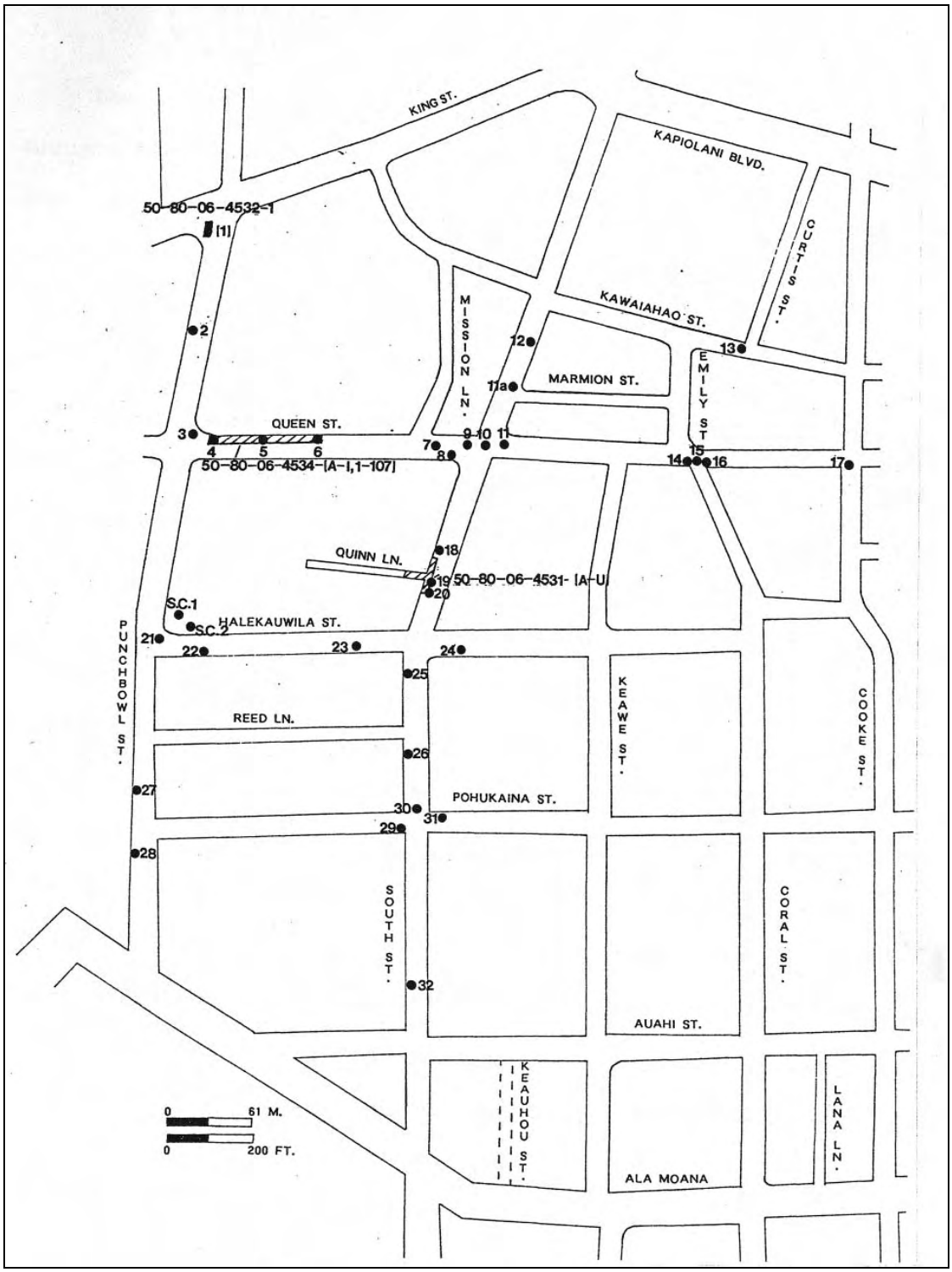


Figure 34. Kaka‘ako ID 3 project area, showing profile locations (circles) and SIHP Burial Areas (rectangles)

of Hawaii, Inc, identified six additional burials in the same location (Avery and Kennedy 1993b:Appendix), totaling nine smallpox cemetery burials in this area.

5.3.6 Kaka‘ako Fire Station (Proposed Fire Department Headquarters)

The Kaka‘ako Fire Station lot is located between Queen Street and Quinn Lane and is bound by South Street on the east and the American Brewery Site to the west. An assessment of this study area was first conducted in 1994 (Heidel and Hammatt 1994). Background and archival research was conducted to determine the use of the land area from pre-Contact times to the modern area. They discovered that the study area initially was awarded to Hawaiian officials in the 19th century, and the parcel eventually came under the control of the government. While under government ownership, the property was used for a hospital and cemetery for the smallpox epidemic of 1853-1854. It was subsequently leased to various individuals until it was designated as the site of one of Hawai‘i original fire stations in 1928 (SIHP # 50-80-14-1346; Fire Stations of O‘ahu Thematic Group). A new fire station was constructed on the study parcel in the 1970s. The old fire station is in the southwestern corner of the lot; the new station is in the northeast corner. In 1979, the old fire station was nominated to the Hawaii and National Register of Historic Places for its architectural and social significance. Plans are to convert this structure into a Fire Department Museum.

Burials associated with the Honuakaha Smallpox Cemetery have been found along Quinn Lane and south of Quinn Lane. Based on background research, the cemetery is understood to partially lie beneath the new street-level parking lot on the southern border of the fire station. Due to the possibility of burials associated with this cemetery, monitoring was conducted in the study area on February 2001 (Winieski and Hammatt 2001a) during geotechnical bore sampling. Five 4-inch diameter bores were excavated, two in the northwest corner of the lot, and three in the central section of the lot. No cultural materials or evidence of human burials were observed during geotechnical sampling, but intact naturally deposited cinder and sand sediments were identified below layers of fill material

In 2004, CSH (Perzinski and Hammatt 2004) conducted a surface and subsurface inventory survey of the Fire Station lot and excavated 12 backhoe trenches in the area of the proposed Fire Department Headquarters Building at the southeast corner of the lot. No burials or other cultural remains were found. The archaeologists concluded, based on the absence of remains in the test trenches, that the *mauka*, northern border of the Honuakaha Cemetery was probably southeast (south of Quinn Lane) and west (under the parking lot surrounding the old fire station).

Backhoe trenching was carried out along the building’s footprint, paralleling both Queen and South Streets. In general, imported fill from the early to mid 20th century constituted the top 40-60 cm of the soils and consisted of sand and sandy clays with historic trash (glass, cut bone, cement) mixed into the strata. Below the fill layers were a series of sandy loam and sand layers which likely represent the early to late 19th century ground surface (prior to filling operations) and contained sparse historic trash (glass, rusted metal) to approximately 100-120 cmbs. Following the sand and sandy loam was a sterile sand layer with no cultural material which extended to approximately 160 cmbs. A mixed layer of sand and cinder, which was likely disturbed by wave action when the project area was part of the old shoreline, lies below the sterile sand and extends to approximately 190 cmbs. The deposit of cinder at approximately 190

cmbs represents the Sugarloaf pyroclastic eruptions ca. 6,000-10,000 years B.P. and overlies the coral shelf. Based on these findings, it is suggested that long term human occupation did not occur on the project area until early historic times, though it is possible that temporary habitation and/or agriculture may have occurred in pre-Contact times.

Subsequent monitoring for the Kaka‘ako Fire Station reconstruction project (Stein et al. 2007) took place between 2004 and 2006. Construction included the building of the new fire department headquarters, trenching for utilities along Queen Street, and most importantly, the excavation of 8 boring holes for parking lot lights in the parking lot area at the southwestern side of the lot. This is the area that was thought to possibly have remains from the Honuakaha Cemetery. The stratigraphy observed during this monitoring project was similar to what had been found during the inventory survey, which was predominately imported fill layers above undisturbed sand deposits with pockets of volcanic cinder. No intact cultural deposits or human remains were found; however, as the eight boring holes were widely spaced across the parking lot, it is still possible that human remains are present below the Quinn Lane corridor and parking lot of the Fire Department Headquarters and museum.

5.3.7 State Office Building

In May of 1982, the construction of the new State Judiciary Complex on the southwest corner of Punchbowl and Halekauwila Street was monitored by Science Management Inc. (personal communication from Farley Watanabe reported in Clark 1987). No pre-Contact artifacts or human burials were found, but historic dumps were common features.

In 1982, Jason Ota and Wendell Kam (1982) reported on six partial sets of human remains recovered during excavation for construction of the State Office Building (2) at the southeast corner of Punchbowl and Halekauwila Streets (TMK 1-2-031:023). The remains were in poor to very poor condition and little could be determined from the osteological analyses performed. Two of the burials showed evidence of incisor evulsion. Tooth evulsion was practiced by the late-pre-Contact Hawaiian and this may indicate the ethnicity of these two burials. All other burials were located in sand and pre-Contact deposits, although some historic disturbance may have taken place. This burial area was later given the designation of SIHP 50-80-14-2963.

5.3.8 Makai Parking Garage

Between September and November of 1987, the Bernice P. Bishop Museum monitored construction of a parking garage on the southeast corner of Punchbowl and Halekauwila Streets in the same TMK parcel as the earlier Ota and Kam study area. Archaeological features (Clark 1987) revealed both prehistoric and historic utilization of the site. Seven human burials, of which four were complete burials with well defined burial pit features, were unearthed. Two complete burials were in a flexed position, one was a bundle burial, and one was too disturbed to determine burial position. Charcoal from one of the complete burials (Feature 28) was dated to A.D. 1270-1410. Feature 28 also showed post-mortem breakage of the limb bones. Only the femoral heads were still present in the burial pit; the shafts had been broken off and removed (Clark 1987:75-76). Osteological analyses of the burials and analysis of grave goods indicated that the individuals were of Hawaiian ancestry, probably from the commoner class rather than the chiefly (*ali‘i*) class. The burial area was considered part of State site 50-80-14-2963, which

was first identified by Ota and Kam (1982). Artifacts recovered at the site ranged from basalt tools - including an adze, a hammer stone, and a poi pounder top - and a coral abrader to glass bottles, ceramic fragments, and metal objects. Clark concluded that the "nineteenth century use of the site area included primarily burying of trash and burial of animals" (Clark 1987: 114).

5.3.9 Judiciary Parking Garage

In December of 1985, monitoring was conducted for the proposed Judiciary Parking Garage at the northwest corner of Pohukaina and South Streets (Athens 1986); Reed Lane bound the project area to the north. No undisturbed sand layers were noted in the excavations and much of the area appeared to have been disturbed prior to the excavation. It is likely that the area was under water, or was intertidal in prehistoric times, and therefore, little in the way of pre-Contact Hawaiian deposits would be found. No pre-Contact cultural deposits or artifacts were recorded, but historic artifacts were common in concentrations and scattered throughout the several fill layers exposed in the construction trenches. Soda bottles of three O‘ahu bottlers were found, from the Sunrise Soda Water Works, Pacific Soda Works, and Arctic Soda Works. These blob-top bottles date between 1880 and 1915. The deposit was given the designation of SIHP 50-80-14-3984.

In 1988, monitoring for the Federal Judiciary Building parking complex was conducted by the B. P. Bishop Museum (Leidemann 1988). The project area is described as on the northwest corner of Pohukaina and South Streets in the text (Leidemann 1988:1), which would make this project area the same as Athen’s 1985 study area. However, on Figure 1 (Leidemann 1988:2), the project area is drawn on the northwest corner of Reed Lane and South Street, which would make this project area immediately north of the Athen’s study area. Leidemann makes no mention of the Athen’s study in her report. Clark (1987:22) states that the project areas are the same. As in the Athen’s study, no undisturbed sand deposits were recorded and no pre-Contact artifacts were found. The results of the analysis of the artifactual material determined that the most likely time frame for the manufacture and disposal of the historic artifacts found was for the years between 1880 and 1930. The deposit was given the designation of SIHP 50-80-14-1973.

5.3.10 Honolulu Iron Works, Ka‘ākaukukui Cemetery

In the 1850s, Hawaiian sugar planters became interested in a type of centrifugal machine that could separate sugar from molasses. In 1851, an engineer named David Weston installed his version of this machine in a Maui sugar mill. invented a type of centrifugal machine that could separate sugar from molasses. With backing from Hawaiian businessmen, Weston returned to the islands in 1853 and founded the Honolulu Iron Works, which he set up in a building already occupied by a flour mill (Kuykendall 1938:326-327). The flour mill was at first the most successful part of the business, where wheat from Maui and as far away as Chile was ground into flour and then exported to California. However, as the sugar industry became more prominent in the Hawaiian Island economy, the Iron Works began to build the machinery needed to operate the new sugar mills not only in Hawai‘i but all over the world. At one point, the iron works employed 1,500 workers, many who lived in the Kaka‘ako area (Nicol 1998:510).

Business began to decline in the 1950s, and in 1973 the works were closed (Nicol 1998:510). At first the old buildings were converted to retail space, but eventually all were torn down; the

last warehouse was demolished in 1982 (Kawasaki 2005:2). Today this block is covered by Waterfront Plaza and Restaurant Row, which includes seven five-story buildings surrounded by

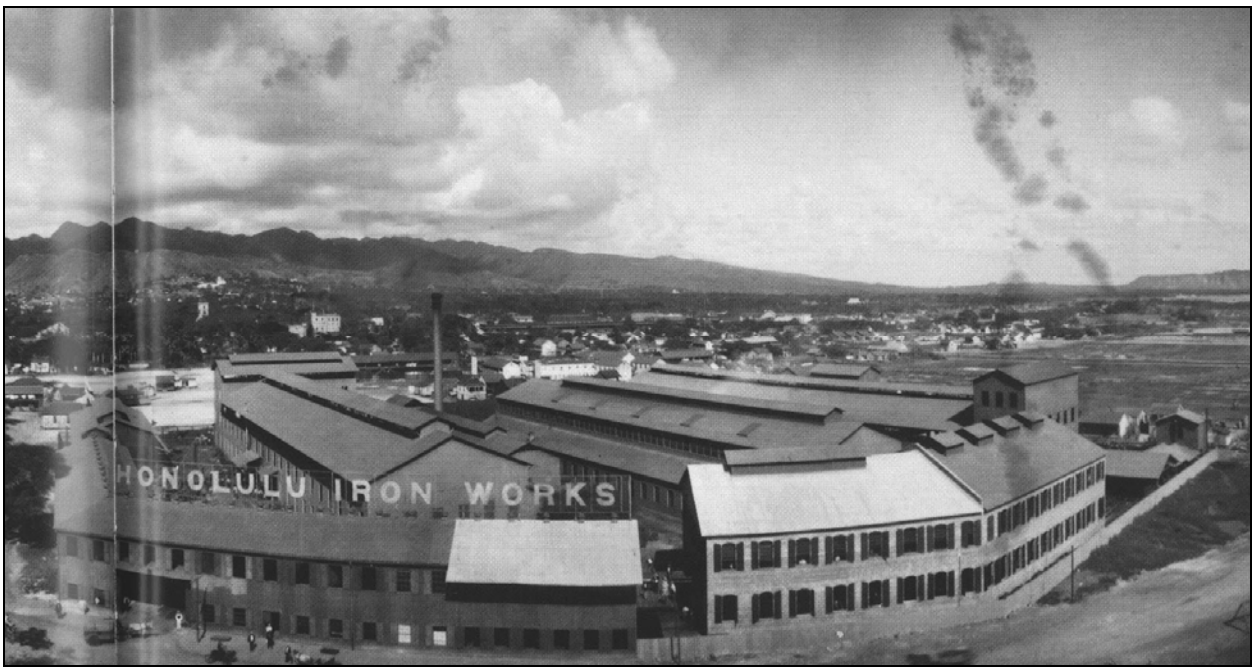


Figure 35. 1901 (circa) photograph of the Honolulu Iron Works complex; note the empty lots east of the complex within the Kaka‘ako Mauka Area District (photograph reprinted in Grant 2000:222-223)

green space. As there are no buildings remaining, this complex is not listed on the Hawai‘i or National Register of Historic Places.

In 1985, five burials were uncovered at the Honolulu Ironworks construction site (Yent 1985) at the corner of Punchbowl and Pohukaina Street (TMK 2-1-29:1) (note: Yent has the location at Queen Street, but this is marked out and replaced by Pohukaina Street in the SHPD copy of the report). The burials were found in burial pits in the sand deposit that underlay a least a meter of the ironworks fill. The burials were later given the designation of SIHP 50-80-14-2918, which is used to designate burials from the historic Ka‘ākaukukui Cemetery, utilized from the 1700s to the early 1800s. Griffin et al. 1987 states that eight burials are known from this cemetery and places at least some of the burial locations at the corner of Auahi Street and South Street. He also states that: “Many more burials are very likely [*sic*] to exist along the extent of the old sand beach. As development proceeds in a Diamond Head direction, human burials and house sites are certain to be found” (Griffin et al. 1987:4). A preliminary end of field work report for monitoring at the project was written by a team from Paul H. Rosendahl, Ph.D., Inc. (Davis et al. 1988). No additional burials were found.

5.4 South Street to Cooke Street

5.4.1 Queen Emmalani Tower (Keola La‘i Condominium)

In 1991, monitoring and test excavations (Schilz 1991) were recommended for a property bound by Kawaiaha‘o Street (north), South Street (west), Queen Street (south), and Emily Street (east) during the construction of the Queen Emmalani Tower (TMK 2-1-048:008-019). A kerosene storage facility was built on a portion of this lot as early as 1876 and was present u to 1884. Another portion of the property was used for tenements in the “Magoon Block,” which was present as early as 1884 and was demolished in 1940.

After testing for hazardous waste materials at the site was completed, it was recommended that only a literature and archival research for the project area should be conducted. From background research, the authors (Schliz 1991) concluded that the area was probably a marshland in the early post-Contact period; there was no record of a fishpond in the area. The redevelopment and construction that began in the 1880s has probably disturbed any subsurface historic deposits that may be present.

During monitoring for the project, a human skull was found in the back dirt pile. Carol Kawachi (1991) from the SHPD went to the site to monitor the decontamination of the remaining dirt piles. One additional bone, a humerus, was found. The burial remains were designated SIHP # 50-80-14-1604. The human remains were examined by osteologists from the University of Hawai‘i (Pietrusewsky and Ikehara 1991). Historic artifacts, related to the residential use of the buildings in the Magoon Block were also found in the back dirt piles.

In 2005, Perzinski et al (2005) conducted an archaeological inventory survey in the same area Schilz (1991) worked on, excavating 13 trenches. Perzinski et al (2005) discovered two additional human skeletal elements, which were considered part of previously identified site -1604. Three subsurface features, a garbage pit with many historic artifacts (dating to the decades around the turn of the century), a wall remnant/concrete slab remnant, and a post hole, were considered residential/industrial remains of the late nineteenth/twentieth century occupation and use of the block and were designated SIHP # 50-80-14-6766.

A representative stratigraphy for the project area is shown in Trench 3 (Figure 36 and Figure 37), which was located in the northwestern portion of the project area, near the intersection of Queen and South Streets. An 1884 indicates a structure, attributable to J. Magoon, was formerly located in this vicinity. Later structures located in this vicinity included a storage facility, furniture store, shops, and residential dwellings. The stratigraphic sequence indicates that this portion of the project area was subjected to several historic land filling episodes that have been documented in historic and modern times. Stratum I was consistent throughout the project area, consisting of an approximately 1-inch thick asphalt slab. Strata II through VII consist of modern and historic fill layers, containing construction debris, including concrete and metal pipe fragments, crushed coral fill, and construction grade basalt gravel. These strata represent the multiple construction and demolition cycles which took place within the project area throughout the development of the Kaka‘ako area. In addition, historic bottles and bottle fragments were observed at the surface of Stratum VII. The natural sediments (i.e. Strata VIII) were encountered

at a depth of 150 cmbs, with the water table at 175 cmbs. Stratum VIII consisted of a black sandy clay, consistent with a wet, marsh-type environment.

Figure 36. Queen Emmalani Towers, photograph of Trench 3 stratigraphy.

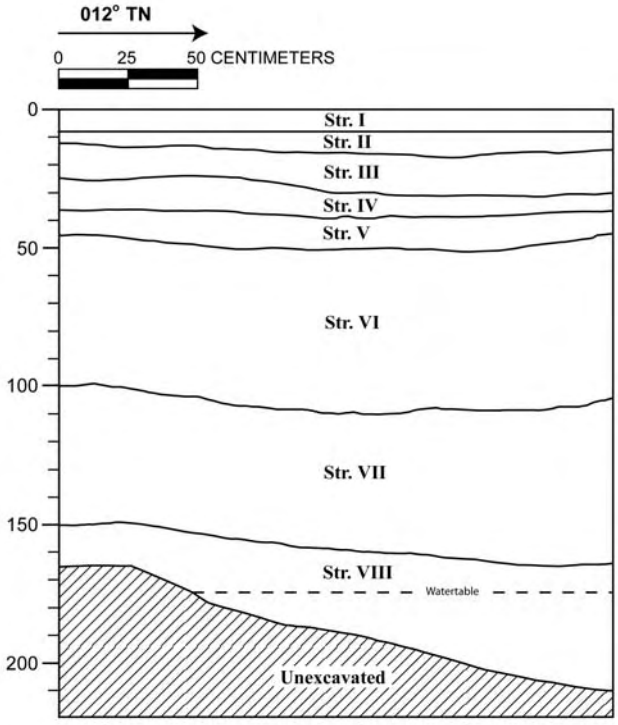


Figure 37. Queen Emmalani Towers, Trench 3 Stratigraphic Profile

CSH (Hazlett et al. 2007) monitored construction at the Queen Emmalani site (now called the Keola La‘i Condominium). In one trench, near and parallel to Kawaiaha‘o Street. Historic artifacts dating to the decades around the turn of the century were found in several trenches. Two isolated human skeletal remains in historic fill sediments were discovered in a utility trench near and parallel to Kawaiaha‘o Street. These human remains were considered part of site SIHP # 50-80-14-1604.

5.4.2 Kaka‘ako Improvement District 3 and Pohulani Elderly Housing

In November of 1990, during construction of an elderly housing project at the southwest corner of Coral and Queen Streets, human bones were uncovered and reported to the State Historic Preservation Division (Douglas 1991a). Disinterment for the burials was recommended and Cultural Surveys Hawai‘i then conducted excavations in November of 1990. Eight separate burials were identified on the east side of the property; only five were removed. A glass bead was found with one burial, suggesting a post-Contact date. One burial also exhibited a pre-mortem loss of the mandibular incisors, which suggests deliberate tooth evulsion. This procedure was known to have been practiced by Hawaiians in the pre-Contact and early post-Contact period. The author concluded that the burials were probably of Hawaiian ethnicity, perhaps representing a nuclear family. This burial area was later designated SIHP # 50-80-14-4380.

In March of 1991, during excavation of a waterline trench between Coral and Queen Streets across Mother Waldron Park, human skeletal remains were discovered and disinterred (Douglas 1991b). The remains were determined to be of Hawaiian ancestry, with a pig burial possibly associated with the burial. These burials were considered part of SIHP # 50-80-14-4380.

Douglas (1991c) also conducted background research on the property and structures and Mother Waldron Park, which has been designated SIHP # 50-80-14-1388. No subsurface field work was conducted at the park.

Between November 1990 and September 1992, Cultural Surveys Hawai‘i (Winieski and Hammatt 2000a) monitored construction at the Kaka‘ako Improvement District 3 area, the Pohulani Elderly Rental Housing project area, and the Kauhale Kaka‘ako Project area (TMK 2-1-30, 31, 32, 44, 46, 47, 48, 50, 51, 52, 54). Kaka‘ako Improvement District 3 was bounded by Kapi‘olani and King Streets (north), the northern end of Cooke Street (east), Halekauwila Street (south), and South Street (west). It includes extensions of Keawe and Cooke Streets to the south.

The monitoring of sub-surface excavations revealed that although the area had been previously disturbed to a great extent, a cultural layer and *in situ* sand and volcanic cinder deposits are still intact below fill layers. The cultural layer contained historic artifacts mixed with scant traditional Hawaiian cultural materials. Twenty human burials were discovered during these projects, 9 at the Pohulani Elderly Rental Housing project (SIHP 50-80-14-4380) and 11 in and around Mother Waldron Park (SIHP # 50-80-14-5820). Five burials were in an extended position, seven were flexed, and the position of eight could not be determined. One burial was in a coffin and one contained a glass trade bead, suggesting that the burials were of post-Contact age. Seventeen of the burials were recovered and reinterred in Mother Waldron Park. Three were left in place beneath the Pohulani Elderly Rental Housing Facility.

The archaeologists conducted backhoe testing in the Kauhale Kaka‘ako parcel between Ilaniwai and Halekauwila streets. This parcel is just north of LCA 1503, which was described as a fishpond. The profile sections from each trench are shown in Figure 38. A consistent stratigraphic sequence was observed in Trenches 1-4. It consisted of graded surface fill (Stratum IA) containing silty sand, and basalt and coral gravel, which ranged from 15 to 25 cm (centimeters) thick. Underlying the surface fill was a layer of crushed coral fill (Stratum IB). Below the crushed coral fill was a layer of white sandy clay. A buried “A” horizon (Stratum II) consisted of very dark grayish brown organically stained silty sand. Stratum III consisted of white to yellow, very coarse calcareous sand. Stratum IV, at the base of the test excavations, consisted of grey sandy loam, which depending on the proximity to the water table, graded to grey gleying sand clay loam. It ranged in depth from 115 to 170 cm below surface at the base of excavation.

In four of the test trenches (T 1-4) and old buried “A” horizon was revealed beneath fill layers. In test trench 1 this layer contained scattered historic era refuse, a small amount of shell midden (cowrie and cone shells), and a pocket of charcoal and ash. The historic refuse included bottle glass and ceramic fragments and a few fragments of saw-cut mammal bone. Trench 5 exhibited the same fill layers as the other test trenches, but in place of the old buried “A” horizon, there was a horizontally banded layer of fine sandy loam (Stratum II.) The sediment color alternated from very dark grayish brown to light brownish gray. This banding suggested the previous deposition of pond sediments. One fragment of saw-cut cow bone was observed in this layer. Underlying Stratum II was a layer of grey medium to coarse sandy loam mixed with very fine gravel (Stratum III). At 150 cmbs, the base of excavation, cemented coral (Stratum IV) was encountered.

In 1998, an archaeological assessment for a 6.8 acre land parcel was written by Cultural Surveys Hawai‘i (Hammatt and Chiogioji 1998). The parcel is bound by Halekauwila Street (north), Pohukaina Street (south), Keawe Street (west) and Cooke Street (east). The parcel is the site of a municipal parking lot, a state government building, Mother Waldron Playground and a lawn area. It is also the former sites of the Pohukaina Elementary School. This report focused on researching the historic land use of the parcel, especially the history of the Pohukaina Elementary School, which began as a girl’s school in 1913 and the origin of the Mother Waldron Park, which was constructed in 1937. The park area has been designated as SIHP # 50-80-14-1388, as part of a thematic group of Honolulu City and County Art Deco Parks. A reinterment site for the Hawaiian burials discovered during construction within Kaka‘ako ID-3 (Winieski and Hammatt 2000a) is already present at the corner of Cooke and Halekauwila Streets, as mentioned above. The SHPD’s burial division has also designated an interment site at the corner of Cooke and Pohukaina Streets, which “will be reserved for future interments” (SHPD memo of July 2, 1992, cited in Hammatt and Chiogioji 1998:29).

5.5 Cooke to Kamake‘e Street

5.5.1 King Street Property near the Roman Catholic Church

In 1995, Lisa Anderson (1995) conducted an archaeological subsurface inventory survey of the King Street Place property. This lot is adjacent to the western side of the Roman Catholic

King Street Cemetery. The western half of the Roman Catholic lot was given to the Catholic Mission in the 1840s, and it was first used as a cemetery in 1851. It continued to be used up to 1928. Eight trenches were excavated on the property; no burials were found, but historic artifacts

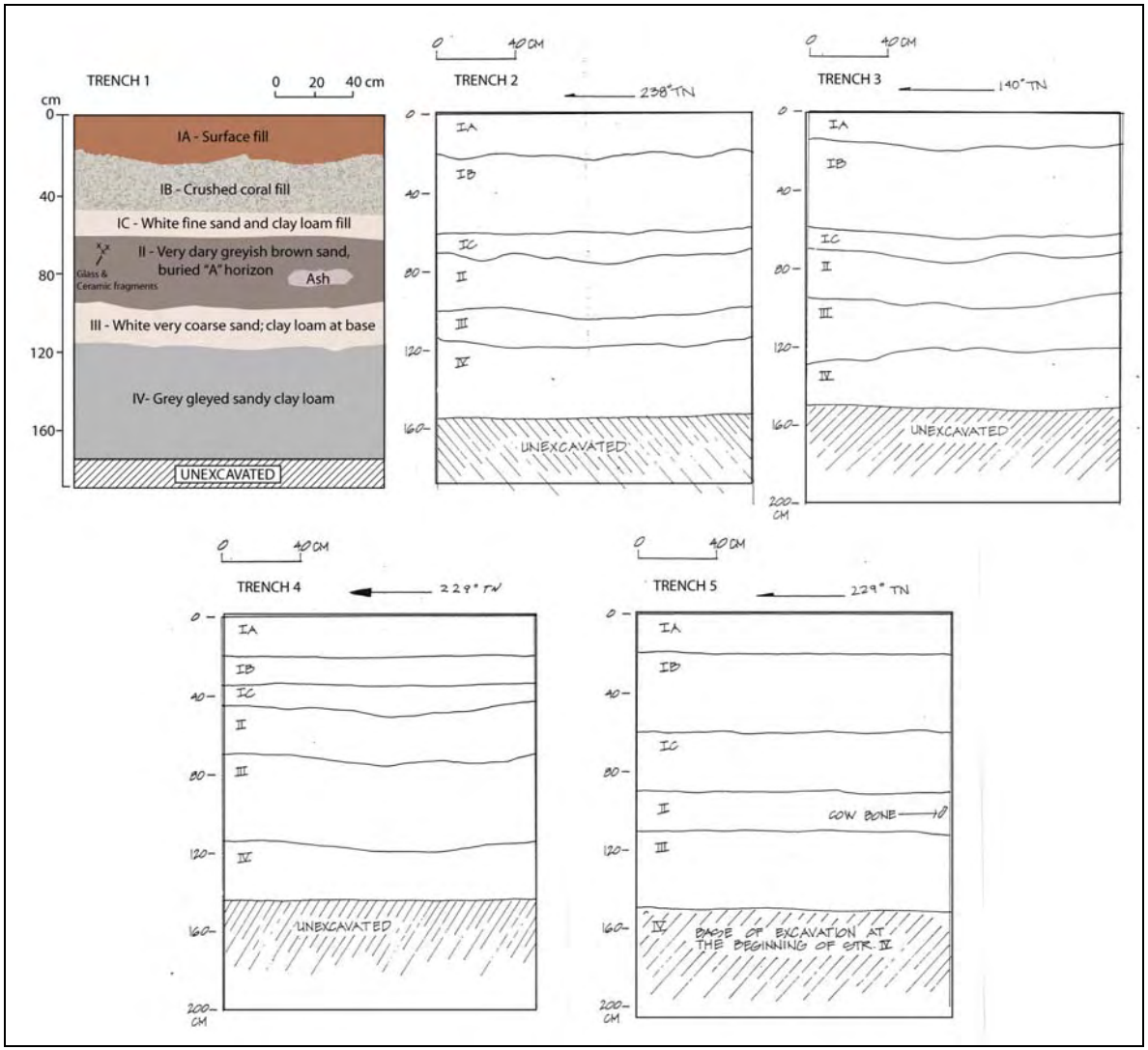


Figure 38. Kauhale Kaka‘ako Parcel, profiles for five test trenches (Winieski and Hammatt 2000a)

dating from 1810 to the early 1900s were common in pit features, indicating that the lot had been used for 19th century habitation... This historic trash pits were given the site number SIHP # 50-80-14-5373.

During the subsequent monitoring of the lot in 1996, one historic burial was found at the One Archer Lane project area, within a few feet on the boundary of the Roman Catholic Cemetery. This indicated to Kana‘i Kapeliela (1996) of the SHPD that the burial was part of the cemetery.

In 1996, during the course of monitoring of a tank installation at One Archer Lane, a trash concentration, subsurface post holes, a basalt mound, a recent trash pit, and a human burial were inadvertently encountered. The burial was examined by Kana‘i Kapeliela (1996) of the SHPD, and given the site designation SIHP # 50-80-14–5455.

In August of 1997, two months after monitoring was halted, a concentration of burials was inadvertently encountered during construction activities. In all, a minimum of 29 individuals were encountered. Analysis of the burials showed that “the burials dated from the mid-1800s to the 1920s” (Anderson 1997a), suggesting that the burials were associated with the cemetery. The thirty burials were regarded as part of SIHP # 50-80-14-5455. Various loose bones recovered appear to account for the 30th individual in the minimum number estimate. In 1997, an exploratory excavation was made for the proposed reinterment plot for the SIHP # 50-80-14–5455 burials at One Archer Lane. Four diagnostic foot bones foot bones were found. The author suggests that these bones were missed during the original disinterment process (Anderson 1997b).

In 2006, Cultural Surveys Hawai‘i (Perzinski et al 2006) conducted an archaeological inventory survey of the Kewalo HECO dispatch area on 11 Archer Lane. Two burials were identified in this study associated with the previously identified SIHP # 50-80-14-5455 and the Roman Catholic King Street Cemetery. These burials were left in place.

5.5.2 Symphony Park

Allen (1997) reported on the analysis of two geoarchaeological cores excavated at Symphony Park on Kapi‘olani Boulevard. The three lowest (earliest) stratum in the cores was for a marine bay that formed somewhere between 5200 and 2500 B.C. The next stratum contained terrigenous soil, indicating that the area was then solid ground. Between A.D. 300-500, a lagoon formed behind a barrier beach; the pollen analysis indicates that this may be the first era indicating human occupation. The lagoon became a marsh in A.D. 340-600, which stabilized over time. The upper strata were fill layers, deposited to fill in the marches in the late 19th to early 20th centuries.

5.5.3 Ward and Kapi‘olani

In 2005, Scientific Consulting Services conducted an archaeological assessment on three parcels in Kaka‘ako near the corner of Ward Avenue and Kapi‘olani Boulevard. Nine backhoe trenches were excavated; the material was a compacted fill. While archaeological monitoring was recommended for any future subsurface activity, no burials nor significant artifacts were encountered (Monahan 2005).

5.5.4 Moana Vista Project

In 2005, Cultural Surveys Hawai‘i conducted an archaeological inventory survey of the Moana Vista project area between Kapi‘olani boulevard and Waimanu street. No finds, either pre-Contact or historic were reported (O’Leary and Hammatt 2006).

5.5.5 Kewalo Project Area

In 2005, Pacific Consulting Services, Inc. conducted a subsurface archaeological inventory survey of a project area on the southwest corner of Kapi‘olani boulevard and Kamake‘e Street. Despite the excavation of 45 trenches, no historic or pre-Contact findings were reported, with the exception of a previously described remnant of a small pond (SIHP # 50-80-14-6636) (Clark and Gosser 2005).

5.5.6 Ward Theaters

In 2000, Cultural Surveys Hawai‘i performed archaeological monitoring for Victoria Ward Ltd. at the site of the Ward Village Phase II (Ward Theaters) construction project in Kaka‘ako (TMK 2-3-02:1) (Winieski and Hammatt 2001b). This project area is adjacent to the Kaka‘ako ID-7 District and is bound by Ala Moana Boulevard on the south and Kamake‘e Street to the east. No pre-Contact materials, historic cultural materials, or human burials were encountered. Observation of the stratigraphic sequences within the project area revealed that fill materials were placed over a pre-existing marshy surface. In the northwest corner of the project area, an old “A” horizon and naturally deposited pond sediments and calcareous sand were observed. In the southwest corner of the project area, an old “A” horizon and naturally deposited calcareous sand were observed.

Approximately 90% of the pile cap excavations (shown on Figure 39) exhibited nearly identical stratigraphic sequences. Beneath what had previously been asphalt parking surfaces or building slabs was a 40 cm thick crushed coral fill layer. Beneath this layer was slurred clay fill, usually light gray. However, in some instances a brownish yellow clay slurry overlaid the gray layer, evidence of different episodes of filling. Beneath the slurry layer decomposing coral shelf occurred. The water table occurred at approximately 100 cmbs.

At the northwest corner of the buildings foot print, a few of the pile cap excavations exposed an old “A” horizon beneath fill materials, shown in a profile and a photograph (Figure 40 and Figure 41). Underlying the old “A” horizon was light brownish gray sandy clay which was interpreted as representing old pond sediments. This old “A” horizon was also present above a sterile calcareous sand layer in a 50 meter shallow trench dug for telephone cable conduits behind Nordstrom Rack, outside but related to the project area. In this trench the old “A” horizon and sand layer were continuous, apparently not disturbed by previous construction.

At the southeast corner of the project area, near the intersection of Auahi and Kamake‘e Streets, the old “A” horizon and sand layer were present, however they were discontinuous, having been previously disturbed by previous construction activities and replaced with backfill. It is near this area that a human burial was encountered within the sand matrix during the adjacent Kaka‘ako Improvement District 7 project (site -6377).

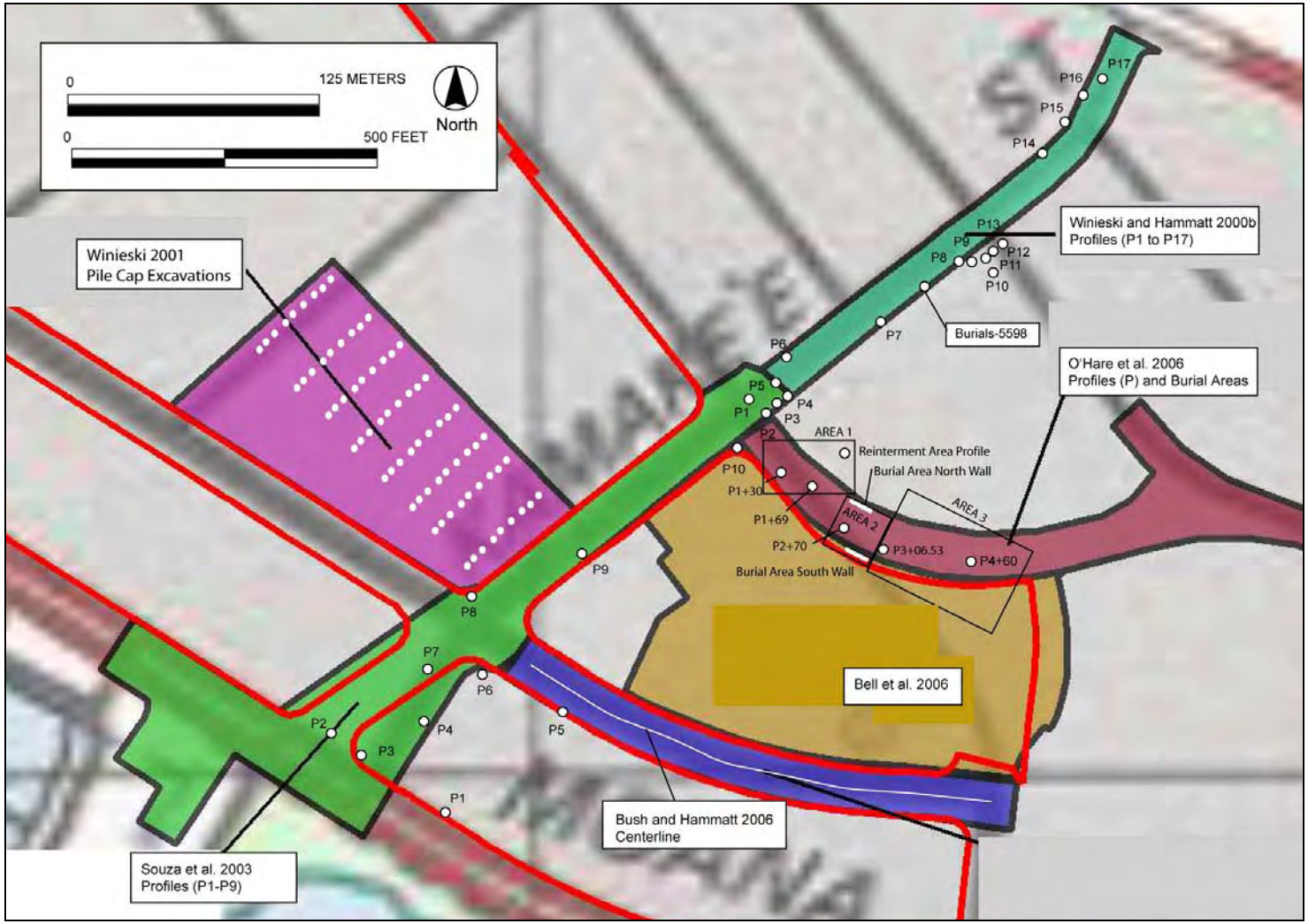


Figure 39. Previous Archaeological Work at eastern boundary of Mauka Area District, showing location of soils profiles

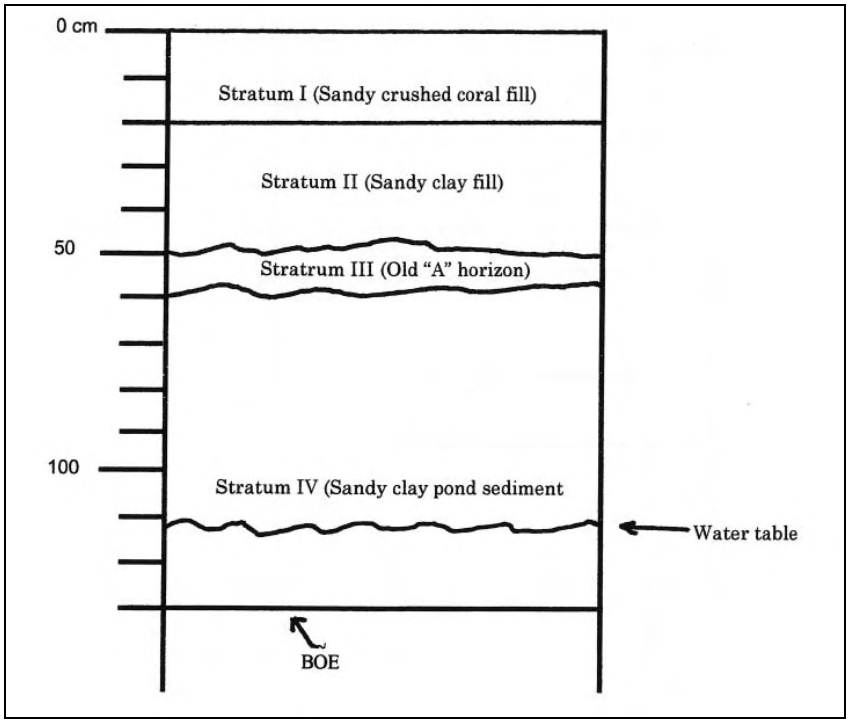


Figure 40. Ward Village Phase II, Ward Theaters, Profile of pile cap excavation in northeast corner of complex footprint showing old “A” horizon and pond sediment (Winieski and Hammatt 2001)

Figure 41. Ward Village Phase II, Ward Theaters, photograph of pile cap trench showing old “A’ horizon capping clay pond sediments (Winieski and Hammatt 2001)

5.5.7 Kaka‘ako Improvement District 4

The Kaka‘ako Improvement District 4 project was on the road alignment of Kamake‘e Street between Queen Street and Kapi‘olani Boulevard (TMK 2-3-02 through 05), adjacent (but not within) the northeastern corner of the current study area (Winieski and Hammatt 2000b). From August 1995 to August 1996, archaeological monitoring for the Kaka‘ako Improvement District 4 construction project was conducted by Cultural Surveys Hawai‘i. The project documented two isolated historic coffin burials (SIHP 50-80-14-5598), on Kamake‘e Street, between the intersections of Kawaiaha‘o and Waimanu Streets. The two burials, adjacent to one another, were within an undisturbed sand deposit, directly underlying an “A” horizon, which itself underlay approximately 50 cm of construction fill and pavement. Well-defined burial pits were present, as well as staining from the deteriorated coffin wood. No associated artifacts, other than the coffins, were discovered during disinterment. Additionally, during excavation for a manhole hookup approximately 2 meters west of Kamake‘e Street on Waimanu Street, a horse or mule skeleton was discovered within the undisturbed sand layer, approximately one meter blow the surface. No other materials were observed during the Kaka‘ako ID-4 project, except for randomly scattered bottles and bottle fragments of modern provenance discovered within fill materials. One “Star Soda Works” bottle was dated to c. 1900.

Excavation within the project area extended across the complete breadth of Kamake‘e Street. Extensive prior utility installation down the center of the street had almost totally replaced any naturally deposited sediments; pipes, manhole shafts, storm drains and associated backfill deposits were common. The result was that natural deposits, thought discontinuous, were exposed most frequently along the sides of the street and adjacent to the existing buildings where prior construction activities had less impact. Sand deposits were most extensive on the south-east (Diamond Head) side of Kamake‘e Street, extending the two blocks between Queen and Waimanu Streets. Only on this side of the street were occasional remnants of an old buried “A” horizon observed. The northwest (*‘ewa*) side in this stretch consisted predominantly of fill material, though some pockets of sand were observed. Fill materials were predominant in the two block stretch of Kamake‘e Street, from Waimanu Street to Kapi‘olani Boulevard.

The stratigraphic sequence can be characterized as follows. The top soil surface was usually asphalt road or concrete sidewalk, curb or gutter surfaces, ranging in depth form 0-20 cmbs. Underling these were thin gravel or sandy crushed coral beds, averaging 10 to 20 cmbs. In most cases, the road bed overlay a layer of loose sandy crushed coral fill that sometimes was as thick as 180 cm, well below the water table. It is likely that this material represents the fill originally transported to the area during the late historic grading and development of Kaka‘ako. In general, where previous construction activity had not impacted the stratigraphic sequence, naturally deposited very pale brown to yellow sterile fine to medium well-sorted calcareous sand, with coral rubble inclusions, underlay the coral fill material. This sand layer extended down to the water table, which usually ranged from 150 to 200 cmbs. At the water table, the sand layer had decomposed and yielded a very fine layer of light greenish gray to greenish gray gleyed sand with numerous rubble coral inclusions.

Seventeen profiles were described and drawn, from P1-3 at the junction with Queen Street north to P-17 near the junction with Kapi‘olani Blvd. The old burial “A” horizon, which was

observed on the Diamond Head side of Kamake‘e Street between Waimanu and Queen Street consisted of a very dark grayish brown silty sand that underlie modern fill layers and overlay the sand layers. Generally it was quite thin and contained only diffuse charcoal flecking. In other areas it contained historic rubble (metal, bricks, bottle glass, and ceramic fragments), and in one spot two coffin burials (site -5598) originated from the base of this layer. Profiles 1, and 2, and 3, at the junction of Kamake‘e and Queen St. (the three excavations made on the northeastern boundary of the Mauka Area District) are shown on Figure 42. A photograph of a representative profile with the “A” horizon is shown in Figure 43, and a photograph of a representative profile without the “A” horizon is shown in Figure 44.

5.5.8 Kaka‘ako Improvement District 7 (ID-7)

The Kaka‘ako Improvement District 7 (ID-7) project constructed improvements to drainage, water, sewer, and utility systems on Kamake‘e Street between Queen Street and Ala Moana Boulevard, and also extended the drain system from Ala Moana Boulevard to Kewalo Basin (TMK 2-1-58, 2-3, 2-3-01 thru 05). The project additionally included the realignment of the existing Kamake‘e Street between Auahi Street and Ala Moana Boulevard. During excavation activities associated with the Kaka‘ako Improvement District 7 Construction Project, three human burials were encountered (Souza et al. 2002). Burial 1 (SIHP # 50-80-14-6376), a single cranium, was inadvertently discovered by Delta personnel on October 13, 2000 in the base yard back dirt pile. The backdirt pile derived from a trench on Ala Moana Blvd. and Kamake‘e Street. Burial 2 (SIHP 50-80-14-6377), an adult individual, was encountered by a Cultural Surveys Hawai‘i archaeologist during backhoe excavations for a box drain on Kamake‘e Street. The burial was within an undisturbed sand deposit. Burial 3 (SIHP # 50-80-14-6378), consisting of a femur and several rib fragments, was recovered in the Delta Co. base yard on Pensacola Avenue and Kapi‘olani Boulevard. The original location of the burial could not be determined.

Ten profiles were described and drawn, beginning with P1 at the junction with Queen Street at the north end to P1 to P3 at the junction with Ala Moana Blvd at the southern end. Most of the excavations occurred in previously disturbed fill material. As expected, the land comprising Ala Moana Beach Park and the Kewalo Basin consists totally of fill material, since the areas were seaward of the shoreline in pre-Contact and early historic times. Natural deposits, though discontinuous, were exposed most frequently along the ‘*ewa* (west) and Diamond Head (southeast) sides of Kamake‘e Street extending down to Ala Moana Boulevard. An old “A” horizon was observed in Profiles P1, P3, P5, P6, P7, P9, and P10. The stratigraphic sequence for the project area was fairly consistent throughout. A representative profile (P7 at the junction of Kamake‘e Street and Auahi Street) is shown on Figure 36.

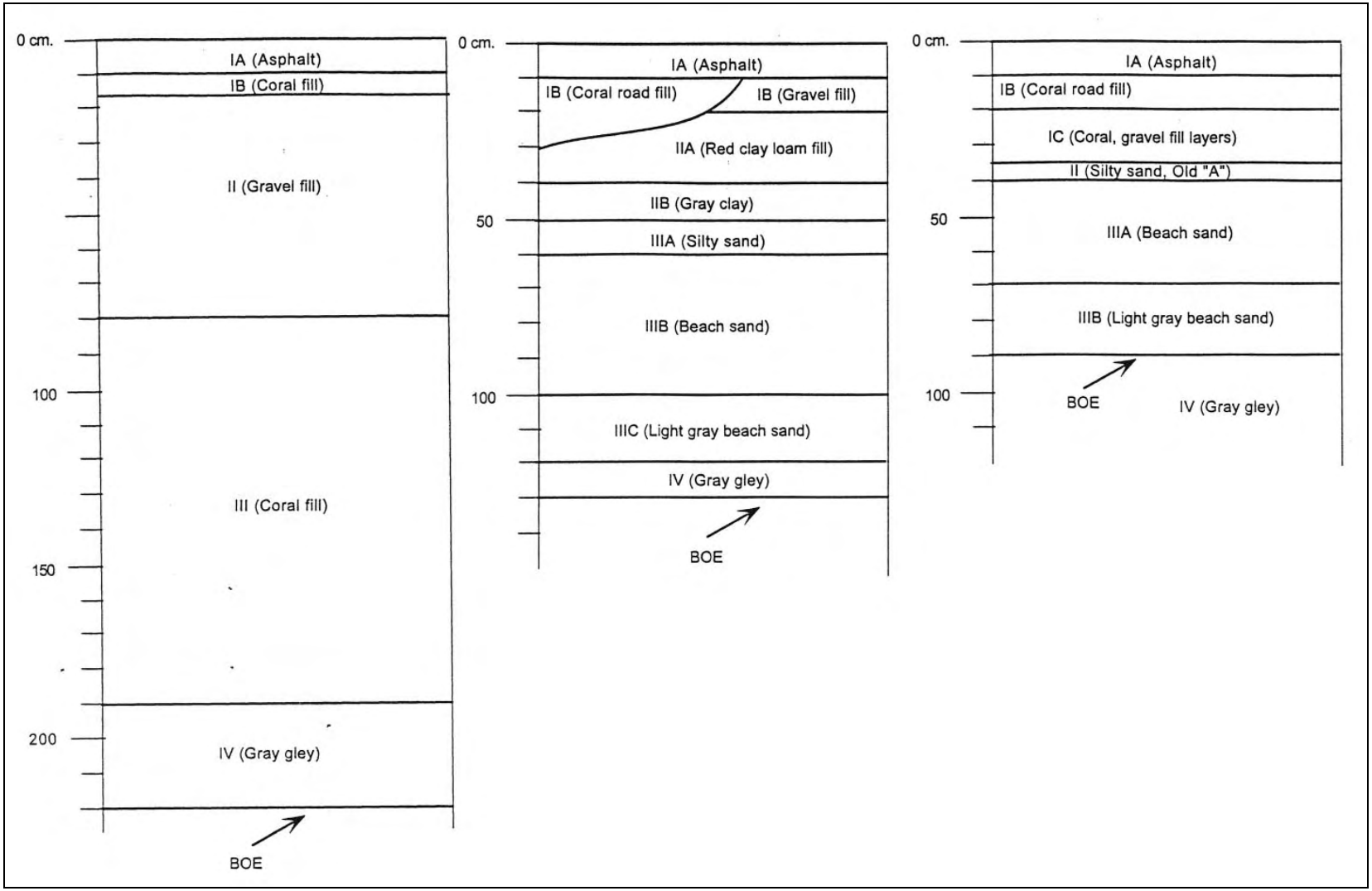


Figure 42. Kaka‘ako Improvement District 4 (ID-4); Profiles 1, 2, and 3 on Kamake‘e Street (Winieski & Hammatt 2000b)

Figure 43. Kaka‘ako Improvement District 4 (ID-4), view of east face of trench on Kamake‘e Street southwest (*makai*) of Waimanu Street, showing fill layers overlying old “A” horizon and sterile sand layers (Winieski & Hammatt 2000b)

Figure 44. Kaka‘ako Improvement District 4 (ID-4), View of northeast (*mauka*) face of manhole shaft on Kamake‘e Street at intersection with Queen Street, showing multiple fill layers overlying sterile sand layer (Winieski & Hammatt 2000b)

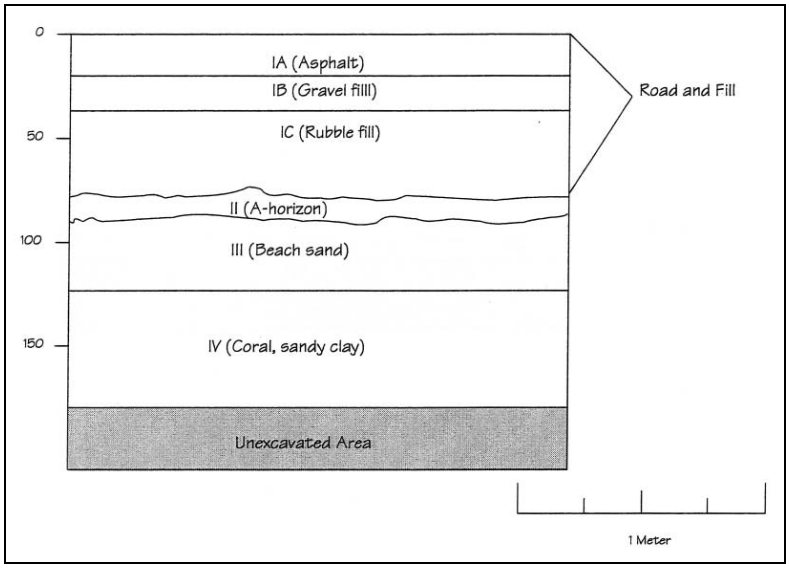


Figure 45. Kaka‘ako Improvement District 7 (ID-&), P7 profile, southwest of Auahi Street (Souza et al. 2002)

IA Asphalt
IB Gravel road fill
IC Crushed coral and rubble fill
II 10YR 5/2 grayish brown medium to fine sand; “A” horizon containing sparse and diffuse charcoal flecking.
III 10 yr 7/4 very pale brown fine to medium calcareous sand
IV 5Gy 7/1 light gray, sandy clay; gleyed with angular coral gravels

Figure 46. Kaka‘ako Improvement District 7 (ID-7), southeast profile near Kamake‘e and Auahi Street showing thin dark “A” horizon below street fill gravel, crushed coral layers and above calcareous sand, (Souza et al. 2002)

5.6 Kamake‘e to Pi‘ikoi Streets

5.6.1 Pensacola and Kapi‘olani Lot

In 1992, an archaeological assessment (Chiogioji and Hammatt 1992) of a lot that once housed the Kapi‘olani Community College was conducted by Cultural Surveys Hawai‘i. This project area is bound by Pensacola Street on the east and Kapi‘olani Street on the south. It is adjacent to McKinley High School to the west. Based on the background and previous archaeological research, it was concluded that the property could contain burials, the remains of Hawaiian agricultural features, and pre-and post-habitation deposits. Due to these concerns, archaeological monitoring was recommended during any future construction in the study area. This report also covered the historical background on McKinley High School, which is designated as SIHP # 50-80-14-9926.

5.6.2 Burial at Pi‘ikoi and Kapi‘olani

In 1994, during excavation of a trench for an underground telephone line near the north-east corner of Pi‘ikoi Street and Kapi‘olani, the remains of a single individual were inadvertently discovered and later disinterred (Athens et al. 1994). Osteological analysis revealed that the remains (SIHP # 50-80-14-4847) were the fairly complete skeleton of a 12 to 15-year old female. Radiocarbon analysis of a sample of bone collagen yielded a date of death of between AD 1295-1473, supporting the osteological determination of Hawaiian/Polynesian ancestry. The remains were interred within a wetlands environment at a shallow depth of 50-80 cmbs (centimeters below surface). A lack of burial goods and the presence of the remains within an unusual wetlands context, strongly suggested that the location of the remains did not reflect an intentional burial. Osteological analysis revealed severe bone infection of the right pubis as the probable cause of death. The individual probably passed away, undiscovered, at the very spot of interment. Athens et al. (1994:8) placed the location of this burial near an embankment that crossed the present location of Pi‘ikoi Street and intersected with the present location of Sheridan Street pictured in an 1884 survey map.

5.6.3 Moana Pacific Lot

An archaeological inventory survey of a property the Moana Pacific property (TMK 2-3-010:028, 048, 050, 052-056) was conducted by CSH in 2003 (O’Hare et al. 2003). Twenty-four test trenches were excavated. Site 50-80-14-6636 consists of the pre-Contact to early 20th century land surface that underplays the dredged fill materials from the Kewalo and Ala Wai Canal land reclamation projects, which took place in the 1920s and 1930s. This land surface is a wetland deposit (Stratum III), which probably extends across the entire project area. This site also contains a sand berm that crosses the southeast corner of the project area. This sand berm is illustrated on an 1884 map, but may have been constructed earlier. Radiocarbon date determinations for the sand berm do not give a definitive date for the construction of this feature. State Site # 50-80-14-6637 consists of a trash dump (Feature 2 in the trench profiles) found in 6 trenches, all located in the northeast corner of the project area. This trash pit contained wood, brick, tires, ceramic dinnerware, insulators, rusted metal, and glass bottles. Many of the glass bottles were dated to the 1920s to 1940s, some specifically to the 1930s.

Four strata and thirteen sub-strata were identified in the study area. The upper surface was designated Stratum I; this is a 20th century ‘dry’ fill material consisting of sand, silty loams, and silty clay loams. Stratum I was subdivided into substrata (Ia to If) based on soil types. These strata often contained historic trash dating to the 1920s and 1930s, including ceramic dinnerware, glass bottles, wood, bricks, and metal fragments. Below the fill was one or more strata (Strata IIa and IIb) of fine clay, with micro-bands of sand. This stratum represented the dredged fill hydraulically pumped into the wetland area during the reclamation of the Kewalo area in the 1920s and 1930s. Strata IIIa and IIIb represents the original wetland deposit. These layers are a sandy clay loam with various high percentages of organic material. Below the wetland deposit is a layer of natural gleyed gray coarse sands and coral rubble, designated Layer IV. The coral ruble layering is a soupy mix of angular coral rubble and coarse sands that continues below the depth the backhoe could excavate. In addition, four subsurface features were designated; three (Features 1-3) have fill soil, often with early 20th century trash. Feature 4 is part of a sand berm, shown on Figure 47.

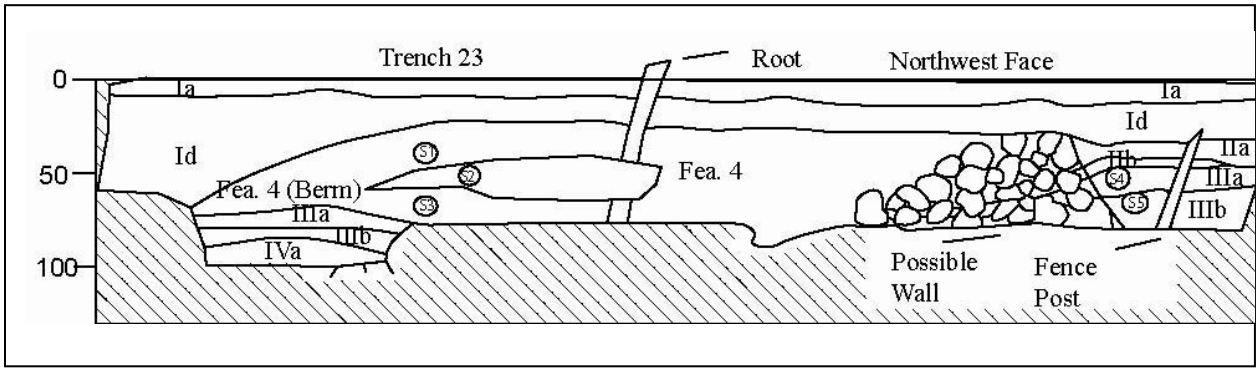


Figure 47. Moana Pacific Property Trench 23 Profile, northwest face

Construction at the Moana Pacific project area was monitored from by CSH from August 2, 2006 to November 20, 2006 (Hazlett et al. 2007). A portion of the previously identified trash dump (site 6637) was found, but no other cultural remains were recorded.

5.6.4 Victoria Ward Village Shops

In 2006, Cultural Surveys Hawai‘i performed an archaeological inventory survey for the Victoria Ward Village Shops Project adjacent to Kaka‘ako ID-7 District and bounded by Auahi Street on the south and Kamake‘e Street to the east. A total of 64 trenches were excavated in the project area in the initial phase of subsurface testing and an additional 22 trenches were excavated by the request of the O‘ahu Island Burial Council (OIBC). Three sites were reported, including a total of 11 human burials (Bell et al. 2006). SIHP # 50-80-14-6854 a subsurface cultural layer/activity area remnant consisting of an immature pig skeleton, remnants of a historic privy, remnants of a culturally enriched A horizon (containing both historic and prehistoric cultural material), and five human burials. SIHP # 50-80-14-6855 is an activity area remnant, comprised of a pronounced subsurface traditional Hawaiian cultural layer including six human burials. SIHP # 50-80-14-6856 is a historic fishpond remnant, part of Land Commission Grant 3194, “Kolowalu,” awarded to Kalae and Kaaua. Additional finds of human remains were

discovered during archaeological monitoring. Following extensive consultation with the OIBC, SHPD and cultural descendants all disinterred burials were reinterred in July 2008.

The common stratigraphic element within the project area is the ubiquitous historic and modern fill layers that were documented immediately below the surface in all trenches. These fill layers included:

- crushed coral rubble,
- terrigenous clays and clay loams,
- marine hydraulic dredge clays and silts that were pumped into the project area from dredging operations off shore of Ala Moana Beach Park. For a discussion of this hydraulic dredge fill material and its deposition, refer to LeSuer (et al. 2000),
- asphalt layers, often associated with basalt gravel base courses, and
- rusted metal and glass trash layers, likely from the old Kaka‘ako incinerator

The project area’s stratigraphy is most usefully discussed in terms of the types of natural land surface that are preserved beneath these ubiquitous fill layers. As depicted on Figure 48, in terms of pre-fill land surface the project area can be broadly divided into three areas: natural low-lying salt flats, marsh, or pond sediments; natural jaucas sand beach deposits; and areas where modern/historic fill episodes have removed the former natural land surface, leaving only low energy lagoonal deposits.

5.6.5 Ko‘olani Heights (Sunset Heights)

In September of 2003, Cultural Surveys Hawai‘i (O’Hare et al. 2004) completed the fieldwork pertaining to the archaeological inventory survey of the proposed Ko‘olani (also called Sunset Heights) project. The project area is located on Waimanu Street in Kaka‘ako, bounded by the Hawaiki Tower to the east, the Nauru Tower to the south, and the Queen Street Extension Project to the west. The archaeological inventory survey primarily consisted of subsurface testing as the project area had undergone previous stages of filling and surface clearing. The majority of the project area at the time of the survey was paved asphalt, with additional landscaped and bare-earth areas. Subsurface testing consisted of thirteen (13) trenches excavated with the use of a backhoe. Subsurface testing indicated the presence of undisturbed sand in the southwestern (*makai*) portion of the project area. The stratum that represents the original wetland surface was designated SIHP # 50-80-14-6636. Three historic garbage pits, all with artifacts dating to the first three decades of the twentieth century were designated SIHP # 50-80-14-6639 (two pits) and SIHP # 50-80-14-6641 (one pit). The remaining trenches contained primarily mixed dry fill materials, over hydraulic fill materials, down to the underlying coral shelf.

Tulchin and Hammatt (2005) conducted additional trenching at the Ko‘olani site and recovered numerous historic artifacts, mostly glass bottles. There was no evidence of indigenous pre-Contact cultural materials, early historic development, or human remains throughout the subsurface testing area. However in the course of archaeological monitoring (Hammatt 2007) for this project in 2003 to 2004, some eighteen burials were encountered. Two of these burials were isolated, single burials (SIHP # 50-80-14-6910 and –6912), while the other 16 burials comprised

a cluster of coffin burials (-6911). This cluster of coffin burials appears to have been a discrete historic cemetery.

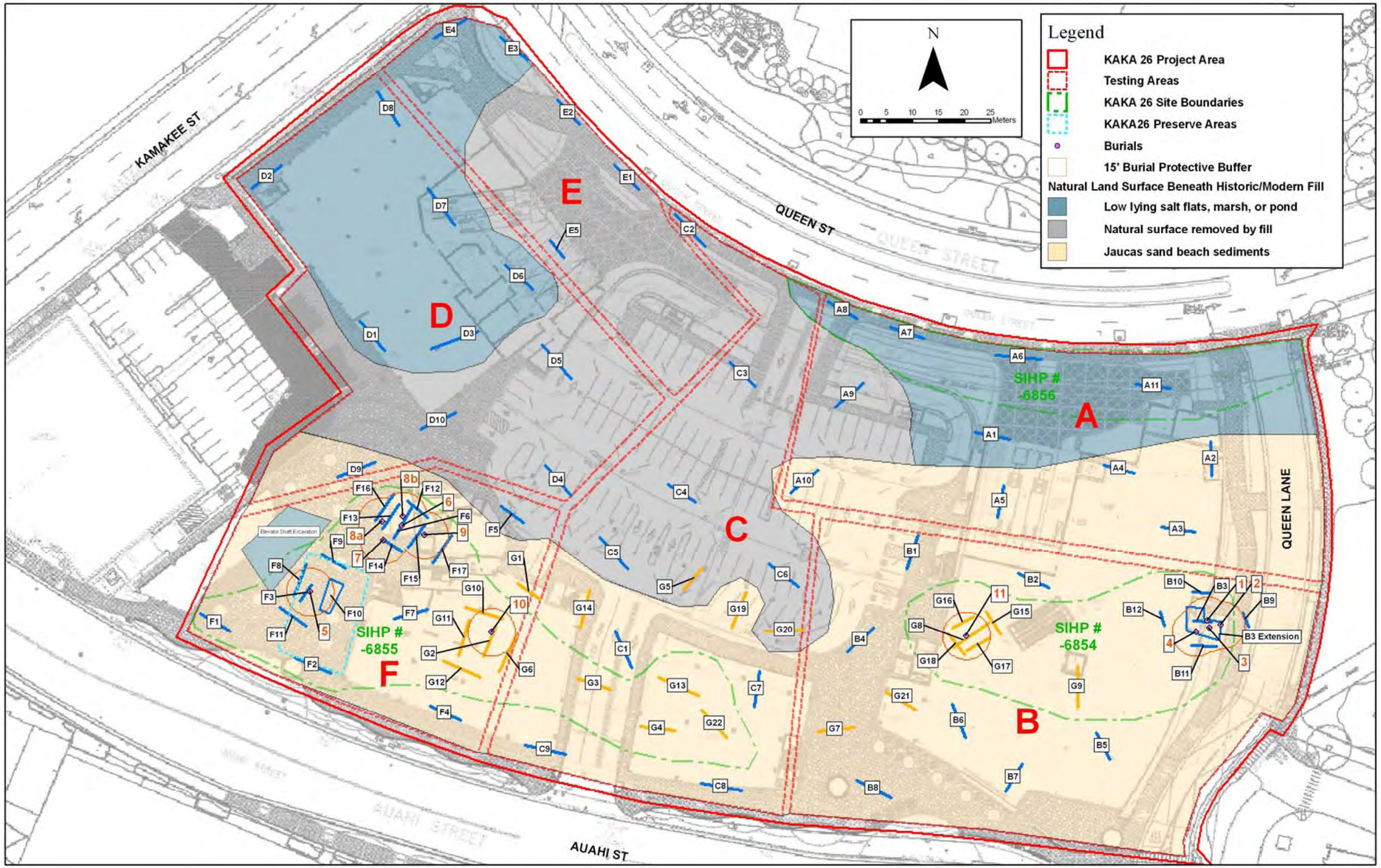


Figure 48. Victoria Ward Village Shops, trench location map showing historic property boundaries and the distribution of different types of natural land surface between fill layers

5.6.6 Street Rehabilitation Pi‘ikoi Street and Kapi‘olani Boulevard

Monitoring for the Rehabilitation of Streets, Unit 5 B Project on Pi‘ikoi Street between Ala Moana Blvd. to the south and Matlock Street to the north in urban Honolulu (TMK Plats 2-3-06, 07, 10, 11, 12, 14, 15, 35 & 38 and 2-4-03, 04, 11 & 12) was conducted by CSH (Esh and Hammatt 2006) in 2004. Construction activities in the area primarily consisted of the resurfacing of Pi‘ikoi Street. This activity did not extend deeper than 30 centimeters below base course, and did not require archaeological monitoring. Construction activity requiring monitoring was limited to excavation at the intersection of Pi‘ikoi and Young Street for traffic signal improvements. No cultural materials were encountered during monitoring.

Archaeological monitoring report for the emergency phase rehabilitation of streets: Unit 9, Phase I Kapi‘olani Boulevard from Kalākaua Avenue to Kamake’e Street Honolulu Ahupua’a, Kona District, O‘ahu (TMK: 2-3 3,4,7,9,10,15,16,21,22,35,39,40 & 41) was conducted by CSH in 2004 (O’Leary and Hammatt 2004). No archaeological remains were encountered during the excavation of the five trenches and five sewer manholes during the emergency phase of sewer rehabilitation because all of the excavation was shallow and was taking place in sediments which had been excavated previously and/or were construction fill.

5.6.7 Kaka‘ako Improvement District 10 (ID-10)

The Kaka‘ako Improvement District 10 (ID-10) project constructed improvements to drainage, water, sewer, and utility systems on Queen Street and Waimanu Street beginning at Kamake‘e Street and ending at Pi‘ikoi Street (TMK 2-3-04, 06, & 07). The project area for the extension of Queen Street, between Kamake‘e Street and Pi‘ikoi Street is approximately 792 linear meters (2600 linear feet) long (see Figure 39). During monitoring of the construction, 30 human burials were found and disinterred. A preliminary analysis (O’Hare et al. 2003) of the human skeletons and the associated grave goods indicates that 28 of the burials (SIHP # 50-80-14-6658) constitute a cemetery possibly used between the 1840s and the 1880s. Two burials (SIHP # 50-80-14-6659) were isolated finds and may not be related to the main cemetery cluster. These remains were located just to the southwest of the current project area. Historic trash pits (SIHP # 50-80-14-6660) were also discovered during monitoring (O’Hare. et al. 2006). The human remains and associated grave goods will be reburied on-site in a specially constructed vault complex.

Six stratigraphic strata were described: Stratum I consists of a number of twentieth century fill layers (designated Ia-Ii). These strata often contained historic trash dating to the 1920s and 1930s. Substrata Ia-Ih were dry fills. Substratum Ii was a “wet” fill material, consisting of dark reddish brown fine clay that was dredged from inshore or offshore waters and hydraulically pumped as a slurry of fine grained sediments into the wetland area during the reclamation of the Kewalo area in the 1920s and 1930s. Stratum II and III consisted of well-sorted fine sands; each had a weak “A” horizon at the top of the stratum. Stratum IV was a layer of coarse sand representing an unconsolidated reef deposit. Stratum V was a gleyed or clay layer, which represents the original pre-Contact to early post-Contact marshy environment of the area. Stratum V was subdivided into two substratum, a light greenish gray gleyed clay (Va), and a gray clay mixed with decomposing coral (Vb). Stratum V was interpreted as the result of the

creation of a low-energy depositional environment, with fine silts and clays deposited by low-velocity water. Stratum VI was the coral bedrock shelf.

Three profiles are located west of the cemetery in Area 1. Beneath the modern fill layers (Stratum I), this area has pockets of intact sand (Strata II and III), but did not contain any burials. It is possible that this sandy section (Area 1) was not as stable as the sandbar area (Area 2) adjacent to the lip of the Kolowalu Pond. This is the only area that had a stratum of “wet” coral fill, which was used in the 1920s and 1930s to fill in low-lying areas. Thus this area must have been a low lying, marshy area, not a higher, stable sand area such as Area 2. The sand strata were stratigraphically above a gleyed clay wetland layer (Stratum V) or above the coral bedrock (Stratum VI), as shown in the profile for the reinterment area (Figure 49and Figure 50).

Area 2 is limited to a section of the Queen Street Extension in which there is a continuous area of undisturbed sand strata, Strata II and III. It was within this area that 28 human burials were uncovered within a discrete cemetery, designated Site 50-80-14-6658. These two sand strata probably represented two sequential sandbar surfaces on the southwestern edge of the Kolowalu Parcel pond. The burials that were excavated (intruded) through Stratum II and III sometimes also intruded into the next lower strata, Stratum IV, a layer of coarse sand or Stratum V, the gleyed clay wetland layer. Although Strata II and III represent stable surfaces near the pond, no evidence for habitation (such as postholes, firepits, or scattered traditional Hawaiian artifacts) was found within these strata. In several trenches, the water table was found at the base of these strata. At the eastern edge of Site -6658, within Stratum III and intruding into one burial of that site, a trash pit with artifacts dating to the 1920s-1930s was exposed, as shown in the profile for the north wall of the cemetery area (Figure 51).

Area 3, east of area 2, had no intact sand deposits, and would have been within the Kolowalu Parcel, and thus part of the pond. Area 3 includes all excavations in the project area from the eastern end of Area 2 to the extreme east end of the project area, at the new junction of Queen Street and Pi‘ikoi Street. In this area, fill materials are found all of the way down to the top of a stratum of gleyed clay (Stratum V), which formed on the bottom of the pond, or down to the coral bedrock (Stratum VI).

5.6.8 Hokua Towers

In 2006, archaeological monitoring was conducted by CSH during excavations associated with Hawaiian Electric Company’s (HECO) underground electrical duct installation to be used to service the newly constructed Hokua Tower on Auahi Street (Bush and Hammatt 2006). Excavations took place using a backhoe with a 2’-wide bucket, as well as by hand shoveling. Excavations included 350 m of electrical line trenching and two associated manholes along a centerline (see Figure 39).

The excavated electrical trench provided a detailed view of a cross-section of the stratigraphy for the project area. Profiles were taken at regular intervals along the excavation trenches. The following general strata description represents a ‘typical’ profile. No archaeological finds were encountered during monitoring.

Stratum I represents the dry, uppermost fill layers. Stratum II represents fill material, pumped or dumped from shoreline dredging operations dating back to the construction of the Ala Wai Canal and Ala Moana Beach Park in the mid-1920s and the Kewalo Basin in the 1930s. Stratum

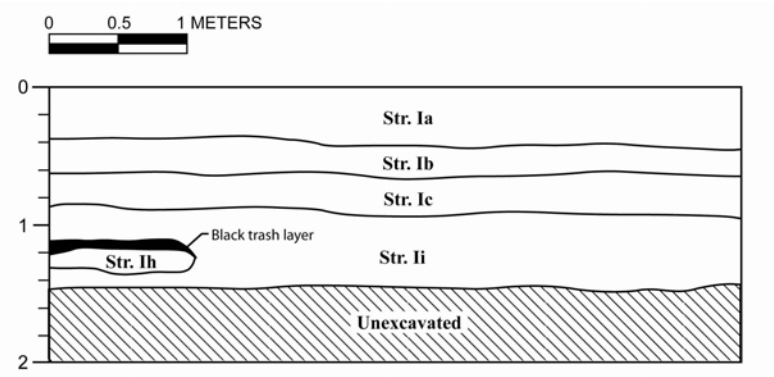


Figure 49. Kaka‘ako Improvement District 10 (ID-10), Profile Area 1: Burial Reinterment pit, north face; a portion of Site 50-80-14-6660 (historic trash pit Stratum Ih) intrudes into this area (O’Hare et al. 2006)

Profile Area 1: Burial Reinterment Pit, north face

St. Description

Ia **Fill**; Brown (10YR 4/3) sandy loam with 50% gravel and cobbles; weak, fine, granular structure; loose when dry, non-plastic; abrupt, smooth boundary; contains modern trash.

Ib **Fill**: Light yellowish brown (10YR 6/4) silt loam with 40% gravel and cobbles; weak, fine granular structure; weakly coherent when dry, non-plastic; abrupt boundary; contains modern trash.

Ic **Fill**: Very pale brown (10YR 8/2) medium to coarse sand with 80% crushed coral rubble; single grain structure, loose when moist and dry, non-plastic; abrupt, smooth boundary.

Ih Historic Trash Dump (Site 50-80-14-6660)

Ii Greenish Gray (10GY 5/1) clay; “wet” dredged material; weak, medium subangular blocky structure; microlayers; sticky when wet, slightly plastic.

Figure 50. Kaka‘ako Improvement District 10 (ID-10), Profile Area 1: North face of burial reinterment pit (O’Hare et al. 2006)

Profile Area 2: Profile probing pit, burial probe testing area, north face

St. Description

Ia **Fill**; Brown (10YR 4/3) sandy loam with 50% gravel and cobbles; weak, fine, granular structure; loose when dry, non-plastic; abrupt, smooth boundary; contains modern trash.

Ic **Fill**: Very pale brown (10YR 8/2) medium to coarse sand with 80% crushed coral rubble; single grain structure, loose when moist and dry, non-plastic; abrupt, smooth boundary.

Ih **Fill**: Historic Trash dump; this is a portion of Site -6660 (early nineteenth century trash pit), which intrudes into the cemetery (Site -6658) near Burial 22.

II Gray (10YR 5/1) sand; fine to medium granular structure; loose when moist, slightly plastic; abrupt, smooth boundary; burials of Site 50-80-14-6658 intrude through this stratum.

III Light gray (10YR 4/2) fine well-sorted sand; single grain structure; loose when dry, non-plastic; burials of Site -6658 are found at the base of this stratum.

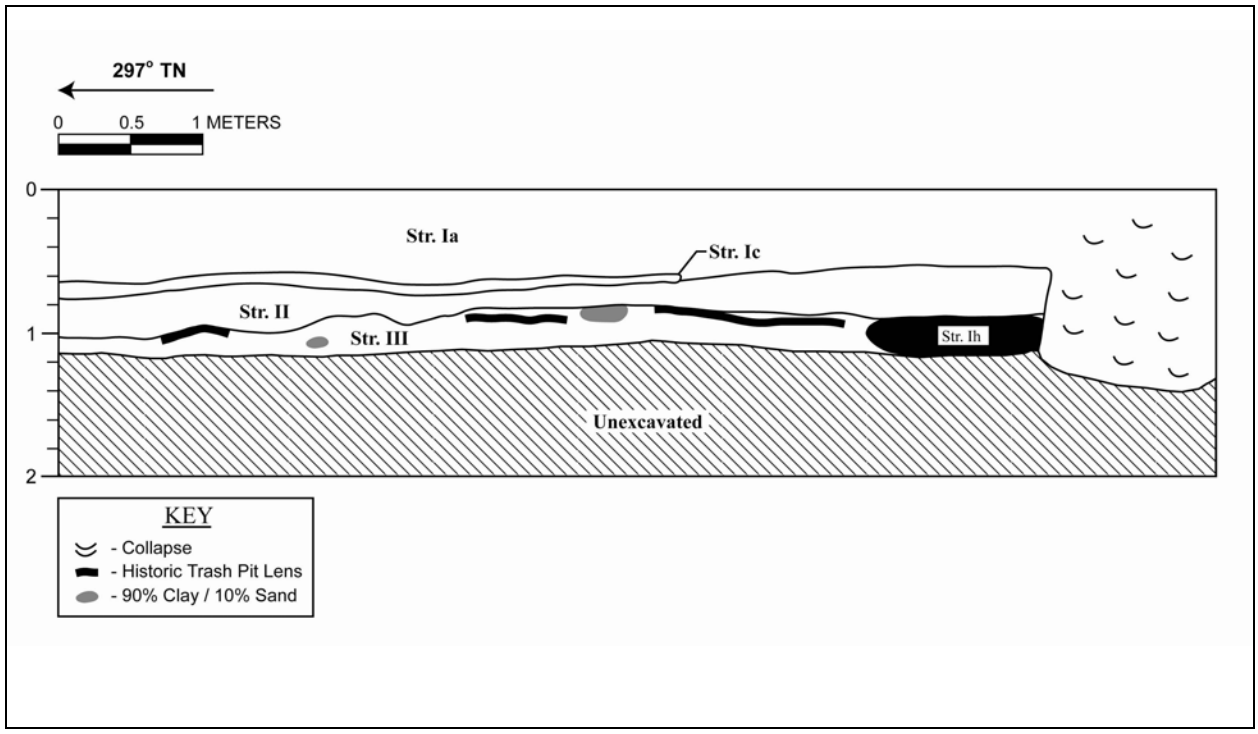


Figure 51. Kaka‘ako Improvement District 10 (ID-10), Profile Area 2: Burial probe testing area, north face (O’Hare et al. 2002)

III represents the original ground surface before the Kewalo area was filled with marine and other sediments in the early part of the 20th century. This stratum consists of sand, and is believed to be contemporary with burials that have been discovered in the general vicinity surrounding the project area. Stratum IV is the layer above the coral reef substrate, composed of a greenish-gray gley mixed with coarse sand; containing up to 75% coral boulders. The top of the water table was usually found at the top of this layer, on average at 170 cmbs (centimeters below surface).

A profile was taken of Manhole 2 (Figure 52), located in front of the Starbucks coffee shop (east end of project area). No cultural material was encountered during the entire length of trenching, but .a possible buried “A” horizon was encountered in the middle of trenching between the two manholes, directly fronting Starbucks. The sand layer continued, at varied depths and thicknesses, for the entire length of trenching.

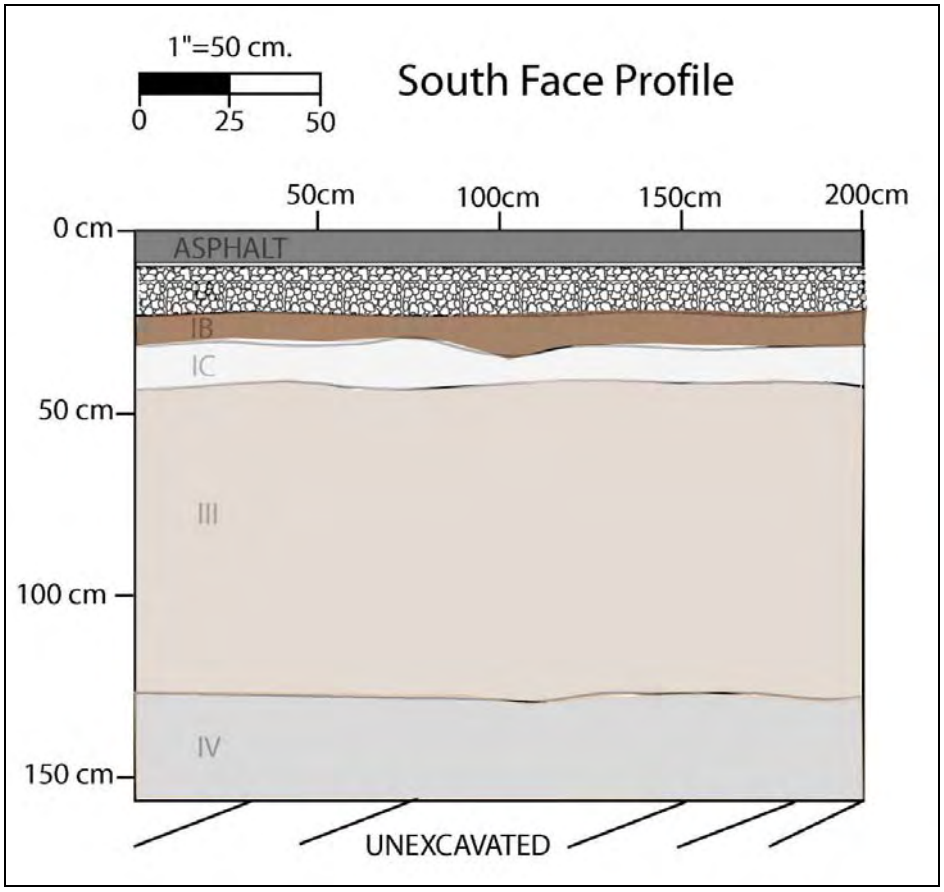


Figure 52. Hokua Towers, Profile 3 Trenching near Manhole 2 (Bush and Hammatt 2006)

IA Road Fill; angular basalt gravel, terrestrial origin, abrupt, smooth lower boundary;

IB Fill: 7.5 YR 4/1 Dark Gray sandy loam, structureless, dry, loose, non-plastic, no cementation, mixed origins, abrupt, smooth lower boundary;

IC Fill: 7.5 YR 8/1 White coral rubble with crushed coral sand, coarse, granular, dry, non-plastic, no cementation, marine origin, abrupt, smooth lower boundary;

III 10 YR 7/2 Light Gray sand, fine to medium texture, structureless, wet, loose, non-plastic, no cementation, marine origin, contains naturally occurring marine shell; sterile coralline beach;

IV Grey sludge mixed with 70% coral boulders to cobbles and a coarse crushed coral sand; this is the decomposing remains immediately above the existing coral shelf.

5.7 Engineers Boring Logs

The engineering firms of Ernest K. Hirata and Associates, Inc. (identified by B#-3) and R. M. Towill Corporation (identified by B-#) have excavated several exploratory borings in the Kaka‘ako area. The engineering firms described their soils under the United Soil Classification System, which is different that than the U.S. Department of Agriculture Soil Classification System used by CSH archaeologists. This makes it somewhat difficult to compare soil profiles described by the engineers with those in previous archaeological reports. The engineers also do not identify buried A horizons (former land surfaces), nor do they identify cultural layers. The descriptions of the soils in the bores is described in Table 4 and the locations of the bores excavated by engineers are shown on Figure 53. The soils in Table 4 are generally listed by location, from west to east from Keawe Street on the west to the eastern end of Queen Street.

The boring holes were generally excavated beneath present street surfaces. The top layer is the asphaltic concrete with a base course of gravel or sand/gravel. In most areas, beneath this is a tan silty sand, a calcareous sand. In boring holes, near the northwestern corner of the Mauka Area District there is a stratum of black silty sand with volcanic cinders from the Tantalus/Sugarloaf eruptions (shown on Figure 53). In most places, there is an underlying layer of gray, mottled gray, or dark gray silty sand, which the engineering firm Ernest K. Hirata and Associates, Inc. identifies as lagoon deposits. R.M. Towill does not interpret their soils profiles. This lagoon deposit was usually found from 4.0-5.0 ft (1.2-1.5 m) below the surface. At B1-2168, near the northwestern corner of the Kaka‘ako area, it was found at 6.0 ft (1.8 m) below surface, and at B12-2204, near the southeastern corner of the Kaka‘ako area it was found at 7.0 ft (2.1 m) below the surface.

The 2604 series of holes along Ward Street was excavated only deep enough to expose the underlying fill layers beneath the road. The other boring holes series were excavated through the top of the coral shelf/coral rubble stratum. This coral shelf was found as shallow as 7.5 ft (2.3 m) below surface (B1-2204) near the northwestern corner of the Kaka‘ako area to a depth as great as 24 ft (7.3 m) below the surface in the southeastern corner (B12-2204). The locations of areas with the coral shelf approximately 10 ft below the surface, 10-20 ft below the surface, and 20-24 ft below the surface are shown on Figure 53.

Table 4. Engineering Firms Boring Log Information

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
B-2	0-0.07	0-0.3	Asphalt	Pavement
South	0.07-0.3	0.3-1.0	Gray silty sand with gravel	Fill
	0.3-0.6	1.0-2.5	Grayish brown clayey silt	
	0.6-1.5	2.5-5.0	Brown silty sand	
	1.5-3.0	5.0-10	Grayish brown silty sand	
	3.0-4.7	10-15.5	Coral	Coral shelf
B-14	0-0.07	0-0.3	Asphalt	Pavement
South	0.07-0.6	0.3-2.0	Gray tan silty sand	

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
	0.6-1.2	2.0-4.0	Tannish white silty sand	
	1.2-1.5	4.0-5.0	Grayish brown sandy silt	
	1.5-2.4	5.0-8.0	Gray tan silty sand	
	3.0-4.9	10-16	Coral	Coral shelf
B-22	0-0.07	0-0.3	Asphalt	Pavement
South	0.07-1.5	0.3-5.0	Grayish brown silty sand	
	1.5-3.0	5.0-10	Dark gray silty sand	
	3.0-3.7	10-12	Gray white gravelly sand	
	3.7-4.6	12-15	Gray silty sand	
	4.6-4.7	15-15.5	Dark brown cemented sand	
	4.7-7.0	15.5-23	Coral	Coral shelf
B-30	0-0.07	0-0.3	Asphalt	Pavement
South	0.07-1.5	0.3-5.0	Grayish brown silty sand	
	1.5-2.1	5.0-7.0	Tannish white silty coral	
	2.1-2.7	7.0-9.0	Grayish brown clayey sand	
	2.7-6.0	9.0-20	Gray clayey coral sand	
	6.0-7.9	20-25.8	Tannish white coral	Coral shelf
B-25	0-0.05	0-0.2	Asphalt	Pavement
Keauhou-Keawe	0.05-0.9	0.2-3.0	Grayish brown silty sand with some gravel	Fill
	0.9-1.2	3.0-4.0	Tannish white coral gravel	Fill
	1.2-1.7	4.0-5.5	Dark gray to black silty sand	
	1.7-3.6	5.5-11	Gray silty sandy coral gravel	
	2.6-4.6	11-15	Gray fine sandy silt	
	4.6-4.9	15-16	Tannish white coral	Coral shelf
B-10	0-0.05	0-0.2	Asphalt	Pavement
South-Keawe	0.05-1.1	0.2-3.5	Gray silty sand with gravel	Fill
	1.1-1.5	3.5-5.0	Gray silty clay with sand	
	1.5-2.1	5.0-7.0	Gray black silty sand with some cinders	
	2.1-3.0	7.0-10	Black silty sand	
	3.0-4.6	10-15	Tannish white coral	Coral shelf
B-15	0-0.07	0-0.3	Asphalt	Pavement
South-Keawe	0.07-0.9	0.3-3.0	Grayish brown silty sand	
	0.9-1.2	3.0-4.0	Black organic silt	
	1.2-2.1	4.0-7.0	Gray white gravelly sand	
	2.1-3.0	7.0-10	Black sand (volcanic cinders)	
	3.0-4.6	10-15.1	Tannish white coral	Coral shelf

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
B-18	0-0.07	0-0.3	Asphalt	Pavement
South-Keawe	0.07-0.6	0.3-2.0	Gray silty sand	Fill
	0.6-1.1	2.0-3.5	Concrete rubble	Fill
	1.1-2.1	3.5-7.0	Tan gray silty sand	
	2.1-3.0	7.0-10	Black silty sand	
	3.0-4.4	10-14.5	Tannish white coral	Coral shelf
B-19	0-0.07	0-0.3	Asphalt	Pavement
Keawe-Coral	0.07-0.3	0.3-3.0	Brown sandy silt	
	0.9-1.8	3.0-6.0	Gray white silty sand	
	1.8-3.0	6.0-10	Black sand (cinders)	
	3.0-5.0	10-16.5	Tannish white coral	Coral shelf
B2-1615	0-0.1	0-0.2	Asphalt	Pavement
Keawe-Coral	0.1-1.1	0.2-3.5	Mottled gray silty sand	Sand
	1.1-1.2	3.5-4.0	Loose silty sand	Sand
	1.2-2.9	4.0-9.5	Silty sand with coral	Lagoon
	2.9	9.5-25.4	Loose silty sand with coral	Lagoon
	2.9	25.4	Coral	Coral shelf
B1-1615	0-0.1	0-0.2	Asphalt	Pavement
Keawe-Coral	0.1-0.5	0.2-1.5	Tan Silty sand	Sand
	0.5-0.9	1.5-3.0	Mottled gray silty sand	Lagoon
	0.9-4.4	3.0-14.5	Mottled gray loose silty sand	Lagoon
	4.4-5.8	14.5-19	Gray clayey sand	Lagoon
	5.8	19	Coral	Coral shelf
B-26	0-0.2	0-0.9	Asphalt and concrete	Pavement
Coral	0.2-1.4	0.9-4.5	Tannish white silty sand with some gravel	Fill
	1.4-5.2	4.5-17	Gray white silty sand	
	5.2-5.6	17-18.5	Tan gray gravelly sand	
	5.6-6.3	18.5-20.7	Tannish white coral	Coral shelf
B-35	0-0.15	0-0.6	Asphalt and gravel	Pavement
Coral-Lana	0.15-10.7	0.6-3.5	Tannish white silty sand with some gravel	Fill
	10.7-3.0	3.5-10	Gray silty sand	
	3.0-6.0	10-20	Grayish white clayey gravel	
B1-2168	0-1.8	0-6.0	Tan/grayish silty sand	Sand
Coral-Lana	1.8-4.1	6.0-13.5	Gray silty sand with coral	Lagoon

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
	4.1	13.5	Coral	Coral shelf
B2-2168	0-1.5	0-5.0	Grayish tan silty sand	Sand
Coral-Lana	1.5-1.8	5.0-6.0	Tan/Gray silty sand	Sand
	1.8-4.0	6.0-13	Gray silty sand	Lagoon
	4.0	13.0	Coral	Coral shelf
B3-2168	0-1.8	0-6.0	Grayish tan silty sand	Sand
Coral-Lana	1.8-4.5	6.0-15	Gray silty sand	Lagoon
	4.5	15	Coral	Coral shelf
B4-2168	0-0.8	0-2.5	Grayish brown silty sand	Sand
Coral-Lana	0.8-1.8	2.5-6.0	Tan silty sand	Sand
	1.8-3.4	6.0-11	Gray silty sand	Lagoon
	3.4	11	Coral	Coral shelf
B1-1601	0-0.2	0-0.5	Asphalt	Pavement
Ohe-Koula	0.2-0.6	0.5-2.0	Reddish brown Clayey silt	Fill
	0.6-1.2	2.0-4.0	Mottled gray Silty sand	Sand
	1.2-1.5	4.0-5.0	Dark Gray Clayey silt	Lagoon
	1.5-5.2	5.0-17	Dark Gray Silty sand	Lagoon
	5.2	17	Coral	Coral shelf
B-11	0-0.07	0-0.3	Asphalt	Pavement
Emily-Cooke	0.07-0.6	0.3-2.0	White sandy coral gravel	Fill
	0.6-0.9	2.0-3.0	Gray silty sand with some gravel	
	0.9-2.1	3.0-7.0	Tan gray silty sand	
	2.1-3.0	7.0-10	Black silty sand with some cinders	
	3.0-4.6	10-15.1	Tannish white coral	Coral shelf
B-45	0-0.07	0-0.3	Asphalt	Pavement
Curtis-Cooke	0.07-1.8	0.3-6.0	Tan and gray silty sand with coral gravel	Fill
	1.8-5.0	6.0-16.5	Gray clay silt; grades to silty sand; grades to sandy wil with trace of organics	
B-16	0-0.07	0-0.3	Asphalt	Pavement
Coral-Cooke	0.07-1.4	0.3-4.5	Dark gray silty sand with glass	Fill
	1.4-1.5	3.5-5.0	Dark gray silty sand	
	1.5-2.3	5.0-7.5	Gray white sandy silt	
	2.3-3.0	7.5-10	Black silty sand (cinders)	

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
	3.0-4.6	10-15.1	White coral	Coral shelf
B-27	0-0.07	0-0.3	Asphalt	Pavement
Cooke	0.07-0.6	0.3-2.0	Tannish white sandy gravel	Fill
	0.6-1.2	2.0-4.0	Black sand and organic silt	
	1.2-3.6	4.0-11	Gray white silty coral gravel	
	3.6-4.6	11-15	Tanish white coral	
B-28	0-0.07	0-0.3	Asphalt	Pavement
Cooke	0.07-0.9	0.3-3.0	Dark gray silty sand with glass	Fill
	0.9-1.4	3.0-4.5	Dark gray silty sand	
	1.4-2.1	4.5-7.0	Gray white sandy silt	
	2.1-4.6	7.0-15	Black silty sand (cinders)	
	4.6-5.2	15-17	White coral	Coral shelf
B2-1601	0-0.2	0-0.5	Asphalt and base course	Pavement
Ohe-Koula	0.2-0.9	0.5-3.0	Mottled gray Silty sand	Sand
	0.9-1.4	3.0-4.5	Dk. Gray Clayey silt	Lagoon
	1.4-4.9	4.5-16	Mottled Tan Silty sand	Lagoon
	4.9	16	Coral	Coral shelf
B1-2604	0-0.9	0-3	Light brown silty sand	Fill
Ward Ave.	0.9-2.6	3.0-8.5	Tan sandy coral gravel	Fill
	2.6	8.5	End of bore	--
B2-2604	0-0.3	0-1.0	Asphalt and base course	Road
Ward Ave.	0.3-0.9	1.0-3.0	Brown silty sand with gravel	Fill
	0.9-2.0	3.0-6.5	Tan sandy coral gravel	Fill
	2.0	6.5	End of bore	--
B3-2604	0-0.2	0-0.8	Asphalt and base course	Road
Ward Ave.	0.2-1.1	0.8-3.0	Brown silty sand	Fill
	1.1-1.7	3.0-5.5	Light brown sand with coral	Fill
	1.7	5.5-8.0	Sandy coral gravel	Fill
		8.0	End of bore	--
B4-2604	0-0.3	0-0.8	Asphalt and base course	Road
Ward Ave.	0.3-0.9	0.8-3	Brown silty sand	Fill
	0.9-1.5	3-5	Light brown sand with coral	Fill
	1.5-2.3	5.0-7.5	Sandy coral gravel	Fill
	2.3	7.5	End of bore	--
B1-2204	0-0.2	0-0.7	Asphalt and base course	Road

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
Cooke-Kamani	0.2-1.5	0.7-5.0	Mottled grayish brown silty sand	Sand
	1.5-2.3	5.0-7.5	Mottled gray silty sand	Lagoon
	2.3	7.5	Coral	Coral Shelf
B2-2204	0-0.5	0-1.5	Asphalt and base course	Road
Kamani-Ward	0.5-1.5	1.5-5.0	Tan silty sand	Sand
	1.5-4.4	5.0-14.5	Mottled gray silty sand	Lagoon
	4.4	14.5	Coral	Coral shelf
B3-2204	0-0.5	0-1.5	Asphalt and base course	Road
Ward-Cummins	0.5-1.4	1.5-4.5	Tan silty sand	Sand
	1.4-4.3	4.5-14	Mottled gray silty sand	Lagoon
	4.3	14	Coral	Coral shelf
B4-2204	0-0.2	0-0.5	Asphalt	Road
Ward-Cummins	0.2-1.5	0.5-5.0	Tan silty sand	Sand
	1.5-5.8	5.0-19	Gray silty sand	Lagoon
	5.8	19	Coral	Coral shelf
B5-2204	0-0.5	0-1.8	Asphalt and base course	Road
Cummins	0.5-1.5	1.8-5.0	Mottled grayish brown silty sand	Sand
	1.5-6.4	5.0-21	Gray silty sand	Lagoon
	6.4	21	Coral	Coral Shelf
B6-2204	0-1.1	0-1.3	Asphalt and base course	Road
Cummins	1.1-1.5	1.3-3.5	Tan silty sand	Sand
	1.5-2.7	5.0-9.0	Gray silty sand	Lagoon
	2.7-10.4	9.0-34	Gray silty sand with increased coral content	Lagoon
	10.4	34	Coral	Coral Shelf
B7-2204	0-0.1	0-0.2	Asphalt and base course	Road
Kamake‘e	0.1-1.2	0.2-4.0	Tan silty sand	Sand
	1.2-2.7	4.0-9.0	Mottled gray silty sand	Lagoon
	2.7-7.3	9.0-24	Mottled gray silty sand-increased silt content	Lagoon
	7.3	24	Coral	Coral shelf
B8-2204	0-0.5	0-1.8	Asphalt and base course	Road
Kamake‘e	0.5-1.5	1.8-5.0	Tan silty sand	Sand
	1.5-2.7	5.0-9.0	Mottled gray silty sand	Lagoon
	2.7-7.3	9.0-24	Mottled gray silty sand-increased coral content	Lagoon

Bore ID (Streets)	Depth (m)	Depth (ft)	Classification	Deposit Type
	7.3	24	Coral	Coral shelf
B9-2204	0-0.3	0-1.0	Asphalt and base course	Road
Kamake‘e	0.3-1.4	1.0-4.5	Mottled tan silty sand	Sand
	1.4-7.3	4.5-24	Light gray silty sand	Lagoon
	7.3	24	Coral	Coral shelf
B10-2204	0-0.4	0-1.2	Asphalt and base course	Road
Kamake‘e-Queen	0.4-1.1	1.2-3.5	Mottled grayish brown silty sand	Sand
	1.1-2.1	3.5-7.0	Gray silty sand with clay	Lagoon
	2.1-5.8	7.0-19	Gray silty sand with clay-increased coral content	Lagoon
	5.8-9.3	19-30.5	Tan silty sand with clay-high coral content	Lagoon
	9.3	30.5	End of bore	--
B11-2204	0-0.4	0-1.2	Asphalt and base course	Road
Kamake‘e-Queen	0.4-1.5	1.2-5.0	Tan silty sand	Sand
	1.5-3.7	5.0-12	Mottled gray silty sand	Lagoon
	3.7-9.3	12-30.5	Mottled gray, loose silty sand	Lagoon
	9.3	30.5	End of bore	--
B12-2204	0-0.2	0-0.8	Asphalt and base course	Road
Kamake‘e	0.2-1.5	0.8-5.0	Tan silty sand	Sand
	1.5-2.7	5.0-9.0	Mottled gray silty sand	Lagoon
	2.7-5.8	9.0-19	Mottled gray silty sand with increased silt content	Lagoon
	5.8-8.8	19-29	Mottled gray silty sand with increased coral fragments	Lagoon
	8.8-12.3	29-40.5	Mottled tan silty sand	Lagoon
	12.3	40.5	End of bore	--
B-13-2204	0-0.4	0-1.3	Asphalt and base course	Road
Kamake‘e	0.4-2.1	1.3-7.0	Tan silty sand	Sand
	2.1-5.8	7.0-19	Gray silty sand	Lagoon
	5.8-8.8	19-29	Mottled tan silty sand	Lagoon
	8.8-12	29-39.5	Mottled gray silty sand	Lagoon
	12.0	39.5	End of bore	--

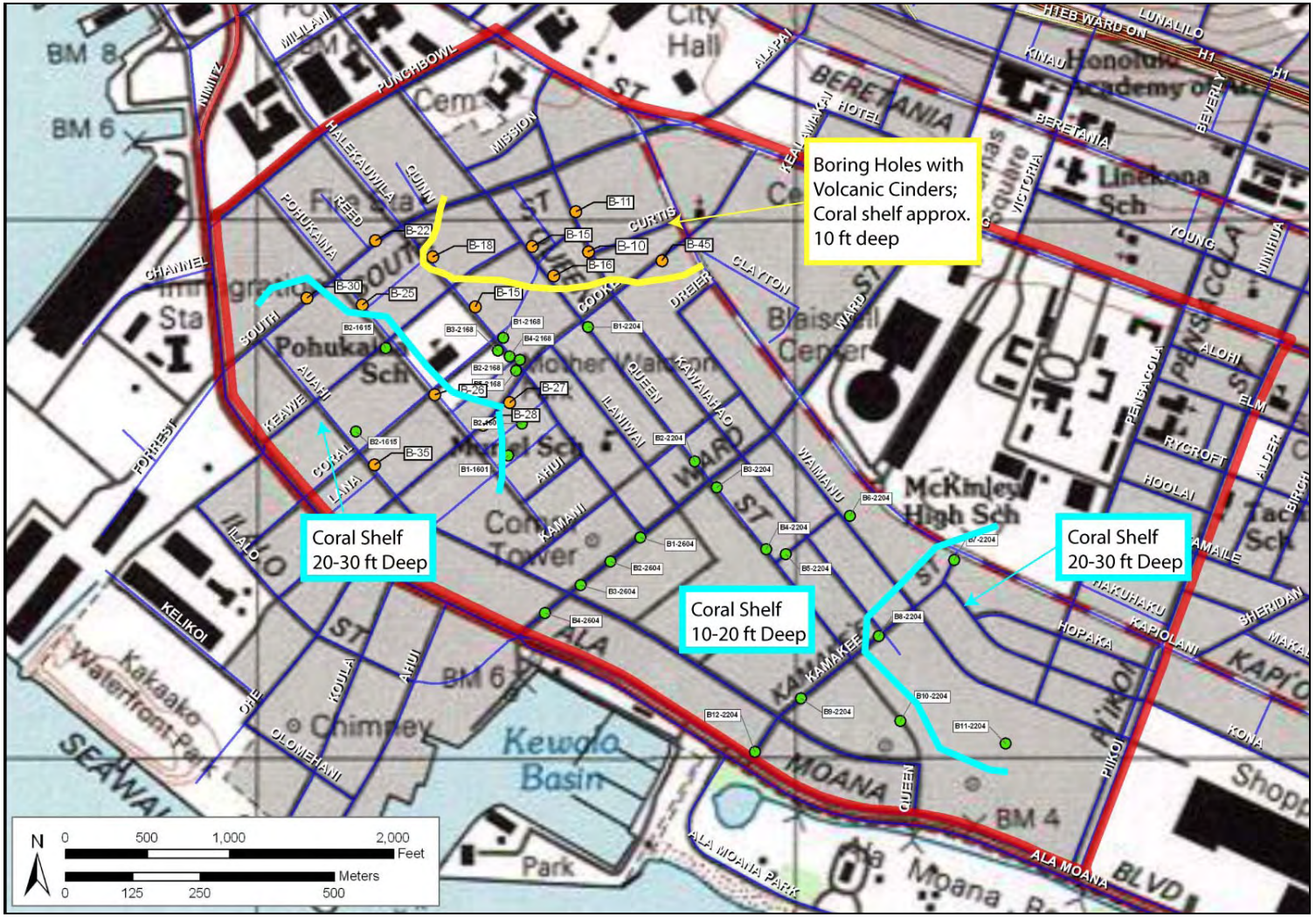


Figure 53. Boring log locations; boring holes with volcanic cinders in the NW corner; coral shelf is 20-30 ft deep at the SE and SW corners, 10 20 feet deep in the central section, and approximately 10 ft deep in the NW corner

5.8 Summary of Information from Previous Archaeological Research

5.8.1 Summary of Kaka‘ako Stratigraphy

The Kaka‘ako Mauka Area has been heavily modified over the last 150 years due to historic filling of the area for land reclamation. However, much of the cultural and natural deposits and land forms of the area (low-land marches, sand deposits, coral reef flats, and fishponds) survived below this fill. There are three major stratigraphic zones of interest in the Kaka‘ako area:

Zone 1

Zone 1 consists of two types of historic fill in Kaka‘ako. The first type was deposited during the various land reclamation projects in Kaka‘ako, when fishponds and other low-lying areas were filled. Using dredged material from Honolulu Harbor and the reef flats fronting the Kaka‘ako area, large amounts of trash and refuse from the town dump, and soil and sand from various locations on the island. The western section of Kaka‘ako (west of Ward Avenue) was largely filled in and built over the course of approximately 40 years from circa 1875 to 1915 during the Kaka‘ako and Kewalo land reclamation projects. The eastern section of Kaka‘ako was generally filled in the 1920s to the 1940s, during the excavation of the Kewalo Basin and the Ala Wai Canal. The second type of fill in Kaka‘ako consists of the layers of material used to bring the various road in the Kaka‘ako area up to grade. The road fill layers in Kaka‘ako were made up primarily of crushed coral, soil, and crushed basalt gravel. These materials were used to bring the sub-standard roads up to grade and to make them passable during the wetter part of the year.

Zone 2

Zone 2 consists of the natural and cultural strata of the land prior to the historic filling of the area including, fishpond deposits, traditional pre-Contact and early historic Hawaiian cultural layers, human burials, and the buried A horizon of the pre-fill land surface. Most archaeological features encountered include historic refuse pits, building foundations, scattered historic and prehistoric artifacts, pre-Contact refuse pits and cultural deposits, fishponds, and both historic and pre-Contact burials. Fishpond deposits are often distinguished as layers of gleyed marine sediment containing marine shell and decaying organic matter. Based on the archaeological research completed to Kaka‘ako to date, it has become apparent the vast majority of pre-Contact Hawaiian burials in Kaka‘ako are buried in natural sand layers associated with the pre-Contact intertidal shoreline. These sand layers have been extensively disturbed in some areas, but many undisturbed remnants remains.

Zone 3

Zone 3 is the geologic non-cultural and pre-cultural stratigraphy of the Kaka‘ako area including, sterile coralline sand deposits, cinder deposits from the Tantalus/Sugarloaf eruptions, and a coral reef shelf/deposit from the last interglacial period. The Tantalus eruptions are thought to have taken place only six to ten thousand years ago, making them by far the most recent eruptions of O‘ahu (Farrell 1976). The Tantalus eruptions are relatively unique to O‘ahu in terms of the type of well-sorted cinder produced. The eruption of the cinder predates human occupation in Hawai‘i by thousands of years. The cinder layer provides a very clear demarcation between the underlying sterile geologic stratigraph and the layers contemporaneous with cultural activity.

This cinder is found only on the inland portion of the Mauka Area District; on the coastal section the lowest strata is of sterile sand. Below both is a coral shelf deposited during the last interglacial period, the Waimanalo Stand, at 122,000 +/- 7,000 year before present.

5.8.2 Summary of Archaeological Resources and Predictive Model

Cultural Surveys Hawai‘i’s research suggests that the Kaka‘ako Mauka Area District is located in a region less extensively populated than the nearby centers of Waikīkī and Honolulu by the Hawaiians inhabiting the southern coast of O‘ahu before the nineteenth century. However, maps and documents produced during the nineteenth century indicate that the Kaka‘ako region had been utilized for fishpond farming, salt making, wetland agriculture, and human burials by the Hawaiians. It is likely that evidence left behind by those involved in exploiting the area’s resources remain intact beneath the late nineteenth and early twentieth century fill layers covering Kaka‘ako/Kewalo today. Figure 54 is a modern aerial map with overlays for the location of 1850s Land Commission Award houselots, former fishponds, former salt ponds and salt lands, historic structures/areas (1893 rifle range; 1911 animal quarantine station), and previously identified sites, including burials. Based on background research, it is predicted that construction activities in the Mauka Area District have the potential to inadvertently uncover:

In the Kaka‘ako Mauka Area between Punchbowl Street and Pi‘ikoi Street, there are four large historically documented cemeteries; Ka‘ākaukukui Cemetery (SIHP # -2918; 8 burials recorded), utilized from the 1700s to the early 1800s; the Honuakaha Smallpox Cemetery (SIHP # -3712; 56 burials recorded), used from 1853-1854; Kawaiaha‘o Cemetery (SIHP # -4534; 129 burials recorded), used from 1875-1920, and the King Street Roman Catholic Cemetery (SIHP # -5455; 33 burials recorded), used from the mid-1800s to the 1920s. The full extent of these cemeteries has not been excavated and there are probably hundreds of burials still within these cemeteries within the modern cemetery boundaries or under modern structures.

There is also a cluster of at least 28 historic coffin burials at the Kaka‘ako ID 10 area (SIHP # -6658) a cluster of 16 coffin burials at the Ko‘olani Condominium project area (SIHP # -6911), two coffin burials at the Kaka‘ako ID-4 area (SIHP # -5598), and two historic burials (one coffin and one with historic grave goods) at Kaka‘ako ID-3 area (SIHP # -5280). There is no historic documentation on these small burial areas and their extent and time of use is unknown. Thus a total of 274 historic burials have been recorded in some way (recorded *in situ* or disinterred) in the Kaka‘ako Mauka Area.

The remaining 66 burials found in the Kaka‘ako Mauka Area were not buried in coffins, or do not have associated historic grave goods, or consist of partial, previously disturbed, burials. Some skeletons were found in a traditional flexed position, suggesting a traditional Hawaiian burial practice. These may date to the pre-Contact period or the early post-Contact period (before the mid-19th century), when most Hawaiians adopted Western style burial practices (usually extended within a coffin). Most of these burials can not be assigned to a specific time period.

Figure 54. Aerial photograph with locations of former fishponds (shaded blue), salt ponds (shaded orange), salt works, 19th century and habitation areas and houselots (shaded green) shown on 19th century historic maps

Also found within the Kaka‘ako Mauka area are wetland/fishpond deposits (SIHP # -6636 and -6856), and historic deposits/ trash pits (SIHP # -1973, -3984, -6637, -6639, -6641, -6660, -6766, -9917, and -9991), which usually date around the last decades of the 19th to the early decades of the 20th century. These are usually inland of the main early to mid-nineteenth century habitation areas, as seen in the Kukuluae‘o and Kewalo (eastern) section of the Mauka Area District and in the Ka‘ākaukukui (western) section of the Mauka Area District (Figure 54).

In summary, post-Contact habitation refuse and fill layers are found throughout the area. Several refuse dumps have been dated to the late 19th and early 20th century, when the expansion of street construction east of the main Honolulu area brought in businesses and large number of occupants, some who lived in separate ethnic enclaves. Based on previous archaeology reports, it appears that all pre-Contact human burials in the Kaka‘ako area that have been encountered were buried in sandy deposits characteristic of this backshore area. The majority have been identified as probably of Hawaiian ethnicity, buried in the post-Contact period from the 18th to the 20th centuries.

5.8.3 Summary of Historic Resources

Kaka‘ako is a highly urbanized with a mix of low, mid and high rise structures. There are no structures in the Mauka Area that predate or reflect the style of construction prior to western contact with native Hawaiians in 1778. A few remaining buildings were built by or inspired by nineteenth century missionaries, however, most buildings in Kaka‘ako were built during the twentieth century after Hawai‘i became a U.S. territory. In consultation with the SHPD, HCDA conducted an inventory to identify structures built prior to 1941 to determine which properties in Kaka‘ako were eligible for the National Register of Historic Places (NRHP). The Chapter 206E, HRS requires that sites of historic or cultural significance within the Mauka Area must be preserved.

To preserve Kaka‘ako’s historic resources, the Draft Mauka Area Plan calls for protection of buildings which are historically significant, in productive use, and economically self-sustaining. All sites are listed on either the State or National Register of Historic Places. HCDA designated the eight properties listed in Table 3 to be protected by the Draft Mauka Area Plan. Of these, five properties are listed in the NRHP and six are listed in the HRHP. Properties listed in both Registers include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. The NRHP is administered by the National Park Service (NPS), which is part of the U.S. Department of the Interior, while DLNR manages the HRHP.

Table 5. Historic Properties to be Protected in the Kaka‘ako Mauka Area District

Historic Site	Proposed Action[1]	National Register	Hawaii Register	SIHP # [2]
Kawaiaha‘o Church and Grounds	Preservation	Yes	Yes	50-80-14-9991
Mission Houses	Preservation	Yes	Yes	50-80-14-9991
Old Kaka‘ako Fire Station	Rehabilitation	Yes	Yes	50-80-14-1346
Mother Waldron Playground	Preservation	No	Yes	50-80-14-1388

McKinley High School	Rehabilitation	Yes	No	50-80-14-9926
Makiki Christian Church	Preservation	No	Yes	50-80-14-9719
Yee/Kobayashi Store	Restoration	No	Yes	50-80-14-9739
Royal Brewery Building	Preservation	Yes	No	50-80-14-9917

Source: *Kakaako Community Development District Plan and Rules, 1982.*

Notes: [1] *Preservation means keeping a property in its present condition.*
Rehabilitation means returning a property to a useful state while preserving significant features.
Restoration means accurately renovating or replacing the original form and details of historic structures.
[2] SIHP (State Inventory of Historic Places) site designation (50=Hawai‘i, 80=O‘ahu, 14=Honolulu Quad)

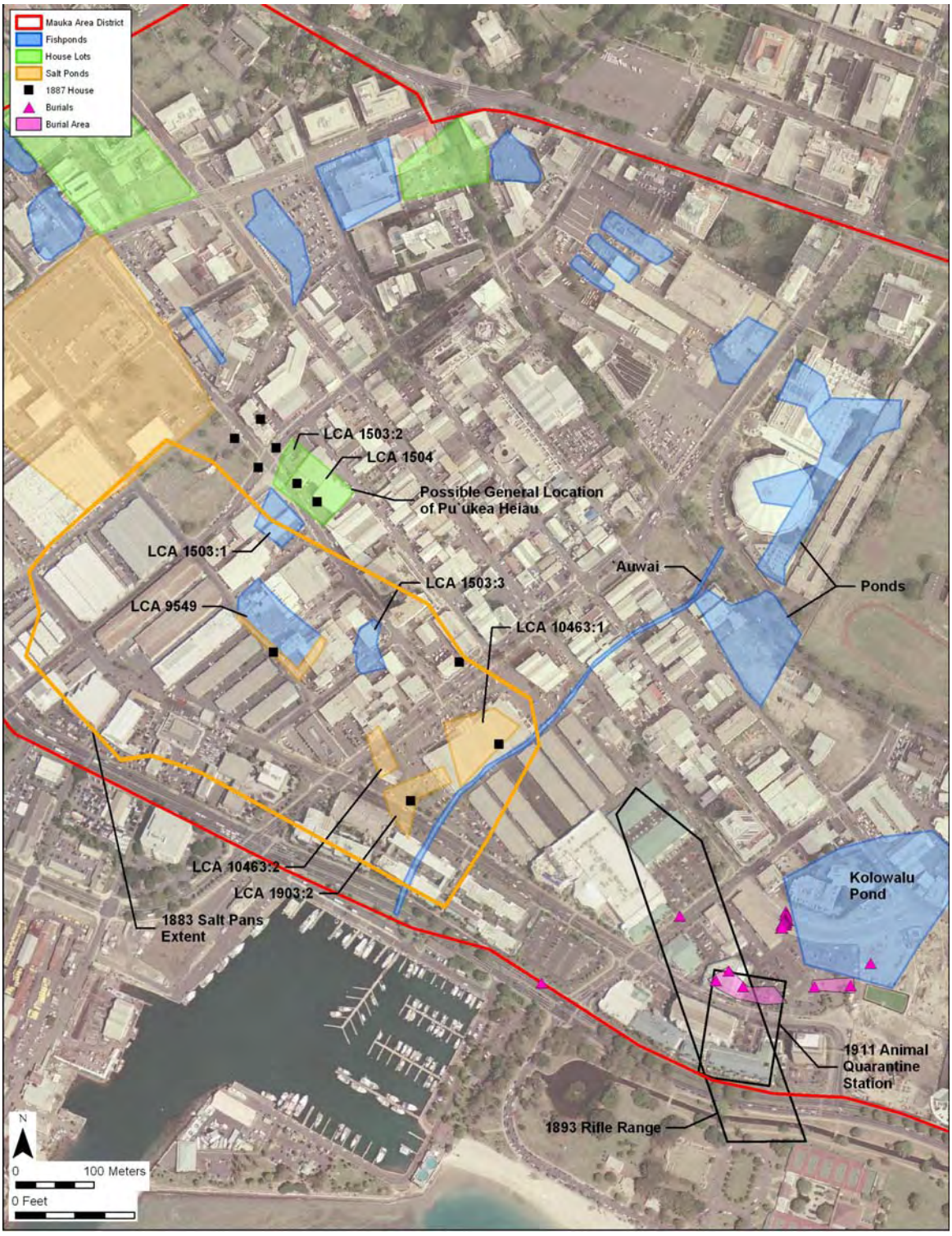


Figure 55. Former location of fishponds, salt pans and mid-nineteenth century habitation area in the Kukulae‘o and Kewalo (eastern) section of the project area

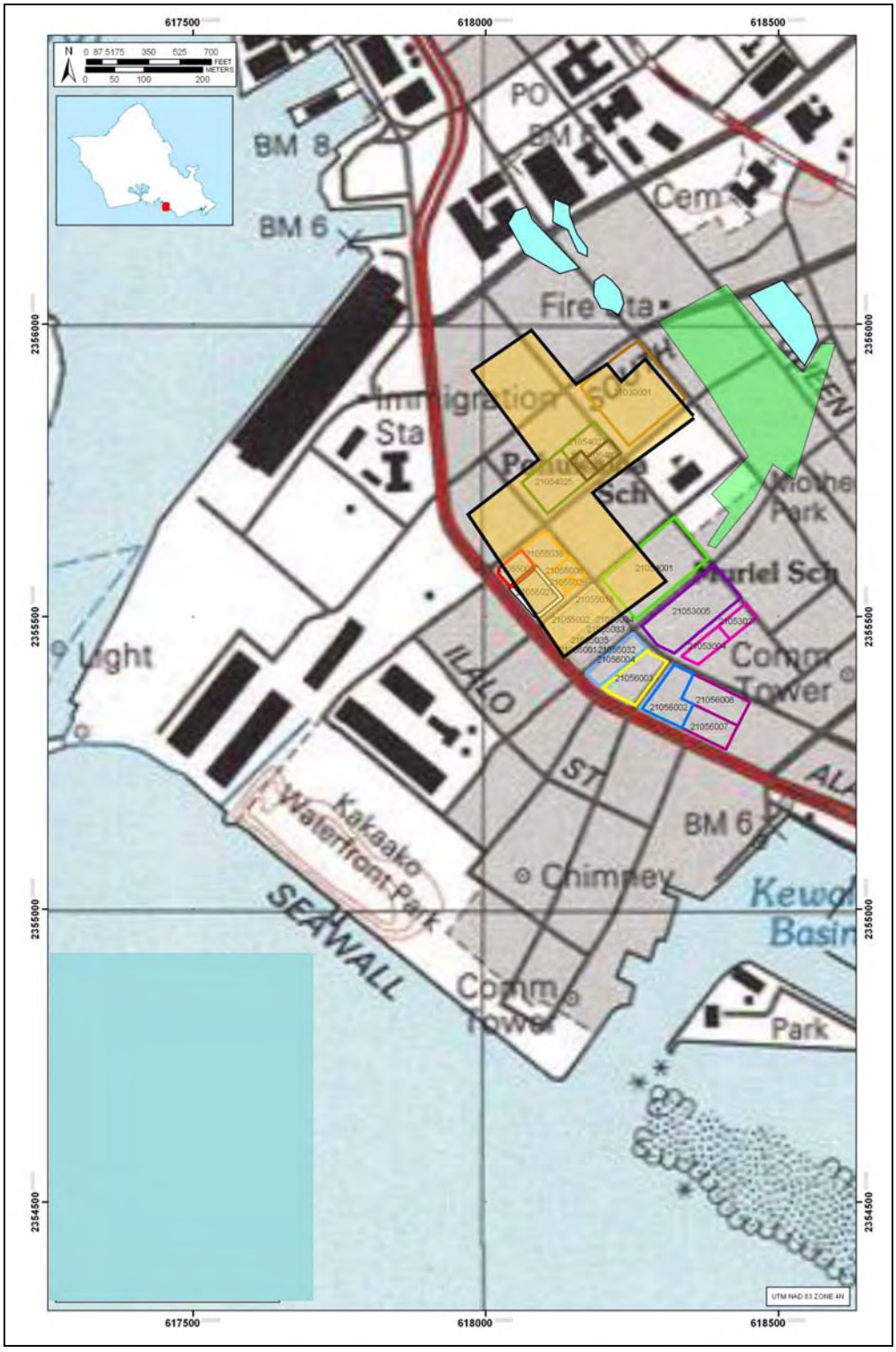


Figure 56. Former location of fishponds (shaded in blue), salt pans (shaded in orange), and habitation areas (shaded in green) in the Ka‘ākaukui (western) section

Section 6 Community Consultations

6.1 Community Consultation Effort

Throughout the course of this evaluation, 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 Mauka Area District within the larger context of Kaka‘ako, Waikīkī Ahupua‘a and surrounding environs. The community consultation effort was made by letter, e-mail, telephone and in-person contact. In the majority of cases, letters along with a map and aerial photograph of the Mauka Area District were mailed with the following text:

> We are asking your *kōkua* and participation in the Cultural Impact Assessment (CIA) that will assess potential impacts to cultural practices and resources as a result of the implementation of the proposed revisions to the Kaka‘ako Community Development District Mauka Area Plan.
>
> At the request of Hawaii Community Development Authority (HCDA), Cultural Surveys Hawai‘i, Inc. (CSH) is conducting a CIA for the 450-acre Kaka‘ako Community Development District Mauka Area located in Kaka‘ako, Waikīkī Ahupua‘a, Honolulu (Kona) District, on the island of O‘ahu, Tax Map Keys: [1] 2-1-29-32, 44, 46-56 and 2-3-01-11. The Kaka‘ako Mauka Area is bounded by King, Punchbowl, Pi‘ikoi streets and Ala Moana Boulevard. Please see the attached USGS and aerial view maps.
>
> In 2003, the HCDA initiated a comprehensive review of the Kaka‘ako Community Development District Mauka Area Plan and Rules (“Plan”), originally adopted in 1982. The Plan establishes planning principles and development objectives for the orderly redevelopment of the Kaka‘ako Mauka Area. The comprehensive review has resulted in proposed revisions to the existing Plan. After an extensive public (pedestrian, bicycle, automobile and public transportation input process, a Draft Mauka Area Plan was completed in May 2007. Major revisions include:
>
> - Developing a pedestrian-friendly mixed-use district where people are able to work, live, shop and play in a neighborhood community. New developments would be mixed horizontally as well as vertically, while achieving the highest use of prime urban land.
> - Creating great places, including a network of green streets and pedestrian friendly environment.
> - Encouraging a mix of housing opportunities, including reserved housing units for gap group residents.
> - Allowing easy connections) and providing strong physical and visual Mauka-Makai connections.

- Supporting the small lot, mixed-use pattern of Central Kaka‘ako.

The intent of the Draft Mauka Area Plan is to provide necessary guidance in planning and development of a high-quality, urban community that also promotes positive economic development, preserves Honolulu’s diverse cultural heritage, and incorporates best practices in energy and environmental sustainability.

A Draft Supplemental Environmental Impact Statement (“SEIS”) has been prepared to assess the impacts that may result from proposed revisions to the Plan. The CIA will be included in the SEIS. Although the redevelopment will be in Kaka‘ako, this CIA will include the entire *ahupua‘a* of Waikīkī. We are seeking your *kōkua* and guidance on any of the following aspects of this study:

The purpose of this cultural study is to assess potential impacts to cultural practices and resources as a result of proposed development of the off-site infrastructure improvements in the Waikīkī Ahupua‘a. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- General history and present and past land use of the project area.
- Knowledge of cultural sites which may be impacted by future development of the project area - for example, historic sites, archaeological sites, and burials.
- Knowledge of traditional gathering practices in the project area, both past and ongoing.
- Cultural associations of the project area, such as legends and traditional uses.
- Referrals of kūpuna or elders and kama‘āina who might be willing to share their cultural knowledge of the project area and the surrounding ahupua‘a lands.
- Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.

Several (1-5) attempts were made by mail, email and telephone to contact individuals, organizations, and agencies apposite to the CIA of the Kaka‘ako area and Waikīkī Ahupua‘a. The results of all consultations are presented in Table 6. The responses of the Historic Hawai‘i Foundation, the State Historic Preservation Division, and Hui Mālama I Na Kūpuna O Hawai‘i Nei follow the table.

Table 6. Results of Community Consultation

Name	Background, Affiliation	Comments
Ailā, William	Hui Mālama I Na Kūpuna O Hawai`i Nei	Mr. Ailā responded via email on August 5, 2008. See section 6.3 below.
Agard, Louis	Former fisherman in Kewalo Basin	CSH spoke with Mr. Agard in a phone interview on August 11, 2008. See section 7.1.1 below.
Alves, Henry	Former resident of Kaka‘ako 1923-1941 and Participant in the 1978 University of Hawai‘i Oral History Study: *Remembering Kaka‘ako 1910-1950.*	Mr. Alves responded via email on July 1, 2008. See section 7.1.2 below.
Apo, Peter	Hawaiian Cultural Consultant	CSH sent letter and maps via email and post August 4, 2008. On September 26, 2008 Mr. Apo had no comments for this CIA.
Bosley, Bob	Diamond Head Sprinkler Company	CSH contacted Mr. Bosley via telephone August 18, 2008 . Mr. Bosley had no comments for this CIA.
Cayan, Phyllis “Coochie”	State Historic Preservation Division, History and Culture Branch Chief	Ms. Cayan responded via email on November 7, 2008. See section 6.2 and Appendix D.
DaMate, Leimana	‘Aha Kiole member, father raised in Kaka‘ako	Ms. DaMate and her father were unable to participate in this study at the time interviews were conducted.
Dang, Mike	Kamehameha Schools	CSH sent letter and maps via email and post August 4, 2008. Subsequent contact efforts were made on August 5 and September 17, 2008.
D’Olier, Mitch	Former manager of the Victoria Ward Estates.	CSH sent letter and maps August 4, 2008. Subsequent contact effort was made August 27, 2008.
Enomoto, Stanton	Office of Hawaiian Affairs, Special Assistant to the Administrator	CSH sent letter and maps August 4, 2008. Subsequent contact effort was made on September 17, 2008.

Name	Background, Affiliation	Comments
Faulkner, Kiersten	Historic Hawai‘i Foundation	See response below table (Figure 46).
Freitas, Bob	Planner, Department of Hawaiian Homelands	CSH sent letter and maps August 4, 2008. Subsequent contact efforts were made on August 8, August 18 and September 17, 2008.
Frierson, Jim	Kaka‘ako Coalition, Kaka‘ako small business owner	CSH sent letter and maps October 17, 2008 On October 18, 2008, Mr. Frierson declined to participate.
Galuteria, Brickwood	Raised in Kaka‘ako	CSH sent letter and maps August 4, 2008. Mr. Galuteria referred CSH to the 1978 University of Hawai‘i Oral History Study: *Remembering Kaka‘ako 1910-1950.* Subsequent contact effort was made on September 17, 2008.
Garcia, Clifford	Longtime business owner of Tropical Lamp & Shade Co.	CSH interviewed Mr. Garcia on October 8, 2008. See Section 7.1.7 below.
Haili’s Hawaiian Food	Long-time tenant in the Ward Farmer’s Market	CSH sent letter and maps August 4, 2008. Subsequent contact efforts were made on August 8, August 13, August 19 and September 3, 2008.
Hedlund, Nancy	Secretary, Ala Moana/Kaka‘ako Neighborhood Board	Ms. Hedlund invited CSH to attend the Neighborhood Board Meeting to introduce the CIA community consultation process and invite participation. CSH attended the Ala Moana/Kaka‘ako Neighborhood Board Meeting July 22, 2008.
Higgins, Colette	Hawaiian historian, specializing in Queen Kapi‘olani, Kapi‘olani Girls’ Home and the Kaka‘ako Branch Hospital	CSH sent letter and maps August 4, 2008. August 11, 2008 Ms. Higgins shared historical information and photographs about the Kaka‘ako Branch Hospital and Kapi‘olani Girls’ Home, however, CSH did not include the information in the report due to copyright issues.
Huihui, Henry	Family were former residents of Kaka‘ako	CSH sent letter and maps June 24, 2008.
Hughes, Dr. Claire	Mother grew up in Kaka‘ako	CSH spoke with Dr. Hughes in a phone interview on October 16, 2008. See section 7.1.8 below.
Hustace, Cedric	Descendant of Victoria Ward.	CSH sent letter and maps on July 23, 2008. Mr. Hustace referred CSH to Mitch D’Olier.
Iopa, Rob	President, WCIT Architecture	CSH sent letter and maps on August 4, 2008. Subsequent contact effort was made on August 11, 2008.

Name	Background, Affiliation	Comments
Jones, Bob	Writer for Midweek Press	Mr. Jones wrote an article September 17, 2008 in the Midweek Press regarding the project. See section 6.5 for article.
Khan, Leimomi	Kama‘āina	CSH met with Mrs. Khan September 18, 2008. See section 7.1.4 below.
Kapua, Charles	Member of Pearl Harbor Hawaiian Civic Club. Mr. Kapua’s grandfather owned a fish market in Kaka‘ako	CSH interviewed Mr. Kapua October 3, 2008. See section 7.1.6 below.
Keppeler, Bruss	Native Hawaiian Chamber of Commerce member	Mr. Keppeler was referred to CSH by Linda Kaleo Paik. CSH sent letter and maps on September 30, 2008. Subsequent contact efforts were made on October 2 and October 6, 2008
Kikiloi, Kekuewa	Kamehameha Schools	CSH sent an email with letter and maps August 1, 2008. On August 12, 2008, Mr. Kikiloi had no comments for this CIA.
Kruse, Kehaulani	Member, O‘ahu Island Burial Council	CSH sent letter and maps on June 24 and August 4, 2008.
Lavoie, Frank	Chairperson, Downtown Neighborhood Board	CSH sent letter and maps August 4, 2008 and an email August 1, 2008.
Lee, Vivien	Researcher for the 1978 University of Hawai‘i Oral History Project *Remembering Kaka‘ako1910-1950*	CSH sent letter and maps August 4, 2008. On October 6, 2008, Ms. Lee referred CSH to the UH Oral History Project: *Remembering Kaka‘ako1910-1950* (UH 1978).
Lewis, Dennis	Honolulu Fire Department Historian	CSH met with Mr. Lewis on September 9, 2008 when he shared historical information about the Kaka‘ako Fire Station. included in Appendix C.

Name	Background, Affiliation	Comments
McKeague, Mark Kawika	O‘ahu Island Burial Council	CSH sent letter and maps November 7, 2008. Mr. McKeague referred CSH to Ms. Kehaulani Kruse and Ms. Hinaleimoana Wong. His statement is pending.
McQuivey, Jace	Chairperson, O‘ahu Island Burial Council	CSH sent letters and maps June 24, 2008. Subsequent contact effort was made on August 4, 2008, September 29, 2008 and November 6, 2008.
Mitchell, Samuel	Member, Makiki Neighborhood Board	CSH met Mr. Mitchell at the Ala Moana-Kaka‘ako Neighborhood Board Meeting July 22, 2008. Mr. Mitchell referred CSH to historical information found on the following websites: http://www.geocities.com/~ukulele/kamakatour.html http://www.ukulele.org/?Inductees:1997-1998:Manuel_Nunes http://en.wikipedia.org/wiki/Robert_William_Wilcox http://en.wikipedia.org/wiki/Alexander_Cartwright
Mendonça, Melvin	Former McCully firefighter	CSH met with Mr. Mendonça September 18, 2008. See his interview summary in section 7.1.3 below.
Moore, Paulette	Family owned a home in Kaka‘ako	CSH conducted a phone interview with Mrs. Moore on October 16, 2008. See her interview summary below in Section 7.1.9.
Nabarro, Doris	Owner of Tsukenjo Lunch House on Cooke St., which started in 1959 as a saimin stand.	CSH sent letters and maps on July 23, 2008. Subsequent contact effort was made on August 8, 2008.

Name	Background, Affiliation	Comments
Nakayama, Perry	Researcher for the University of Hawai‘i Oral History Project *Remembering Kaka‘ako 1910-1950*	CSH sent letter and maps August 4, 2008.
Nāmu‘o, Clyde	Administrator, Office of Hawaiian Affairs	See section 6.4 and Appendix B.
Nicol, Brian	Former editor-in-chief at Honolulu Magazine which featured a piece on Kaka‘ako	CSH sent letter and maps August 4, 2008. Subsequent contact effort was made on August 19, 2008.
Nishimoto, Warren	Director, Oral History Center, University of Hawai‘i	Mr. Nishimoto responded via email, August 20, 2008 and referred CSH to the University of Hawai‘i Oral History Project *Remembering Kaka‘ako1910-1950* (UH 1978) and *Hanahana: an Oral History Anthology of Hawai‘i’s Working People* (Kodama-Nishimoto et al. (1995).
Oda, Bob	Kamehameha Schools	CSH sent letter and maps August 4, 2008. Subsequent contact efforts were made on September 17 and September 22, 2008.
Paik, Linda Kaleo	State Historic Preservation Division, History and Culture Branch, Cultural Specialist	Ms. Paik responded via email on July 14, 2008. See section 6.2 below for response.
Recca, Regina	Ke Alaula o ka Mālamalama	CSH sent letter and maps August 4, 2008.
Seeling, Terry	Honolulu Fire Department Information Office	CSH sent an email with letter and maps August 4, 2008.

Name	Background, Affiliation	Comments
Stevens, Anne	Chairperson, Ala Moana/Kaka‘ako Neighborhood Board	Ms. Stevens invited CSH to attend the Neighborhood Board Meeting to introduce the CIA community consultation process and invite participation. CSH attended the Ala Moana/Kaka‘ako Neighborhood Board Meeting July 22, 2008.
Steelquist, John	Chairperson, Makiki Neighborhood Board	CSH sent an email with letter and maps August 1, 2008. CSH was unable to attend the October 16, 2008 Makiki Neighborhood Board meeting.
Vaughan, Palani Jr.	Musician, historian	Mr. Vaughan responded via email on October 15, 2008. See section 7.1.5 below.
Yamaguchi, Mae	Pohukaina School	CSH sent letter and maps August 4, 2008. Subsequent contact effort was made on September 15, 2008.

HISTORIC HAWAI'I FOUNDATION

September 18, 2008

Brian Kawika Cruz
Cultural Research Specialist
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua, Hawai'i 96734

RE: Cultural Impact Assessment for Kaka'ako Ma uka Area Plan, Located in the Waikīkī Ahupua'a, Honolulu, Hawai'i for Hawai'i Community Development Authority

Dear Mr. Cruz:

Thank you for the opportunity to participate in the Cultural Impact Assessment (CIA) for HCDA's Kaka'ako Ma uka Area Plan.

Since 1974, Historic Hawai'i Foundation (HHF) has been a statewide leader for historic preservation. HHF's mission is to preserve and encourage the preservation of Hawaii's historic buildings, places, objects and communities.

Historic Hawai'i Foundation provided previous comment to HCDA specifically about the Ward Neighborhood Master Plan proposed by General Growth Properties. As part of the evaluation of that proposal, HHF requested an inventory of architectural historic resources. The study, conducted by Fung Associates for GGP, resulted in a parcel by parcel that noted:

1. Which buildings will attain the age of 50 years within the planning horizon;
2. Which demonstrate historic integrity related to location, setting, design, materials, workmanship, association and feeling; and
3. Which demonstrate historic significance related to embodiment of distinctive characteristics of a type, period or method of construction that represents the work of a master and that possess high artistic value.

The inventory identified 13 parcels within the master plan boundary that contain structures that have historic integrity. Many of these have not yet attained the age of 50 years, but will become eligible for designation on the State Register of Historic Places within the 30 year planning horizon. Of the 13 parcels, HHF believes that 12 of them are not exceptionally significant. However, HHF believes that the IBM Building at 1240 Ala Moana Boulevard is eligible for designation on the Hawai'i Register of Historic Places as a distinctive architectural type and as the work of a master.

The IBM Building was designed by Vladimir Ossipoff in 1962 for the IBM Corporation. Ossipoff was the foremost architect active in Hawai'i in the 20th century. He worked in Hawai'i for 67 years and his architecture is known for its distinctive mix of Hawaiian, Japanese and modern elements.

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Email preservation@historichawaii.org / Web www.historichawaii.org

The description of the building included in *Hawaiian Modern: The Architecture of Vladimir Ossipoff* notes that Ossipoff's overriding design concerns for the building were to protect the large glass facades from the sun, to project a global image for IBM and to integrate Hawaiian sensibilities. The most distinctive feature of the building is the geometric sunshade made of 1,360 precast-concrete pieces. The grille design includes curvilinear surfaces slanted more than 45-degrees to wash clean in the rain, discourage bird nesting and to interpret both Polynesian decorative patterns and computer keypunch cards.

As part of the CIA, we recommend that similar study and evaluation of the remaining blocks be conducted and that the findings from the GGP inventory be incorporated. Notable sites will include those already listed on the Hawai'i State or National Registers of Historic Places, such as McKinley High School and the Ala Moana Pumping Station, as well as those that are eligible, such as the Dickey-designed theater, WWII-era and post-war Quonset huts, modernist structures at the Blaisdell complex, and other residential, commercial and industrial buildings throughout Kaka'ako.

Kaka'ako has a long history and the current built environment reflects those roots, including many parcels and buildings from various eras and architectural styles. Kaka'ako Ma uka reflects the broad patterns of history and development of Honolulu, of Hawai'i, and of the nation.

We look forward to seeing the CIA and the recognition of the historic buildings, sites, objects and landscapes contained in this significant part of the island.

Thank you for the opportunity to comment.

Very truly yours,

Kiersten Faulkner

Kiersten Faulkner, AICP
Executive Director

Figure 57. Historic Hawaii Foundation Response Letter, September 18, 2008

6.2 State Historic Preservation Division (SHPD)

CSH contacted Linda Kaleo Paik on June 24, 2008. In an email response sent to CSH on July 14, 2008, Linda Kaleo Paik, Cultural Specialist for the History and Culture division of the State Historic Preservation Division (SHPD) provided the following:

> The Kakaako area as you are well aware is within the urban corridor. That being said, it is also an area that has been developed more extensively in recent years. With this new development concentration, there have been a large number of inadvertent finds. Though many of the historical sites have been compromised, destroyed or dwarfed by development, the area still contains significant features and sites that should and must be included in the CIA. These sites need to be documented and your study would be valuable moving forward. Our people hold the ancestors as a vital part of our culture and the disturbance from their burial site has been the subject of many controversial projects. Knowing that Kakaako has the potential for uncovering such sites, extreme caution should be practiced in the planning of projects for this area.

CSH also contacted Phyllis “Coochie” Cayan on November 4, 2008. In an email response sent to CSH on November 7, 2008, Phyllis “Coochie” Cayan, State Historic Preservation Division (SHPD), History and Culture Branch Chief provided the following:

Ms. Cayan referred CSH to the Van Horn Diamond *‘ohana*, the Nalani Olds *‘ohana*, the Richard Papa *‘ohana*, the Kahanamokus and Paoa *‘ohana*, the Norman *‘ohana*, the Paulette Kaleikini *‘ohana*, the Les Kuloloia *‘ohana*, the Hawaiian Civic Club association, the Honolulu Civic Club, Jalna Keala, Desoto Brown at the Bishop Museum, the Kūpuna Group at the Waikīkī Community Center, Jeff Apaka at the Waikīkī Community Center, the Musicians Union, Makiki Valley descendants of original *‘ohana* who used to live in the ahupua‘a, Derek Tamura (son of a businessman in Kaka‘ako), Dr. Kekuni Blaisdell and Uncle Louis Agard. She also recommended CSH put an ad in the OHA newspaper Ka Wai Ola to attract input from further families.

She also states this about Kaka‘ako’s past:

> I believe the practice of fishing and gathering- those makai and mauka practices were important for those families to survive. In the beginnings of Kaka‘ako, the many diverse families who lived and worked there (home above shops, etc.) are reminiscence of what the development is seeking, a place where folks will live, work and play. Many of those businesses would be interesting contacts regarding Kaka‘ako’s cultural diversity, too.

She also states this about potential burials in the Mauka Area:

> As you know from past and current projects in the area and the ahupua‘a—the makai area is a high risk for human burials. There has been past inadvertent finds mauka, but not as numerous as the makai areas.

6.3 Hui Mālama I Na Kūpuna O Hawai‘i Nei

CSH contacted William Ailā on August 4, 2008. In an email response sent to CSH on August 5, 2008, William Ailā, Board Member of Hui Mālama I Na Kūpuna O Hawai‘i Nei, provided the following:

> My only recommendation during the development process is to make sure the all properties should be required to have an exhaustive/complete archeological inventory survey, especially in any areas containing sand. Also that the survey occurs prior to the design of the building and its utilities. This would allow for the buildings to be designed around any *iwi kūpuna* found.

6.4 Office of Hawaiian Affairs

CSH contacted Clyde Nāmu‘o, Administrator of the Office of Hawaiian Affairs (OHA) on June 24, 2008. In a response sent to CSH on August 21, 2008, Mr. Nāmu‘o commented on several issues pertaining to the HCDA Mauka Area Plan:

1. The Draft Supplemental Environmental Impact Statement (DSEIS)’s lacked community consultation in the draft Cultural Impact Assessment (CIA) by Cultural Surveys, Hawai‘i. The Office of Environmental Quality Control (OEQC) Guidelines for CIAs require community consultation. OHA recommends the CIA include community consultation and provided a list of community members and cultural descendants for consultation.
2. HCDA should require that any development activity in Kaka‘ako under their jurisdiction be reviewed by SHPD prior to design and planning of the development.
3. OHA addresses the need for every developer within HCDA’s jurisdiction to conduct an archaeological inventory survey to identify *iwi kūpuna* within the project area [Mauka Area District] as the probability of burials in the project area is high. OHA recommends an archaeological inventory survey be conducted beyond the typical 3% testing area to minimize or eliminate the “inadvertent finds” or burials discovered during the construction process. OHA uses the examples of Kaka‘ako and Kālia to demonstrate the cultural insensitivity of past treatment of “inadvertent finds” and hopes they can be avoided (see Appendix B for OHA letter).

It is critical to note here that OHA’s response was based on a preliminary Literature Review and Cultural Assessment report (O’Hare et al. 2008). This preliminary report did not include community consultation. As stated in Section 1.4.2 in the report, the community consultation for the project was still pending. In the DSEIS the CSH report by O’Hare et al. (2008) was included in Appendix B as a “Cultural Impact Assessment.” The current document (Spearing and Hammatt 2008) is in fact the Cultural Impact Assessment for the HCDA Mauka Area Plan; and, as such includes responses from OHA’s referred community members and cultural descendents in the community consultation sections.

6.5 Bob Jones

Mr. Bob Jones is a *kama‘āina* of O‘ahu and writes for the Midweek Press. Mr. Jones declined to be interviewed and referred CSH an article he wrote published in Midweek on September 17, 2008. Following is his article on the proposed plans in Kaka‘ako.

> The Hawaii Community Development Authority has invited us - the public - to be "buttinskies" on the proposed Queen-Auahi-Ala Moana mega-project in Kakaako on 60 acres. Here's my RSVP.
>
> The developer, General Growth Properties (GGP), likes to stress what it capitalizes as the "Central Plaza," a 700-by-200-foot mall on Auahi Street. Foot traffic, farmers' market, performance stages. OK, right?
>
> But you'll pay for the open space with "vertical living structures." That's what developers prefer to call high rises these days. And that's the whole issue with me because we've already lost much of our Koolau view plane from Ala Moana Beach Park, and this plan by GGP will erase more of it.
>
> Somebody needs to stand up and say "enough already" to those spires along the main city corridor, not only for height concerns but also for thickness. It's no solution even if we keep the towers at 20 stories instead of the requested 40 but allow the base footprint to cover 16,000 square feet.
>
> GGP is trying to hold us hostage to taller and thicker towers by saying if it can't have its verticality and thickness, then we can't have as much open space.
>
> I'm not against high rises. I'm just death on them where they seriously impinge on what we are visually.
>
> GGP tries to assuage the "vertical living" fears by saying "we are engaged in a very careful planning process that puts a high premium on the preservation of the beautiful mauka to makai view corridors. Of course, some of our residential and commercial development will necessitate building towers; but in the end this preserves more land for open space and creates an attractive urban environment, rather than allowing sprawl to occur."
>
> Why am I not assuaged? Because there need not be urban sprawl in Kakaako, certainly not that part of it, were not GGP's primary objective being able to pepper the area with more retail space. The envisioned 4,000 housing units are mainly to create spending customers. Do you really think those center-city towers are going to be affordable to the average working family.
>
> Here, again, is GGP's vision: "We are planning a mix of residential units - from high-rise and mid-rise residential towers to townhouses to lofts. Our goal is to attract a diverse mix of residents - young professionals, families, seniors and others with a diverse range of incomes to constitute a dynamic and socially

vibrant new neighborhood.” Good with word images, yeah? *Dynamic and socially vibrant*.

Section 7 Summaries of Kama‘āina Interviews

7.1 Talk Story Interviews

Kama‘āina (native-born) and *kūpuna* (elders) with knowledge of the Mauka Area District and surrounding environs participated in “talk-story” sessions for this assessment. The approach of CSH to cultural impact studies affords those community contacts an opportunity to review transcriptions and/or interview notes, and to make any corrections, deletions or additions.

CSH employs snowball and judgment sampling, an informed consent process and semi-structured interviews (Bernard 2005). To assist in discussion of natural and cultural resources and any cultural practices specific to the Mauka Area District and Kaka‘ako generally, CSH initiates the talk-story sessions with questions from five broad categories including: Gathering Practices, Marine and Freshwater Resources, Burials, Trails and Historic Properties. Presented below are summaries of participants’ talk-story sessions and their comments and concerns about the Mauka Area District. Section 7 also includes written responses from Henry Alves, Bob Jones, and Palani Vaughn, Jr.

7.1.1 Louis Agard

Louis Agard is a *kama‘āina* of Honolulu and has worked in Kewalo Basin for almost 60 years as a crew member on tuna boats and as the captain of a tour boat. He is the oldest tenant at Kewalo Basin and currently works at the fish auction block in Kaka‘ako. CSH conducted a phone interview with Mr. Agard on August 11, 2008. During the interview, Mr. Agard shared his suggestions for the new Kaka‘ako projects’ design and modifications to Kewalo Basin.

He suggests that development in the new Kaka‘ako Plans should “go green” and use as much available technology to make this green initiative possible. For example, businesses near the shoreline should employ the use of a deporter, which takes deep, cold ocean water and uses it to power air conditioners. He notes this type of system was used in the past in other places. On the Big Island, they are using a similar system to draw water from the deep sea and desalinize it for drinking.

He also made suggestions to generate more tourism to the area. His first idea is to create a pedestrian overpass over Ala Moana Boulevard to Kewalo Basin. This overpass would provide access to the walkway along Ala Moana from the John Dominis restaurant to Honolulu Harbor. The overpass would connect tourists with parking access, reducing traffic and give access to attractions. He also suggests refurbishing the fish auction house and developing a tourist attraction. Because the fish auction house is a dangerous place with slippery floors and moving vehicles, he recommends building a second floor of the auction block, to be used by tourists as an observation deck. Developing the auction block into a tourist attraction would generate business for charter boats and other businesses in the area.

7.1.2 Henry Alves

Mr. Henry Alves is a current resident of Kailua, but was a resident of Kaka‘ako from 1923 to 1941. He was also a participant in the 1978 University of Hawai‘i Oral History

Report *Remembering Kaka‘ako 1910-1950*. CSH contacted Mr. Alves on June 23, 2008. Mr. Alves replied in an email to CSH on July 1, 2008.

> As a resident,(858 So. Queen Street) from 1923 to 1941 and subsequently, a principal in numerous subdivisions, may I recommend the following…
>
> In the early 20’s, and into the 30’s, the plantation syndrome prevailed because the neighborhood was substantially subdivided by the ethnic groups. The residential sites encompassed the majority of the area with a mix use of stores, churches, schools and small shops.
>
> The area referenced should be designated residential – commercial mix use district with a height limitation of 40 feet.
>
> Too much emphasis is placed on the past, which should be considered, but not significant that it becomes unfavorable to the development of the site.

7.1.3 Melvin Mendonça

CSH conducted an interview with Mr. Melvin Mendonça on September 18, 2008 and October 3, 2008 at his home in Hawai‘i Kai. Although he spent most of his time at the McCully fire station, he also spent time at the Kaka‘ako fire station and shared his memories with CSH.

Mr. Mendonça was born in Kaimukī at 1112 13th Ave. on February 29, 1927. His father John was a firefighter working at the Waikīkī firestation at the time of his birth. His mother Violet died in 1951. He had 5 brothers, and he was the third child.

Mr. Mendonça was in the fire department for 30 years. When asked about the “haunted” Kaka‘ako fire station, Mr. Mendonça said that “everyone knew it was haunted” but he himself did not experience the choking ghost that others had. Some firefighters from the Kaka‘ako fire station would marry girls from the Japanese camp.

When asked about his memories of old Kaka‘ako, he recalled many businesses in the area. Where Motor Imports Toyota is located today (on the corner of Halekauwila St.), the Honolulu Rapid Transit Department’s trolleys would be parked there as they owned part of the block. His grandfather was the watchman of the McKesson building on South Street. T.O. Murata furniture store was on Queen St. and South St. in the Diamond Head *mauka* corner.

He also recalls the Kewalo Inn which was a restaurant and nightclub. It was located on Ala Moana Blvd. across from the Harbor Office. There was also the Sampan Inn, a plate lunch counter near a shed in Ala Moana Park where fishermen used to patch nets. Another famous nightclub was Leroy’s located where the Gold Bond Building now stands. Both the Kewalo Inn and Leroy’s had live music and dancing. He remembers Fisherman’s Wharf was a nightclub on the second floor of the building (see Figure 48). He was too young to go to the nightclubs, but his two older brothers had their proms there. During WWII, when he was in high school, there were no proms. He said after the war the nightclubs were very popular.

Old Sikorsky planes (owned by Inter-Island Airways, the predecessor of Hawaiian Airlines) were parked in the area. The KGU radio station was where the Honolulu Advertiser is now on South St. and Kapi‘olani Blvd.

He remembers just after he was hired at the fire department, there was a huge fire at Ala Moana and Ward. A Union service station was on fire and the fishing supply store had also caught on fire. They are now relocated on Pohukaina St. Although he was anxious to help, he was fighting a short circuit fire on Ala Moana Blvd.

He also recalls the D.H. Davis lumber yard across Ala Moana Blvd. by the tuna packers. The tuna packers' area was from Ward all the way to the old incinerator. There were also Japanese camp, tenements and boat builders in the area. Sampans were built there all the way to South St. He remembers seeing Ala Moana being dredged, seeing pipes on the street and rocks and water flowing out. Before the dredging, to get to Ala Wai Yacht Harbor, you would have to go through Kewalo Basin.

When asked about Kaka‘ako's reputation as being a "rough" neighborhood, he says he doesn't remember that as being true. He said, "a lot of nice people came from there." He includes the Kalima brothers, a musical group who got their start playing music on the KGMB Amateur Hour.

In 1947 he remembers helping out with the yacht race.

He remembers Ala Moana Blvd. was easy to cross, unlike today. It wasn't more than three lanes.

There were stores and restaurants on Halekauwila St. On Queen St. there was American Laundry and a place to buy gasoline for boats. There was a restaurant on the corner of Ward and an ice plant with an upstairs nightclub that caught on fire.

The Ward sisters lived where the Blaisdell Center is now. He remembers there being a "no trespassing" policy on their property. The Ward Estate extended from Ward St. to McKinley High School.

Mr. Mendonça had no specific comments or concerns regarding proposed development in Kaka‘ako.

Figure 58. Melvin Mendonça

Figure 59. A current photo of Fisherman's Wharf where Mr. Mendonça recalls his brothers celebrated their proms at nightclub on the second floor

7.1.4 Leimomi Khan

Mrs. Leimomi Khan is a *kama‘āina* of the Kaimukī and Punchbowl area. CSH interviewed Mrs. Khan on September 18, 2008 at the Flamingo Restaurant on Kapi‘olani Boulevard. She commented on development on O‘ahu, including the proposed project in Kaka‘ako.

Mrs. Khan would like there to be a good plan for growth with a stable infrastructure and waste management system. She is concerned that the communities in Wai‘anae and Nānākuli, already burdened with overflowing landfills, continue to be the communities that bear the burden of development waste. She would like the government to assure that the infrastructure can accommodate any proposed development, and for developers to clearly define how their project will contribute to the infrastructure, short- and long-term.

Mrs. Khan shares that seeing buildings everywhere changes the island's atmosphere, detracting from the beauty of the ocean and green space; (i.e. parks) are also lost. Development changes the spirit of the *‘āina* and impacts our *‘ano* (character, spirit, way of life, standard of living). She remembers playing hopscotch as a child on the sidewalks in Punchbowl, climbing fruit trees, catching small fish in streams, playing volleyball and other sports in their home backyard, and wonders if children in the future will be able to do the same. She supports development that is planned, considerate and responsible. Mrs. Khan is also concerned with the care of the *iwi kūpuna* and suggests a dedicated cemetery where families can visit.

7.1.5 Palani Vaughn, Jr.

Palani Vaughn, Jr. is a noted composer, musician and historian as well as a *kama‘āina* of Mānoa. Mr. Vaughn was referred to CSH as someone who had done projects in Kaka‘ako. CSH received a statement via email from Mr. Vaughn on October 15, 2008. The following is his statement regarding general history and present and past land use in , knowledge of cultural sites that may be impacted by future development and his recommendations for the project. Mr. Vaughn began his statement with an explanation of his personal knowledge of Kaka‘ako .

> …personal understanding of the history of Kākā‘āko—knowledge that I accumulated during 42 years of research in the vast and diverse Hawaiian studies field, with emphasis on the monarchical history of Hawai‘i.
>
> During the 2005 session of the Hawai‘i State Legislature, I successfully related to the members of that legislative session, through a series of hearing processes in both houses, the purposes of my proposed initiative, which resulted in the passage of a concurrent resolution in support of the initiative.
>
> The initiative I proposed, then, and now, speaks to my request that the State of Hawai‘i honor the ancestors, or the *kūpuna*, of today's native-Hawaiian people—the host culture—with the creation and construction of a series of five (5)

monuments one for each of five (5) of the eight (8) major islands of our State of Hawai‘i, namely, O‘ahu, Kaua‘i, Maui, Moloka‘i, and Hawai‘i, with each monument surrounded by cultural and performing arts complexes.

These monuments and complexes would respectfully honor and memorialize, not only the former Citizens of the Hawaiian Nation, but also the memory of the lives of their *kūpuna*, who were the former native-people of the Hawaiian archipelago, who had lived prior to the formation of the kingdom of Hawai‘i by King Kamehameha I, through the placement of each of their names upon a granite scroll on or around the monuments.

Through these monuments and complexes, therefore, as the ancient people of Hawai‘i would say it, “The bones of the ancestors will live again”.

My initiative proposed further that the primary monument be situated in a historical area of Honolulu, which I proposed be located in Kākā‘āko, and that each of the remaining four (4) satellite monuments be situated in historically geographic areas of the above-stated neighboring islands that would be representative of their significant connectivity to the primary Honolulu monument.

My initiative proposed further that each of the monument complexes also be designated as the repositories for the collection, authentication, and archiving of the genealogies of all of the chiefs of the past, as well as, the members of the resulting Hawaiian monarchy, who ruled over the Hawaiian nation and kingdom.

I propose that this monument also honor the efforts of the Hawaiian Kingdom’s 7th and last king, David La‘amea Kalākaua, who worked tirelessly until his demise in January of 1891, to help and inspire his Hawaiian nation to save itself from extinction, by creating several initiatives to foster that purpose the most significant of which, he accomplished at the start of his reign in February of 1874, by declaring the motto of his reign, as *“Ho‘oūlu Lāhui”*, or “Increase the Nation”.

King Kalākaua entitled his national anthem with the term he coined to refer to the Hawaiian people, *“Hawai‘i Pono‘ī*, meaning, “Hawai‘i’s Own People”.

The question was asked by the legislature, as to why I proposed that the monument be situated in Kākā‘āko. My response was that of that I was guided by what I call the “Voices On the Wind“, who “directed me” to the undeveloped land area of Kākā‘āko area situated and bordered *mauka* by Hale-ka-uwila Street and *makai* by Pohukaina Street.

“Hale-ka-uwila Street” derives its name from an historic palace, “Ka Hale-Ka-uwila”, which was constructed in the ancient traditional thatched-grass and wood-frame construction in 1836 by, then, Kuhina Nui, or “Premier” of the kingdom of Hawai‘i, Elizabeth Kīna‘u.

“Ka Hale-Ka-uwila” was purposefully constructed to be the birthing palace for Princess Harriet Nāhi-‘ena-‘ena, the royal sister of Ka-lani-Kau-i-ke-aoūli-i-luna-lilo, who ruled Hawai‘i, then, as King Ka-mehameha III.

The wood frame of the palace structure came from the native-tree, called, *ka-uwila*. This particular wood, it was said, came from the original, “Ka Hale o Keawe”, which, was once the royal mausoleum for deceased ancient rulers of the island of Hawai’i, who descended from the Keawe-line of rulers. Ka Hale of Keawe was situated on the once-sacred temple, or *heiau*, named *“Pu‘u-honua ‘O Hōnaunau”*, otherwise known as, “The City of Refuge”.

How did these once-sacred timbers come to be utilized in Honolulu for the birthing palace?

Following the death of King Ka-mehameha I, in 1819, there followed the overthrow of the *tabu* system of governance, which derived its authority from the ancient gods and their priests, or *kahuna*, who operated from the sanctuary of their temples, or *heiau*. One such *heiau* was the above-mentioned, *“Pu‘u-honua ‘O Hōnaunau”*, and it was the *ka-uwila* wood-frame of *“Ka Hale Ka-uwila”* from which the *ka-uwila* wood came. This *ka-uwila* wood was rescued and secreted in

mountain caves by the deposed *kahuna*, whose *heiau* were being destroyed under the orders of the, then, co-rulers, King Ka-mehameha II, and *Kuhina Nui* Queen Ka-‘ahu-manu.

Pohu-kaina Street derives its name from the name of one of the homes owned and occupied by King Kamehameha III, who also had a royal palace, named, *“Ka Hale Uluhe”* that had been constructed upon a *heiau*, once, called, *“Mana-mana”*, before its destruction during the overthrow of the *tabu*.

Sadly, while Nāhi-‘ena-‘ena successfully birthed her infant, her baby died within a few days and Nāhi-‘ena-‘ena fell gravely ill. Her brother, the king, had his stricken sister removed to *Ka Hale Uluhe*, with the hope that the *mana*, or “healing power” of the old *heiau* might help his ailing sister recover her health. Unfortunately, she didn’t survive and the king had her body brought back to *“Ka Hale Ka-uwila”* to rejoin her dead infant, while he prepared to return their remains for interment in Lāhainā, Maui, on the mausoleum island, named *Moku ‘Ula*, where the remains of their mother, Queen Ke-opu-o-lani rested.

However, about the same time of these tragic events at *“Ka Hale Uluhe”* , there also occurred the birth of the infant chief, Kalākaua, in the king’s palace *“Ka Hale Uluhe”*, who was secretly taken from the mother, Ke-oho-ka-lole, by the chiefess Ha‘aheo, who was the king’s sister-in-law and Governor of Maui island and brought into the court of the king. The infant boy Kalākaua would be raised in the Lāhainā, Maui, until he was 4 years of age, before being returned to Honolulu.

It is my personal opinion and no one else’s that Kalākaua was the son of King Ka-mehameha III, who was a single, unmarried ruler up to the death of Princess Nāhi-‘ena-‘ena, which I personally believe is the primary reason that he takes the infant chief to his court on Maui.

It would be in later years, that, Alexander Liholiho, a grandson of Kamehameha I and the adoptive son of Kamehameha III, would come to the throne of Hawai‘i following Kau-i-ke-aoūli’s death, and rule as Ka-mehameha IV.

As king, Alexander Liholiho would remove *“Ka Hale Uluhe”*, and in its place build Queen’s Hospital.

Therefore, with this understanding of the dramatic events and historical personages of those times, I suggest that there is important cultural value to this area of Kā-kā-‘āko, and is the reason that I had proposed this location as the site for the primary Monument to the Citizens of the Former Kingdom of Hawai‘i.

While I had proposed that one of the primary functions of the monument complexes would be to serve as the repositories for genealogies and related researches, lately, with the recurring problems regarding the discovery of *iwi*, or human “bones”, and how to protect them on land coming under business, hotel resort, or real estate sub-division development in so many parts of the Hawaiian islands, I will be proposing during the forth-coming session of the legislature that these complexes be considered as the mausoleum repositories for the *iwi*, with vaults and plaques identifying where each of the bones were discovered. I will also propose that markers be placed upon the lands under development to identify the exact former burial site, and where the *iwi* that were once buried there are located in the monument complex.

This proposal would allow native-Hawaiians the assurance that their ancestral bones would not be disrespected and treated honorably. If this proposal finds support with the legislature and acceptance within the Hawaiian community, then, it would give distinct meaning to the expression stated above, that “the bones of the ancestors will live again”. In addition, conceivably, as the *iwi*, accumulate and are placed within these mausoleum repositories within the monument complexes, it would be possible to “view”, in a sense, a re-unification of the former Hawaiian nation in an honored place.

The monument complexes would also become performing arts centers for Hawaiian music and hula and traditional cultural practices. These complexes have the potential to serve as future meeting places for teaching and learning and sharing with the greater community of Hawai‘i.

7.1.6 Charles Kapua

Charles “Uncle Charlie” Kapua is a *kama‘āina* of the ‘Ewa area. His grandfather, John Kapua, Sr., was a business owner in Kaka‘ako in the 1950’s. CSH interviewed Mr. Kapua on October 3, 2008 at his home in Pacific Palisades. Mr. Kapua shared his memories and experiences of working with his grandfather in Kaka‘ako, and his concerns regarding the proposed plans for Kaka‘ako.

Mr. Kapua’s grandfather, John Kapua, Sr., owned Kapua’s Hawaiian Food in the Ala Moana Fish Market (currently the Ward Farmers’ Market). Kapua’s Hawaiian Food was on the Diamond Head side of Haili’s Hawaiian Food. The business moved to Ala Moana Market from Kekaulike Street around 1949 and ended a few years later. Mr. Kapua remembers the businesses at Ala Moana Fish Market being a community that lacked a competitive spirit like most neighboring businesses have today. If his grandfather didn’t have a certain product the customer was inquiring about, he would direct them to the other vendors. Kapua’s Hawaiian Food was the first food vendor in the Market, followed by Haili’s Hawaiian Food a year later, then Bob’s Market a few years after them. The Market had an open front. Haili’s was half of the area, with Kapua’s a quarter and Miyakawa Fish Market in the other corner. Across the way was Harimoto’s Fish Market.

The Ward sisters would regularly order Hawaiian food from Kapua’s. They would call Mr. Kapua’s grandfather and order “the regular.” Their order was usually one pound of dry *aku* (bonito, skipjack) , one to two five pound bags of *poi*, 3 *laulau* (meat or fish-filled leaf packages), one pound of *kālua* pig, *ake* (liver) and *‘opihi* (limpets). He would help his grandfather deliver the food to the Ward Estate. He was told to place the food on the steps and his grandfather would take it in. He describes the Ward Estate home as an old-style plantation home: large, low and spread out. The land was marshy with many coconut trees and peacocks walking around. Mr. Kapua remembers his grandfather having a lot of *aloha* (love, respect) for the Ward sisters.

His grandfather taught Mr. Kapua how to cook Hawaiian food. He would stress that everything was to be clean as he was the former Food Health Inspector. He recalls his grandfather teaching him how to prepare a fish to make *palu* (a relish made of the head or stomach of a fish). Uncle Charlie would clean the fish. His grandfather would come by and take a pinch of the fish and if it wasn’t clean he would throw it out. He also remembers his grandfather giving him a slap if he didn’t clean the sides of the *poi* bowl. At first, his grandfather had an *imu* (underground oven) for *kālua* pig (pig baked in an underground oven), but eventually it became too time-consuming and he would buy the *kālua* pig from various meat departments and vendors.

Mr. Kapua’s grandfather also taught him to make ake, or calf’s liver. He would first pull out the liver from the carcass. They would feed water through the opening, draining all the blood out. It would take 1-1 ½ hours to do so. Then he would cut the grizzle and veins out, which would take 2 ½ hours. If his grandfather saw some grizzle or veins in the liver, he would force Mr. Kapua to eat it raw to illustrate how the consistency was unpleasant to eat. Once the grizzle and veins were cut out, Mr. Kapua would cut the meat into ½-inch cubes. The meat would chill overnight and continue to drain. The next day, he would chop *huluhulu waena limu* (*Grateloupia*

filicina) to add to the mixture. The seaweed was hair-like, red and would bleed when cut. He would also add salt to taste. He would mix everything together until the flavors were evenly distributed. If one were to taste the liver, the salt and the *limu* flavor would be present. Mr. Kapua said it was an acquired taste, but there was a large demand for it. If there was a food he didn't like, his grandfather would feed him bowls and bowls of it, until he acquired a taste for it. The *ake* cost 50 cents for a small bowl. *‘Opihi* was 50 cents a plate. He also remembers not being allowed to mix the *aku palu* as a child. He would clean the *aku* head, but his grandfather and father would chop everything up. He wouldn't be allowed to ask questions, but learned by watching.

Kapua's Hawaiian Food was open 7 days a week and on Sunday they were open until 1:00 PM. He remembers on Sunday there were five boards on the floor and they would clean under the boards. The area for their business was very small, maybe only half the size of Haili's Hawaiian Food stall. Uncle Charlie was the only one of his siblings and cousins to consistently help his grandfather at Kapua's Hawaiian Food.

His grandfather had a sampan boat that would go out to catch fish in Kewalo Basin. They would catch *aku, ‘ōpelu, akule* (*Trachurops crumenophthalmus*) and other fish. When asked if he remembered the names of the *aku* boats, he remembered the Yellowfin *aku* boat. If all of the tasks at Kapua's Hawaiian Food were finished, he would ask his grandfather if he could fish at the pier. Sometimes his grandfather would ask him to help the fishermen with the sampan boat. He would be disappointed, but would have to do what his grandfather said.

He remembers his grandfather waking him up early one morning, around 3:00 AM. His grandfather took him to the auction block at ‘A‘ala Park, a market with all kinds of seafood. There would be other food vendors there from Harumoto's, Bob's Market, Jimmy's Meat Market, etc. To take it back to Ala Moana Fish Market, they would either load the car with the fish or it would be delivered.

Mr. Kapua would rarely go to the Kewalo Theater, but remembers spending a lot of time at Mother Waldron Park. He would play touch football and 5-hole marbles. He met John Fujieki of Star Market there as a kid. The older kids would go to Mother Waldron Park later in the afternoon. He would have to be back at his grandfather's place by 12:30 for lunch everyday.

Mr. Kapua recalls that the Ala Moana Fish Market provided a place for people all over O‘ahu to meet and share ideas. They were joined by the commonality of food, but also talked story, shared news and ideas. He asks, "Why should they knock it down?" as it is a part of Hawai‘i's history.

In regard to the current projects and changes in Kaka‘ako, Mr. Kapua recommends conserving the land with slow, deliberate growth. He would "not like to see a lot of condos." In Kaka‘ako, a lot of things need to happen before the development begins. For example, the infrastructure needs to be in place, especially the sewer system, before anything is built. The water system should also be up to par before anything is built. "The higher you go, the more water you need," he shares. Mr. Kapua is cautious about GGP's *mauka-makai* architectural concept. He believes a wind tunnel would be created from the tall high-rise buildings. He refers to Ala Moana Boulevard. near the ‘Ilikai Hotel where a wind tunnel is created by the surrounding buildings and creates a vacuum in the area. He suggests first building lower buildings, then later working on

the tall high-rises. He is also concerned about the aesthetics of the buildings and traffic problems. Mr. Kapua also suggests a Hawaiian cultural market in Kaka‘ako (Mauka Area District)..

If *iwi kūpuna* (ancestral bones) are found in the Mauka Area District, he suggests first confirming they are truly *iwi kūpuna*. If they are, a monument should be created for them. Mr. Kapua says no matter if *kūpuna* are in living form or in a bone form, they should be equally respected. He refers to the Wal-Mart project in which bones were treated disrespectfully. Mr. Kapua would like the projects to leave evidence of Hawaiian people and for the developers to show respect to the host culture

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Figure 60. Charles “Uncle Charlie” Kapua

Figure 61. Ward Farmer’s Market, formerly Ala Moana Fish Market

7.1.7 Clifford Garcia

Clifford Garcia is a *kama‘āina* and long-time business owner in Kaka‘ako. His father, James Garcia, who passed away in 1996, was the original owner of Tropical Lamp & Shade Co., a business established in 1944 and passed down to Clifford. CSH interviewed Mr. Garcia at his shop on Queen Street on October 8, 2008. In the midst of a busy day, Mr. Garcia generously shared stories about his father's life in Kaka‘ako, his own memories and experiences, and his concerns regarding the proposed plans for Kaka‘ako.

James Garcia was a business innovator and musician in "Old Kaka‘ako." Clifford Garcia directed CSH to an obituary he wrote for his father:

> James "Jimmy" Garcia, Honolulu-born businessman, passed away on June 29, 1996…. He was 89. He was raised in Kakaako on Archer Lane. His parents, Manuel De Jesus Pestana Garcia and Virginia Ferreira, came to Hawaii by sailing vessel from Funchal Madeira, Portugal. When he was a little boy, he would accompany his dad on a horse-drawn wagon to deliver firewood "coal" in Kakaako. His father passed away when he was 8 years old. He then went to St. Louis School, graduating from the 6th grade. His first job was to straighten nails for the construction of the Princess Theater. He then worked at Tropic Battery, making batteries, deliveries and installing them.
>
> In the 1930's he met and married Louise Nobriga, daughter of big Island rancher and dairy man, J.J. Nobriga. He apprenticed at the Honolulu Star-Bulletin; became a cutter and bookbinder at Honolulu Lithograph; and worked evenings as a musician, playing drums with Johnny Noble's Orchestra at the Royal Hawaiian Hotel. He made photo albums for his own store, using his bookbinding expertise, selling them to the servicemen stationed in Hawaii. These tapa fabric mementos were favorites of their families.
>
> Finding a bare bulb annoying him while working in his shop, he used some of his album supplies to fashion a lampshade.
>
> Jimmy and his wife Louise, who passed away in 1970, founded the business that has been located at 977 S. Queen St. for the past 50 years (one of the few Quonset huts around). He was the original designer and maker of abaca lamp shades and koa wood lamps, with his good friend Millard Blair, owner of Blair Woods, Ltd. His business thrived as he won contracts with Honolulu's major hotels, U.S. Government and set directors on movies produced in Hawaii such as Hawaii 5-O….

Mr. Garcia recalled that in his father's day Kaka‘ako was a thriving Portuguese community with Holy Ghost Roman Catholic Church at its heart. James Garcia developed the abaca lamp shades during World War II when blackout windows were used to conceal the city lights for fear of bombing raids and he had to work by bare light bulb. As described above, he used abaca (*Musa textiles*) — a fiber derived from the leaves and stems of a banana native to the Philippines

— as material to make lamp shades. This evolved into a partnership with Millard Blair, who provided the *koa* (*Acacia koa*) for the lamp bases. He bought the Quonset hut that houses Tropical Lamp & Shade for $1,000. “As you can imagine” Mr. Garcia noted, “the Quonset has more than paid for itself.” Figures 51 and 52 depict the early days of Tropical Lamp & Shade.

Mr. Garcia shared his memories of Queen Street (between Ward and Kamake‘e streets) and environs. “This area used to be all coral. Did you see the plumeria tree out front? That is over 100 years old.” When Mr. Garcia was a child it was his understanding that the Victoria Ward sisters lived on the block now occupied by the Blaisdell Center. As a boy he observed that, “There used to be an old wooden fence surrounding the property. Their property was filled with coconut trees…” He mentioned that there was a night club, Trader Vic’s (not part of the west coast chain or restaurants by the same name) across the street. Mr. Garcia also pointed out the building across from the Hamada H. Store on the *mauka* side of Queen Street is on the register of historic places (Figure 55) and that there are a number of other places of historic interest in the area. In 1967 Victoria Ward, Ltd. offered to purchase the family’s land for $65,000, but James Garcia declined. Like his father, Clifford has had a long career building and repairing lamps, including for illustrious venues such as Doris Duke’s Shangri La where he fixed the chandelier that is one of the centerpieces of the estate. He has also branched out into the automotive painting and supplies business, building on his father’s love for collecting and refurbishing T-Birds (Ford Thunderbirds).

Commenting on the proposed plans for Kaka‘ako, Mr. Garcia’s primary concerns are that future developments maintain the historic look and feel of old Kaka‘ako, especially along Queen Street, and that the view planes are protected:

> Keep Kaka‘ako like Old Honolulu, like Chinatown…We don’t need another Kapi‘olani [Boulevard] with the same big dollar stores as everywhere…but fix the streets [which are now in disrepair]…. We have already lost the view of Tantalus. We are losing all the views of Hawai‘i.

He is also concerned that if development leads to increased taxes it will price local vendors/businesses out of the area: “If the Master Plan doesn’t take into account local people…if you get rid of small businesses, where are local people going to go [to sell and buy what they need]?” Knowing that GGP is under the jurisdiction of HCDA, Mr. Garcia commented about GGP land adjacent to the Garcia property, expressing his desire to see that the parking areas and the 100-year old plumeria tree (on the Queen Street border of his property) be preserved (see Figures 53 and 54). He also recommended that CSH talk to another long time *kama‘āina* business owner, Dexter Okata.

Figure 62. The interior of the Tropical Lamp & Shade Quonset hut taken circa 1950 with Millard Blaire (left) and James Garcia (right) in the foregrounds (courtesy of Clifford Garcia)

Figure 63. The Queen Street side of the store circa 1950 featuring James Garcia (second from the left), his sisters and his workers in the foreground and the plumeria tree in the background (courtesy of Clifford Garcia)

Figure 64. Tropical Lamp & Shade today, viewing the Quonset hut from the Ward Avenue side of the building looking toward Diamond Head

Figure 65. The front of the store dominated by the 100-year old plumeria tree

Figure 66. One of the historic buildings on Queen Street referenced by Clifford Garcia

7.1.8 Dr. Claire Hughes

Dr. Claire Hughes is a *kama‘āina* of Mānoa. Her mother, Leilani Brown-Kimokeo, grew up in a Hawaiian fishing village in Kaka‘ako. CSH conducted a phone interview with Dr. Hughes on October 16, 2008. Dr. Hughes shared her mother's memories of living in Kaka‘ako. She also shared her concerns regarding the proposed development plans for Kaka‘ako.

The following are her mother's memories of Kaka‘ako:

> Kewalo Basin was a popular swimming place for the children. My mother called it the "Blue Pond." It was a safe place to swim. The water in the basin was so clean and clear that you could see the bottom. There were no motorized boats in the basin.

> My mother often surfed off Waikīkī. Waikīkī, during her time, extended to where Ala Moana is today. She said in the old days (before all of the man-made outcroppings to protect the shoreline for hotel guests) you could catch a wave that carried you along the shoreline for very long distances. The wave was called *Kanalukualoa* meaning "the long backed wave." The ocean was a favorite play area for the children. She and her brother would go surfing nearly everyday. Their 10-foot surfboard was a plank of *‘ulu* (*Arctocarpus altilis*) wood, probably found from the lumberyard in Kaka‘ako.

> My mother lived in [an] area where many Hawaiians families lived. The fishing village was closer to Kewalo Basin near where Kincaid's restaurant stands today. It was *makai* of the Holy Ghost Church near Mother Waldron Neighborhood Park. Their home was a rented house, not a shack. The home was located a little past Mother Waldron Park, toward town. It was a Hawaiian fishing village, as most of the men fished offshore and on the reefs in the area. My mother gathered seaweed and other food from the area reefs. The Hawaiian enclave was near a lumber yard, as my mother said they passed by the lumberyard almost daily as they went down to swim.

> My mother remembers there was always dried fish hanging in the kitchen. However, she was not allowed to eat it, as Hawaiian families preferred their children to eat fresh fish.

Olympic swimming champions who competed in the time of Duke Kahanamoku, the two Kalama brothers, lived a few houses away. My mother said that she saw and held their Olympic medals. She didn't think that the Kalamas realized what a great achievement their medals represented. They were humble, quiet kids who swam with Duke in the competitions held between piers in Honolulu Harbor.

My mother said that there was an enclave of Portuguese families that lived around the Holy Ghost Church. As a child, she said, the church was considered too far for her to wander to.

The man who collected the rents for homes in the area was a great-grandfather of Shippy and Gard Kealoha (Clarence and Gardner Kealoha, Punahou graduates of 1953 and 1954; Shippy is still alive). My mother said he was a tall, handsome Hawaiian man who drove around the village to collect the rents. He was friendly and well-respected by the villagers. He drove in a large, open car. His wife rode with him.

My grandfather was employed as a diver for the dredging of Honolulu Harbor. He dove without equipment. He could hold his breath underwater for a long time. There were many sharks in the area, so that Hawaiian divers were sought-after by the company.

My mother and her *kahu hanai* (adopted parents) walked to Kawaiaha‘o to tend her father's grave located on the grounds of Kawaiaha`o. Later, her mother was buried there too. Both graves were moved (without her knowledge) to make room for Punchbowl Street widening. She often walked into Honolulu town with her *kahu hanai* and she enjoyed looking at dresses that her mother would later copy sewing dresses for my mother. My mother attended Kawaiaha‘o Church and remembers Reverend Akaiko Akana, a relative of Kekuni Blaisdell.

When she was older she remembered periodically walking up Punchbowl Street to an office above the current Vineyard freeway, to talk to a rather unpleasant man in an official position with the British government.

The Ward estate was the most exclusive home in the area. It was surrounded by a high wooden fence. Often the front gates were left open and they could see down

the long driveway to the large, two-story home. My mother remembers someone on the front porch in a rocking chair. There were mango trees that grew on the grounds between the street and the home. Once, my mother asked the Ward family if she could pick mangoes from their property. They allowed her to pick what was on the ground. Later, when her mother found out, she was scolded.

My mother shared that Kaka‘ako was a really nice place to live during her time. It wasn’t known as a rough place as it was later.

My mother went to Pohukaina School beginning in kindergarten. She spoke only Hawaiian and was sent to school early, so she could practice her English. She was punished for speaking in Hawaiian to her friend on the school’s playground. A note to her parents asked them to refrain from speaking Hawaiian in their home. Her Tutu didn’t agree with being asked to do that and refused. My mother was an avid reader and would go to the main library on Punchbowl and King to borrow books every weekend.

The following are Dr. Hughes’ concerns regarding developments proposed for the Mauka Area District:

Commenting on the proposed plans for Kaka‘ako, one of Dr. Hughes’ primary concerns is infrastructure of the area. From her understanding, the sewage from Kāhala travels down to Thomas Square where the outfall is emptied outside of Kewalo Basin. She gives the example of the recent sewage eruption on Kapi‘olani Boulevard where a new condominium was recently built. She can’t see more people being added to the area without infrastructure improvements. She gives the example of Ward restaurants’ sewage systems overflowing. She questions if there will be enough fresh water for the new residents in the area. Every summer, there is a water shortage and it is the Wai‘anae communities who suffer.

She is also concerned that the proposed plan will create more unaffordable housing for Hawai‘i’s people. She agrees that new homes should be built for Hawai‘i’s young people, as many are moving to the mainland in search of available and affordable homes. She does not agree with the new condominiums being affordable only to rich outsiders. Dr. Hughes mentioned the new Trump Tower in Waikīkī as an example of a housing development that is unaffordable for most local people, but financially accessible to rich foreigners.

Another concern is the disturbance of Hawaiian burials in the Mauka Area District. She asks, “What if a Catholic graveyard was dug up? Wouldn’t people be upset? Why is it any different for Hawaiian burials?” Referring to developments proposed by GGP in Kaka‘ako, Dr. Hughes stated that she feels development is encroaching on things that she and many Hawaiians value

and cherish. In the past, Hawaiian burials have been treated callously and the developers' attitudes and actions are blatantly disrespectful.

Dr. Hughes is also concerned with the visual impact of proposed developments in Kaka‘ako. Viewing photos of the area, she suggests that any developments be built on a lower level. In her opinion, the illustrations of the proposed plans do not look "for Hawai‘i's people."

She also would like for the Kaka‘ako Pumping Station to be preserved. Her mother recalls seeing it being built and how innovative it was for the times.

7.1.9 Paulette Moore

Mrs. Paulette Moore is a *kama‘āina* of Pearl City. Her family owned a home in Kaka‘ako for more than three generations. CSH conducted a phone interview with Mrs. Moore on October 16, 2008. She shared her memories of visiting her grandmother's home in Kaka‘ako as well as her thoughts of the current proposed development.

Mrs. Moore's mother's family, the Kamai-Pungs, owned a home in Kaka‘ako which she would visit every weekend. Their home was at 666 (later 712) Kaka‘ako Street. The property was given to her great-great grandmother, Nalulu Kamai, by King Lunalilo. Kawaiaha‘o archives have shown that Lunalilo's retainers were rewarded with land in the area. Her family lived on the property for more than three generations. In 1958, their property was condemned by the federal government through eminent domain. Their home and property is where the Prince Jonah Kūhiō Kalaniana‘ole Federal Building's parking lot currently stands. She says she cries when she passes by the site of her former home, missing the old days.

Her family's home had two stories, and on the first story there was a kitchen in each corner. The bottom floor was rented out and the family lived on the second floor.

Mrs. Moore remembers feeling "a presence" in the home. She and her cousins would be scared. They would hear footsteps going up the stairs, but never back down. Her mother and grandmother would tell her that it was "just our family protecting us." She says that although she knows that some of her family are buried in Kawaiaha‘o Church cemetery, some of her ancestors may have been buried in their backyard. She explains, "In the old days, if Hawaiian families didn't have enough money to be buried in a church cemetery or if they didn't have a connection to the church, they would bury their dead in their backyard." She remembers seeing her grandmother *‘oli* or pray, asking for permission to live at the place, saying that she would take care of the spirits who lived there. She says she's heard stories of the federal building employees experiencing ghosts at night, and she believes it may be her ancestors' spirits.

Her family's home was across the street from the Canada Dry factory. Every Christmas, the company would throw a party for the neighborhood kids. She and her cousins would come home from the party with a goodie bag and a can of Canada Dry. Also nearby her family home was the Kaka‘ako Café restaurant, which had the "best stew." Her grandparents would send her and her cousins with a huge pot to the Kaka‘ako Café to ask for "quarter stew and five cents rice." She remembers the stew would feed all of the kids. She tells her husband now that he's missed out on the best stew because never tasted the stew from Kaka‘ako Café. The Tomomitsu family owned a market nearby. Heading *makai*, there was the Bireley's Soda Company and Maggie's Inn, a *pau hana* (after work) place where people would drink and relax after work. The Coast Guard

was behind all of their properties. Maggie’s Inn had famous *pipikaula* (beef jerky). She wonders today where they got their meat during war when meat was rationed.

Mrs. Moore’s uncles and aunties would fish at the pier. They would catch *akule* and *‘ōpelu*. Her grandfather would also go to the C.Q. Yee Hop fish market to buy *aku*, which they couldn’t catch. She remembers her family eating the entire fish. Her grandmother would make *palu* from the intestines of the fish. The head was used for soup. The eye was given to the *punahele* (favorite) of the family, who was her brother, the oldest child.

She remembers learning to swim at Healani Beach, near their home. Although Ala Moana Boulevard was not as busy as it is today, it was still busy enough for her to need an adult to accompany her across the street. She would visit the Wilson family who lived in a boat house. Her uncle Charles Ensui Pung was an Olympic swimmer with Duke Kahanamoku and learned to swim and trained at Healani Beach. She says that the beach has been around since the time of the early Hawaiian settlers. During World War II, the beach was blocked with barbed wire. The Coast Guard, under the “Good Neighbor”policy, would allow the neighborhood families to occasionally fish although the beach was blocked.

At 5:00 PM everyday, the Honolulu Iron Works whistle would blow and she and her cousins would know that she would have to be home soon in time for dinner. At 8:00 PM, during the war, the Hawaiian Electric Company would blow a whistle, and her older cousins would have to be home by then.

She says her grandfather built her grandmother a second beach home in Squattersville, which is where the John Dominis restaurant stands today. Poor Hawaiians lived there. However, their home wasn’t a hut like others in the area, but an open-air home.

Mrs. Moore remembers visiting relatives who lived near the Kaka‘ako fire station. Aunty Leialoha lived behind her nephew Sunshine. Her Aunty had no electricity in her home although it was the 1930’s. Instead, she burned *kukuihelepo*, a lantern made of *kukui* (*Aleurites moluccana*) nut oil for light. The Leialoha family had a good mango tree in their yard.

She would play at Mother Waldron Park with her cousins. Her oldest cousin, who was about twelve, was responsible for her and all of her cousins. After playing at Mother Waldron Park they would go to a Japanese candy store (where Diamond Head Video stands today) to buy snacks for the movie. They would see a movie at Kewalo Theater and play again at Mother Waldron Park before returning home before dinner. Kewalo Theater was known as *‘ukupapa* (lice) place because everyone would lie down on the ground to watch the movies, and spread the lice to each other. Her aunties would always comb their hair with a special lice comb when they came home from the movies.

Her family would only participate in Holy Ghost Church activities during special occasions. She and her cousins couldn’t leave their family’s compound unless they were accompanied by an adult or older cousin. Her uncles were friendly in the neighborhood and many of them were involved with the Holy Ghost Church activities.

Mrs. Moore has fond memories of Kaka‘ako Street. The street was not the same as it is now. The street was blocked off from the Honolulu Iron Works to Ala Moana Boulevard, so the kids could play baseball. If she and her cousins hit the ball into the Honolulu Iron Works property,

they would go and ask for the ball back, saying they were Kamai-Pung children. The Iron Works workers would say, “So you’re just like your grandfather” because her grandfather was a famous Chinese baseball player.

Every Sunday, *kūpuna* would visit her grandmother’s home. They would drink coffee from a bowl adding a lot of Carnation cream or milk and sugar, adding a crumbled saloon pilot cracker and topping it with butter. She and her cousins, who would sit on the floor imitating the *kūpuna*, drinking tea instead of coffee. She was instructed to listen and not to speak, so she could learn from the *kūpuna*.

During her time, Kaka‘ako was regarded as a place for poor Hawaiians. Her grandmother resented this reputation because she owned her home.

Regarding the proposed development, Mrs. Moore would like [any] developers to respect the families whose ancestors have been buried in the Kaka‘ako area. Her own grandmother was very careful to respect the spirit of her ancestors. Mrs. Moore refers to the Queen Street widening project in which *iwi kūpuna* were found and were disrespectfully treated. She has family buried at Kawaiaha‘o Church and wouldn’t want a construction truck on her family’s graves.

She would also recommend that the developers keep greenery in mind when planning. She would like to see as much green space as possible, or at least a garden with native Hawaiian trees that people used in everyday life. The garden would pay homage to the ancient Hawaiian people that lived there before. She suggests including *pōpolo* (*Solanum nigrum*), *kukui*, *tī* (*Cordyline fruticosa*) leaf to ward off evil and a rare plant from the uplands, *ha‘uoi* (*Verbena litoralis*). She recalls her brother had a leg injury from playing football. Her father found the *ha‘uoi* on the side of the road, pounded it with Hawaiian salt, put the mixture on her brother’s feet and wrapped it with bandages. She also remembers if she or her cousins had a fever, her grandmother would cut the *ti* leaf and rub their foreheads with the leaf. If illness fell upon the children it was thought that someone was jealous of the family. The children also slept with a *ti* leaf under their pillows.

Mrs. Moore is also concerned with preserving the “old Kaka‘ako” of which she has so many fond memories. She understands that development is inevitable, but she is saddened by the changes in the area.

7.2 Additional Statements

A few of the community contacts invited to participate in this CIA agreed to contribute their comments to the study on the condition that their names are withheld. Following are their statements.

7.2.1 Former Resident of Kaka‘ako (1)

The participant was born on Jan 4, 1942 in Honolulu at Kapi‘olani Hospital. Her family lived in Kaka‘ako but moved to Kailua in 1952 when the industrialization of Kaka‘ako began. Their home was on 1111 Waimanu Street where Eddie’s Auto Air and The Car Store, Inc. is today. Her maternal grandfather built the 2-story home for her grandmother. She lived there with her mother, father, grandfather, grandmother and siblings. CSH interviewed this study participant on September 4, 2008 at the CSH offices. CSH accompanied the study participant on a site visit,

taking a tour of the Mauka Area District on October 1, 2008. She was also present at Former Resident of Kaka‘ako (2)’s interview on October 8, 2008.

Recalling the old neighborhood, she remembers the small corner store where she and her family would go to shop was owned by a Japanese family. Her Japanese neighbors lived in a redwood house. They had their own *furo* (wash room) in the house (which was unusual for the time; most Japanese families went to a public bathhouse). Portuguese families lived on Ward and Kawaiahao St. Her home was near the Gas Company and local soda company- Nihi Soda Company on Waimanu Street. Kawaiaha‘o Street had a Japanese “camp” as well as a Filipino “camp” which was near Honolulu Laundry. The old Honolulu Laundry building can be seen in Figure 60. She remembers the Filipino families would sit on the porch. All the different racial groups mingled with each other even though they lived in “camps” on different streets. The first supermarket on O‘ahu was on Kapi‘olani Street. There was an old barber shop on Queen Street with *tatami* (woven reed) mats. The former building is seen in Figure 55. Mother Waldron Park was a hang-out for the older kids. Figure 57 is a current photo of the park. Kaka‘ako was a safe place to live. The older kids during her mother’s time could stay out late until 1 or 2 AM and then walk home. Her family did not lock their doors and everyone knew each other.

The neighbors would occasionally have *lū‘au* (Hawaiian feast). She would know there was to be a *lū‘au* because there would be a screaming pig in a pigpen. All the neighbors would come and help. Her uncles would bring the fish. Her grandmother would *lomilomi* (massage) the fish with *‘inamona* (relish made of the cooked kernel of candlenut and salt) and add *ogo* seaweed (*Gracilaria parvisipora*). Her grandmother would also make *poi*. In tough times, cornstarch would be added to the *poi* to stretch it out. She also remembers her grandmother growing sweet potatoes. She would mash it and add coconut milk. It was her job to make rice at 4 years old.

She recalls going to Kewalo Theater near Mother Waldron Park. The building is still standing today as shown in Figure 56. She remembers seeing the movie “Bird of Paradise” and being so moved by it when she was a child. She would also see “Porky the Pig” Saturday cartoons. Her uncle and cousin would take her and her siblings to the movies. They would scare the children with ghost stories of a “ghost dog.” She was too young to understand the meaning of the story but remembers being scared. The family would also go to a candy store located across the street from the theater in the parking lot where Diamond Head Video is located.

Her grandmother had the best garden in the neighborhood. The women of the neighborhood would stop by her garden before church to gather flowers and plants for their hats. Her grandmother had the best orchids. There were huge baskets of *laua‘e* ferns (*Phymatosorus grossus*) hanging from the rafters above the porch.

She also recalls other details about her old home. For instance, there was a bombshelter in the backyard. Her mother remembers going into the shelter when she was pregnant and the sirens were going off. Her grandparents also raised chickens and she didn’t like to go into the henhouse for fear of getting pecked when gathering eggs. She remembers the soursop tree next to the chicken coop. She had to run and climb up the fence to get to the fruit before the chickens got her.

She remembers the Ala Moana area being a huge clay flatland. She would collect herbs there with her grandmother who practiced *lā‘au lapa‘au* (medicine). They would collect ‘*uhaloa* (*Waltheria indica*) for sore throat. They also gathered castor beans, which were not poisonous as thought, but a remedy for chicken pox or skin problems. The beans would be boiled then the sick person would bathe in the liquid. Her grandmother grew guava and picked the young shoots for diarrhea. To mend broken legs, they would go down to a sand area and collect a small crawling plant like aloe, with no thorns. It would be mashed, urinated on, and placed on the broken leg. For asthma, *pōpolo* leaves would be mashed and steamed in *tī* leaf, like a *laulau* with a little salt. The person with asthma would chew on it and then swallow it with a spoonful of *poi*. If she or her siblings were getting sick they would get a water enema and drink *māmaki* (*Pipturus* spp.) or guava tea. They would also sit in a chair with a bucket of boiled herbs under them and would be covered with a blanket. They would smell the boiled herbs, sweat, then go to bed.

She shared memories of going to Kewalo Basin, going onto the pier which had boat slips. Her uncles were all fishermen and went fishing there. They would go in a boat or fished on the pier. They would catch *aku* (*Katsuwonus pelamis*), tuna, ‘*ōpelu* (Mackerel scad *Decapterus pinnulatus*), reef fish and “tons of squid.” They would hang the fish on the clothesline to dry. They would give it away to their friends and her family. The family would also swim in Kewalo Basin. The area where they swam is shown in Figure 58.

She remembers the *manapua* (Chinese-style steamed buns filled with meat) man walking around with two cans supported on a stick carried on his back. He sold *manapua*, pork hash and *pepeao* (Chinese style dumpling). He was an old Chinese man who walked around the neighborhood. There was also a Japanese man who sold meat, pork, fish and snacks from a grocery truck.

They would also eat mangoes and although their grandmother had mangoes in her garden, she and her siblings would sneak into the Chinese family’s yard, climb their Spanish mango tree and eat them. They would get caught in the tree eating mangoes. They also ate papaya from their Japanese neighbor’s house and used the stalks to blow bubbles. They would sit on his roof and blow bubbles.

She would walk with her family to St. Agnes Church. Figure 59 shows the former site of the church, which is now a karaoke bar. Father Celestine baptized her, her mother and siblings. She remembers the Holy Ghost Festival and a bean-throwing game taking place.

Commenting on the current changes in Kaka‘ako and the proposed development, she suggests that the developers have a fish market reflecting the Hawaiian culture. Seattle and San Francisco both have fish markets that reflect the cultures of the particular place, and she would like to see Hawai‘i have the same. She says she will miss Ward Farmer’s Market and wishes it could be preserved. She remembers going to the market as a child and seeing the roast pork hanging up on hooks. Every Christmas, she and her family would buy *haupia* (coconut pudding), a large amount of *laulau* and *‘opihi* from Haili’s Hawaiian Food. She says that Haili’s Hawaiian Food is the last Hawaiian food place that is owned by Hawaiians. She says that the smells of the market are nostalgic and bring her back to her childhood. Her friends have told her they remember their mothers bringing them into the Ward Farmer’s Market as children. When they go back to the

market, it brings back memories of the past of when everyone knew each other and the mood was always festive.

Figure 67 The old Kewalo Theater building which is now a scuba shop

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Figure 68. Mother Waldron Neighborhood Park

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Figure 69. Area of Kewalo Basin where the participant and her family would swim

Figure 70. Former site of St. Agnes Church

Figure 71. The old Honolulu Laundry building

7.2.2 Former Resident of Kaka‘ako (2)

Former Resident of Kaka‘ako (2) is a *kama‘āina* and her family lived in Kaka‘ako, near Mother Waldron Neighborhood Park, during the 1940’s. CSH interviewed the study participant on October 8, 2008 in Kaka‘ako with Former Resident (1). She shared her memories and experiences of Kaka‘ako , as well as her concerns for the proposed development.

She remembers the Ala Moana Fish Market in the 1950’s, now the Ward Farmer’s Market, as being a gathering place for local people. There were stalls in the market similar to those that were on Kekaulike Street downtown. Every stall would have a different type of product to sell: produce, fish and meat. There were Japanese, Chinese and Hawaiian food vendors. An alcohol store was on the *‘ewa* side of the Market. She remembers the fishing boats would unload at Kewalo Basin. Everyone would go into the Ala Moana Fish Market to buy *poke* (cut up pieces of fish) and other types of food: the lifeguards, the beach boys, even the sanitary workers, because the dump was close by. The market was a gathering place for local people. Ala Moana Shopping Center wasn’t around yet. In the mid-60’s the building burnt down. The Ward family owned the Market and they quickly rebuilt the building so everyone could start working again. She remembers seeing the Ward family walking through the marketplace.

Other memories include the Portuguese church having a parade in Kaka‘ako. She remembers Mother Waldron Park being a “rough” area. There was a drive-in in front of where Ward Warehouse is today. They sold hamburgers, shakes and French fries. She remembers when her family would see a tidal wave approaching, they would all run outside and look at it. Although the tidal wave was smaller and not dangerous, she laughs at how unsafe it was.

The participant expresses how sad it is to see the whole area changing from a casual place for local people to an upscale place for tourists and foreigners. She shares that Kaka‘ako is nice the way it is now- a casual place for local people to shop and go to the movies. Right now, Kaka‘ako is not like Waikīkī where there’s nothing left of the culture of Hawai‘i. She feels all of Waikīkī has become a place just for tourists. Shopping centers are constructed in a cookie-cutter style that’s like the mainland. Chain businesses and stores are pushing local businesses away. She’s concerned that the changes in Kaka‘ako will force local businesses out of the area when rent is raised to unaffordable prices. Local people can’t afford to live in beachfront property anymore either. If they own property near the beach, hotels build up around them, their property tax goes up and they’re forced to sell their property.

She says that certain special places bring back memories that can’t be replaced. She gives the example of the Ward Farmer’s Market (formerly the Ala Moana Fish Market). It’s one of the last places in Kaka‘ako that’s still for local people. She says it is important to remember your past and preserve your culture. When places are torn down that are associated with your past and culture, it’s heartbreaking.

She is also concerned with the management of Hawai‘i’s resources such as the clean water, clean air and the environment: “Development will cause pollution, create a water shortage and more sewage. The landfills in Hawai‘i are already overused.” She is worried that tall condominiums will block view corridors and hinder trade winds. She is concerned that the developers care more about profits than about the people.

She suggests that developers in Kaka‘ako should have a section for local businesses with a lower rent. By inviting local businesses into the area, the culture of Hawai‘i can continue and will be an attraction to both tourists and local people alike. She also recommends that the developers design shopping centers which are unique and special to Hawai‘i.

She also shares concern for *iwi kūpuna* being found in the area. She’s heard stories of Hawaiian people with the bubonic plague sitting on the beach and dying in the area.

Section 8 Consultation of Cultural and Lineal Descendants

8.1 Community Consultation with Cultural and Lineal Descendants

Section 6.1 above presents an overview of the community consultation effort. The same methods (including the community outreach letter provided in 6.1) were employed to contact and consult with cultural and lineal Descendants of the Kaka‘ako area who might have knowledge of and/or concerns about *iwi kūpuna*, cultural resources and practices specifically related to the Mauka Area District. Results of consultations with cultural and lineal Descendants of Kaka‘ako are presented in Table 7 and in interview summaries below the table.

Table 7. Results of Consultation of the Cultural and Lineal Descendants

Name	Background, Affiliation	Comments
Van Horn, Diamond	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up message was left September 24, 2008. A follow-up letter was sent September 26, 2008.
Guila-Thoene, Nicole (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. August 29, 2008 the letters were returned. A follow-up letter was sent September 26, 2008.
Kaleikini, Ali‘ikaua	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008. Please refer to Paulette Kaleikini’s statement.
Kaleikini, Kala W.	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008. Please refer to Paulette Kaleikini’s statement.
Kaleikini, No‘eau	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008. Please refer to Paulette Kaleikini’s statement.
Kaleikini, Paulette	Cultural Descendant, Spokesperson for the Kaleikini Family	See response below table.
Kaleikini, Tuahine	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008. Please refer to Paulette Kaleikini’s statement.
Keana‘aina, Betty	Cultural Descendent	CSH was referred to the Keana‘aina family by OHA. Letter and maps were sent October 8, 2008. A follow-up phone call was made October 13, 2008.
Keana‘aina, Luther	Cultural Descendant	CSH was referred to the Keana‘aina family by OHA. Letter and maps were sent October 8, 2008. A follow-up phone call was made

Name	Background, Affiliation	Comments
		October 13, 2008.
Keana‘aina, Michelle	Cultural Descendant	CSH was referred to the Keana‘aina family by OHA. Letter and maps were sent October 8, 2008. A follow-up phone call was made October 13, 2008.
Keana‘aina, Wilsam	Cultural Descendant	CSH was referred to the Keana‘aina family by OHA. Letter and maps were sent October 8, 2008. On October 13, 2008 Mr. Wilsam Keana‘aina explained that his family is not from the study area.
Keli‘inoi, Moani K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Keli‘inoi, Kalahikiola (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008. Please refer to Paulette Kaleikini’s statement.
Keli'ipa'akaua, Chase K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Keli'ipa'akaua, Justin K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Keohokalole, Adrian	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Keohokalole, Dennis Ka'imi	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Keohokalole, Joseph M. Keaweaheulu	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Keohokalole, Ema Emalia	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Kini, Debbie P. K. (Norman Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Kini, Nalani K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Kini-Lopes, Puahone K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Kuhea, G. Kealoha	Cultural Descendant	Mr. Kuhea was unable to participate in this study at the time interviews were conducted.
Kuloloio (Kuloloia), Manuel Makahiapo	Cultural Descendant	CSH sent letter and maps August 4, 2008. On August 5, 2008 Mr. Kuloloio responded and said he would schedule an interview on a later date when he was on O‘ahu. Follow-up calls were made September 25th and 30th, 2008 with no answer. A follow-up letter was send September 26, 2008. Mr. Kuloloio was unable

Name	Background, Affiliation	Comments
		to participate in this study at the time interviews were conducted.
Lopes, Kamaha'o (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Norman, Carolyn D.K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Norman, Eileen (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Norman, Kaleo K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Norman, Keli'inui K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.
Norman, Theodore R. K. (Kaleikini)	Cultural Descendant	CSH sent letter and maps August 4, 2008. A follow-up letter was sent September 26, 2008.

8.1.1 Paulette Kaleikini on behalf of the Kaleikini ‘Ohana

CSH contacted Paulette Kaleikini, a cultural descendant of Kaka‘ako and spokesperson for the Kaleikini family (including, Kalahikiola Keli‘inoi, Kilinahe Keli‘inoi, Ali‘ikaua Kaleikini, No‘eau Kaleikini, Kala Kaleikini, Tuahine Kaleikini, Moani Kaleikini, Haloa Kaleikini, Mahiaemoku Kaleikini). In an email response sent to CSH on September 4, 2008, Ms. Kaleikini, representing her family, provided the following:

> The plan for this recent development demands an extensive archaeological survey to include many test pits. At the Queen Street Extension project there were 31 *kūpuna* (ancestors) yanked from *papa* (earth). This was a cemetery so it may have extended *mauka* (toward the mountains), *makai* (toward the sea), *komohana* (west), *ka hikina* (east). At nearby Ko‘olani Luxury Condos, 17 coffins were found with about 25 or more *kūpuna* in that cemetery. The coffin burials do not mean that these burials were of non Hawaiians.
>
> Then at the Walmart there were 65 burials. Ward Village project encroached on 64 *kūpuna*. So the potential for impacting on burials in the Honolulu and Waikīkī *ahupua‘a* is by far extremely high.
>
> I would like to request (should this plan go forward) that a cultural monitor be on duty each and everyday during the survey and testing and also that a detailed record of any/all *moepū* (funerary objects) and artifacts be kept.
>
> There were many fishponds in the Waikīkī, Honolulu, Kaka‘ako, Kewalo and Kalihi *ahupua‘a*. The genealogy and history of my *‘ohana* (family) pertains to many of these fishponds. The Ward Village project sits on part of Land Grant 3194 which belonged to my *kūpuna* Ka‘aua. On this property named Kolowalu was a fishpond. The reason why this *‘āina* (land) was given to *kūpuna* Ka‘aua was because he was *‘ohana* to the king. Ka‘aua was a *kahu* (priest) of ‘Aikanaka, father of the king. Ka‘aua was a cousin to my great-great grandfather, a caretaker of the fishpond . It was the *kuleana* (responsibility) of some of my *‘ohana* to raise the fish for the *ali‘i* (royalty) who were, of course, their *pilikoko* (blood relative). It wasn’t by chance that this *‘āina* was granted to Ka‘aua. It was the history of the *‘ohana* on that *‘āina* that was considered. There’s also the possibility that there were *‘ohana* burials known to Ka‘aua at that time which perhaps included the nearby cemetery where the burials were totally disturbed, demolished and destroyed to make way for the Queen St. extension project. I have a document which says that one *kūpuna* who cared for the fishponds, who was from Ka‘awaloa, never made it back to Keawemoku. So this *kūpuna* could have been laid to rest at Kolowalu along with other *‘ohana* members who were too old to make the trip back.
>
> My *kūpuna* were originally from Ka‘awaloa and traveled to Oahu with the *ali‘i* as they were the retainers and *kahu* of the *ali‘i* who prepared their food, took care of

their personal belongings such as their *malo* (male loincloth), their *niho palaoa* (whale tooth pendant, a symbol of royalty) and *mea kaua* (weapon).

Lands in Kālia Waikīkī were also of my *‘ohana*. The Kūwili pond was 1 of 2 huge and active fish ponds in Kālia when my *kūpuna* inhabited that *‘āina*. Close by was the compound of my *‘ohana*. Four generations of my *‘ohana* lived on this *‘āina* which included my great grandfather, grandfather, mother and older siblings. All were born on this *‘āina* in Kālia. Land Grant 2789 consisted of 78 acres and was issued to William Luther Moehonua who was the son of Aikanaka and Napua. Napua was the sister of my great-great grandfather, Ialua; the same *kūpuna* who was the *kahu* of the fishponds in Kaka‘ako and Kalihi. Aikanaka was the grandfather of King Kalākaua and Queen Lili‘uokalani. My great grandfather was G.W. Keaweamahi, the son of Ialua. The *‘āina* of Kālia was issued to Moehonua in respect to Ialua. As heir to Moehonua, my great grandfather inherited the land from Moehonua upon his death as Moehonua did not have any *keiki* (children). The *‘āina* remained in my *‘ohana* until the land was quiet titled and the *‘ohana* were thrown off the *‘āina* by Ethan.

Some will argue that the coffin burials found in the Honolulu/Waikīkī *ahupua‘a* were of non-Hawaiians. This of course is false as the high chiefess, Keopuolani, the sacred wife of Kamehameha I, was buried in a tomb after a traditional western funeral because she had become a staunch Christian. After her death in 1823, most Hawaiians were also being interred in European manner, in extended positions and often in wooden coffins especially if the native Hawaiian was Christianized and lived in an urban setting and may have been members of the Kawaiaha‘o Church. Also by then, the process of preparing the body for a flex burial was no longer practiced. In the Kaka‘ako area there were many mixed types of burials meaning flexed, semi-flexed and coffin. Prior to the arrival of the Japanese who worked as fishermen for the MacFarland company and the Portuguese who worked in the sugar cane fields, Kaka‘ako was inhabited by Hawaiians only. The burials in the Kaka‘ako area including the coffin type date before the arrival of these foreign peoples in 1907. It is said that the Catholic cemetery on King St. consists of Portuguese people only. This is not true as my *‘ohana*, the first mayor of Honolulu, Joseph James Fern is buried in that cemetery along with his wife, two of his daughters and five grandchildren. He and his *‘ohana* were Catholic. The mayor was the brother of my great grandmother Caroline Kamake‘e Fern originally of Kula Maui. She was the wife of G.W. Keaweamahi and raised her children in Kālia Waikīkī.

With this project, I sense a huge problem should there be any disturbance of burials, flexed or coffin, knowing that this area was predominantly native Hawaiian up until the 20th century. After this time, cemeteries, especially those of non Hawaiians were documented. Why would there be non Hawaiians buried in an area that was predominantly native Hawaiian. My only concern is that any/all burials must be preserved in place and left undisturbed.

Section 9 Cultural Landscape of the Mauka Area District

9.1 Overview

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the study area are presented below. This section examines cultural resources and practices identified within or in proximity to the subject Mauka Area District in the broader context of the encompassing Kaka‘ako landscape. Excerpts from talk story sessions are incorporated throughout this section where applicable.

9.1.1 Growing and Gathering of Plant Resources

In Kaka‘ako, the natural vegetation consists of native grasses and ‘*uhaloa* (*Waltheria indica*). Historic introductions common to the area prior to its wholesale development include *kiawe* (*Prosopis pallida*) and *koa haole* (*Leucaena leucocephala*). According to background research, there appears to have been limited numbers of wet-taro-growing plots, the general physiographic characteristics of low-lying marshy environments offered favorable conditions for fishpond construction in the inland portions and salt-making along portions of the shore From legendary accounts and chants it is told that *pili* and *mahiki* grass could be collected in the area for ceremonial or medical purposes. *Mahiki*, or ‘*aki‘aki*, is a tufted rush (*Sporobolos* sp.) found near the seashore.

Two participants in this current assessment mentioned use of plant resources. Former resident of Kaka‘ako (1) would collect herbs there with her grandmother who practiced *lā‘au lapa‘au* (medicine) in the Ala Moana area. They would collect ‘*uhaloa* for sore throat. They also gathered castor beans as a remedy for chicken pox or skin problems. In their garden, her grandmother grew guava, *laua‘e* ferns and mangoes. Paulette Moore also mentions her grandmother growing *tī* leaves in her yard and using it for medicinal and spiritual purposes. Her father also gathered *ha‘uoi* from in Kaka‘ako to heal her brother’s injured leg.

9.1.2 Marine and Freshwater Resources

The Kaka‘ako area has abundant ocean and freshwater resources. As indicated in *mo‘olelo*, Kewalo once had a freshwater spring in the central portion (current location unknown), as seen in the proverb “*Ka wai huahua‘i o Kewalo*” which translates as “The bubbling water of Kewalo.” Two springs are mentioned in a traditional story of the Waters of Ha‘o. The Kewalo area also once had a famous fishpond that was used to drown members of a pariah caste (*kauwā*) or *kapu* (taboo) breakers as the first step in a sacrificial ritual.

One study participant recalled her uncles fishing in Kewalo Basin. They would catch *aku*, , tuna, ‘*ōpelu*, reef fish and “tons of squid.” Charles Kapua’s grandfather owned a sampan that caught *aku*, ‘*ōpelu* and *akule*. Paulette Moore shares stories about her uncles and aunts fishing at the pier for *akule* and ‘*ōpelu*. Dr. Claire Hughes shared that her mother lived in a Hawaiian fishing village near the Mauka Area District, where most of the men fished offshore and on the reefs in the area. Her mother gathered seaweed and other food from the area reefs. Paulette Kaleikini sharing the genealogy and history of her ‘*ohana*, particular in association with

fishponds in “Waikīkī, Honolulu, Kaka‘ako, Kewalo and Kalihi *ahupua‘a*.” Ms. Kaleikini explained that the Ward Village project sits on part of Land Grant 3194 belonging to her *kūpuna* Ka‘aua. Ka‘aua was a cousin to my great-great grandfather, a caretaker of the fishpond on this property. It was the *kuleana* of some of her *‘ohana* to raise the fish for the *ali‘i* (royalty).

Several participants also mentioned swimming near the Mauka Area District. One study participant remembers swimming in Kewalo Basin. Dr. Claire Hughes’ mother recalled that Kewalo Basin was a popular swimming place for the children. They called it the “Blue Pond.” It was a safe place to swim. The water in the basin was so clean and clear that you could see the bottom. There were no motorized boats in the basin. Her mother often surfed off Waikīkī. Waikīkī, during her time, extended to where Ala Moana is today. She said in the old days (before all of the man-made outcroppings to protect the shoreline for hotel guests) you could catch the *Kanalukualoa* wave that carried you along the shoreline for very long distances.

9.1.2.1 Salt Pans

As noted in the LCA documents, much of the land in the modern-day area known as Kaka‘ako and in Kewalo was used to produce *pa‘akai* (salt). The Hawaiians used salt for a variety of purposes: to flavor food, to preserve fish and other meat, for medicines, and for ceremonial purposes.

Honolulu had another salt-making section in early days, known as the Kakaako salt works, the property of Kamehameha IV., but leased to and managed by E. O. Hall, subsequently E. O. Hall & Son, until comparatively recent years. This enterprise was carried on very much in the ancient method of earth saltpans as described by Cook and Ellis (Thrum 1924:116).

None of the participants mentioned salt gathering or production for this CIA.

9.1.3 Cultural and Historic Properties and Burials

Kaka‘ako is a highly urbanized and with a mix of low-, mid- and high-rise structures. There are no structures in the Mauka Area that predate or reflect the style of construction prior to western contact with native Hawaiians in 1778. A few remaining buildings were built by or inspired by nineteenth-century missionaries; however, most buildings in Kaka‘ako were built during the twentieth century after Hawaii became a U.S. territory. To preserve Kaka‘ako’s historic resources, the Draft Mauka Area Plan calls for protection of buildings which are historically significant, in productive use, and economically self-sustaining. The historic properties protected in the Mauka Area Plan include: Kawaiaha‘o Church and Grounds, Mission Houses, Old Kaka‘ako Fire Station, Mother Waldron Playground, McKinley High School, Maikiki Christian Church, Yee/Kobayashi Store and the Royal Brewery Building.

Kiersten Faulkner of the Hawai‘i Historic Foundation (HHF), mentions an inventory of architectural historic resources done by Fung Associates for GGP regarding the Mauka Plan area that revealed the following:

> “The inventory identified 13 parcels within the master plan boundary that contain structures that have historic integrity. Many of these have not yet attained the age of 50 years, but will become eligible for designation on the State Register of

> Historic Places within the 30 year planning horizon. Of the 13 parcels, HHF believes that 12 of them are not exceptionally significant. However, HHF believes that the IBM Building at 1240 Ala Moana Boulevard is eligible for designation on the Hawai‘i Register of Historic Places as a distinctive architectural type as the work of a master. The IBM Building was designed by Vladimir Ossipoff in 1962 for the IBM Corporation."

Mr. Clifford Garcia also mentioned the building across from the Hamada H. Store on the *mauka* side of Queen Street is on the register of historic places. Dr. Claire Hughes also requests preservation of the old Kaka‘ako Pumping Station.

In the Kaka‘ako Mauka Area between Punchbowl Street and Pi‘ikoi Street, there are four large historically documented cemeteries: Ka‘ākaukukui Cemetery, the Honuakaha Smallpox Cemetery, Kawaiaha‘o Church Cemetery and the King Street Roman Catholic Cemetery. The full extent of these cemeteries has not been delimited and there are probably significant numbers of burials beyond the modern cemetery boundaries or under modern structures. A total of 274 historic burials have been recorded in some way (recorded *in situ* or disinterred) in the Kaka‘ako Mauka Area. 66 burials found in the Kaka‘ako Mauka Area were not buried in coffins, or do not have associated historic grave goods, or consist of partial, previously disturbed, burials. Some skeletons were found in a traditional flexed position, suggesting a traditional Hawaiian burial practice. These may date to the pre-Contact period or the early post-Contact period (before the mid-19th century), when most Hawaiians adopted Western style burial practices (usually extended within a coffin). Most of these burials can not be assigned to a specific time period. Based on the archaeology reports, it appears that all pre-Contact human burials in the Kaka‘ako area that have been encountered were buried in sandy deposits. The majority have been identified as probably of Hawaiian ethnicity, buried in the post-Contact period from the 18th to the 20th centuries.

Several participants in this assessment (e.g., Vaughn, Hughes, SHPD, Hui Mālama and cultural descendant, Paulette Kaleikini) acknowledge the probability *iwi kūpuna* buried in the Mauka Area District. Also found within the Kaka‘ako Mauka area are wetland/fishpond deposits. There are also historic deposits/ trash pits which usually date around the last decades of the 19th to the early decades of the 20th century. Paulette Kaleikini also discussed the possibility of cultural deposits in or near the Mauka Area District.

9.1.4 Trails

John Papa ‘Ī‘ī mentions some Kaka‘ako lands while discussing early nineteenth century trails in the Honolulu/Waikīkī area (Figure 9 and Figure 10). The fact that a trail traversed this region – characterized by ponds, marshlands and *lo‘i* – suggests that the trail, especially as it neared the coastline at Kālia, must have run on a sand berm raised above surrounding wetlands and coral flats. On the *makai* trail (probably close to the current alignment of Queen Street), walking from Waikīkī to Honolulu:

> The trail from Kalia led to Kukuluaeo, then along the graves of those who died in the smallpox epidemic of 1853, and into the center of the coconut grove of

> Honuakaha. On the upper side of the trail was the place of Kinau, the father of Kekauonohi.
>
> From the makai side of Kaoaopa was a trail to the sea at Kakaako, where stood the homes of the fishermen. Below the trail lived Hehehewa and his fellow kahunas. . . (‘Ī‘ī 1959:89)

The participants in this study did not discuss trails.

9.1.5 *Wahi Pana* (Storied, Sacred Places)

The project area is associated with specific *mo‘olelo* like the traditional story of the Waters of Ha‘o. This legend tells of two children of the chief Ha‘o who ran away from their cruel stepmother and finding the Kawaiaha‘o spring. The Kewalo area also once had a famous fishpond that was used to drown members of a pariah caste (*kauwā*) or *kapu* (taboo) breakers as the first step in a sacrificial ritual known as *Kānāwai Kaihehe‘e* (Kamakau 1991:6) or *Ke-kai-he‘ehe‘e*, which translates as “sea sliding along,” suggesting the victims were slid under the sea (Westervelt 1991:16). Another legend is of a man named Kapoi who went to the Kewalo who was instructed by his *aumakua* (family god), an owl, to build a *heiau* (pre-Christian place of worship) named Mānoa. Kapoi built the *heiau,* but broke the *kapu* of king of O‘ahu, Kākuhihewa. Kapoi was seized but saved by an army of owls. Kewalo was the birthplace of the great chief Hua-nui-ka-la-la‘ila‘i. The chief Hua’s *heiau,* called Pu‘ukea, was in Kukuluāe‘o in Honolulu Ka‘ākaukukui is briefly mentioned in the legend of Hi‘iaka, one of the beloved sisters of the Hawaiian volcano goddess, Pele. Hi‘iaka and her companions have been traveling around O‘ahu on the land trails, but decide to travel from Pu‘uloa (Pearl Harbor) to Waikīkī by canoe. One portion of the chant mentions the place Ka‘ākaukukui, with reference to a pool, possibly a reference to the salt ponds of the area.

Palani Vaughan, Jr. shared stories of Ka Hale Kauwila and Ka Hale Uluhe demonstrating the cultural significance of Kaka‘ako. Mr. Vaughan shared the origins of Halekauwila Street:

> “‘Hale-ka-uwila Street’ derives its name from an historic palace, ‘Ka Hale-Ka-uwila’, which was constructed in the ancient traditional thatched-grass and wood-frame construction in 1836 by, then, Kuhina Nui, or “Premier” of the kingdom of Hawai‘i, Elizabeth Kīna‘u. “Ka Hale-Ka-uwila” was purposefully constructed to be the birthing palace for Princess Harriet Nāhi-‘ena-‘ena, the royal sister of Ka-lani-Kau-i-ke-aoūli-i-luna-lilo, who ruled Hawai‘i, then, as King Ka-mehameha III.

He also shared this about Pohukaina Street:

> “Pohu-kaina Street derives its name from the name of one of the homes owned and occupied by King Kamehameha III, who also had a royal palace, named, “Ka Hale Uluhe” that had been constructed upon a heiau, once, called, “Mana-mana”, before its destruction during the overthrow of the tabu.”

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Section 10 Summary and Recommendations

Cultural Surveys Hawai‘i, Inc. conducted this Cultural Impact Assessment at the request of the HCDA. The CIA includes the Kaka‘ako Community Development District Mauka Area located in Kaka‘ako, Waikīkī Ahupua‘a, Honolulu (Kona) District, on the island of O‘ahu and more specifically the approximately 450-acre TMK: [1] 2-1-29-32, 44, 46-56 and 2-3-01-11. According to information provided to CSH from the HCDA, the intent of the Draft Mauka Area Plan is to provide necessary guidance in planning and development of a high-quality, urban community that also promotes positive economic development, preserves Honolulu's diverse cultural heritage, and incorporates best practices in energy and environmental sustainability.

10.1 Results of Background Research

Background research on the Mauka Area District and surrounding Kaka‘ako landscape indicates:

1. The current urban district known as Kaka‘ako is significantly larger than the traditional area of the same name, which is described in mid 19th century documents and maps as a small *‘ili* (traditional land unit). In addition to Kaka‘ako, the Mauka Area District also includes lands once known as Ka‘ākaukukui, Kukuluāe‘o, and Kewalo, and possibly smaller portions of other *‘ili*.

2. In traditional times, the study area was characterized by fishponds, salt ponds, trails connecting Honolulu (Kou) and Waikīkī, and occasional taro *lo‘i*. Wetland/fishpond deposits have been documented in the Kaka‘ako Mauka Area.

3. Based on the results of previous archaeological work, it appears that there are intermittent buried cultural layers in this near shore environment reflecting the Hawaiian pattern of permanent settlements in proximity to agriculture, aquaculture and marine resources.

4. There are four large historically documented cemeteries in the Mauka Area District. The full extent of these cemeteries has not been delimited and there are likely to be hundreds of burials associated with these cemeteries but outside the modern cemetery boundaries or under modern structures. Archaeological evidence has shown that during historic times portions of the lands in and around the Mauka Area District were used to bury large numbers of people in unmarked cemeteries. A total of 274 historic burials have been recorded (*in situ* or disinterred) in the Kaka‘ako Mauka Area.

5. Kaka‘ako is a highly urbanized area with a mix of low, mid and high rise structures. There are no structures in the Mauka Area that predate or reflect the style of construction prior to western contact with native Hawaiians in 1778. A

few remaining buildings were built by or inspired by nineteenth century missionaries, however, most buildings in Kaka‘ako were built during the twentieth century after Hawaii became a U.S. territory. To preserve Kakaako historic resources in accordance with Chapter 206E, HRS, the Draft Mauka Area Plan identifies eight properties to be protected. See Table 5. All eight properties are listed on either the National or State Register of Historic Places. The Draft Mauka Area Plan also proposes to protect the City and County of Honolulu's Neal Blaisdell Center for its cultural and aesthetic value.

6. The study area is associated with *mo‘olelo* (oral history) in which Ka‘ākaukui, Kewalo and Kukuluāe‘o were traditionally noted for their fishponds and salt pans, for the marsh lands where *pili* grass and other plants could be collected, for ceremonial sites such as Pu‘ukea Heiau, Kewalo Spring, and Kawailumalumai Pond at which sacrifices were made, and for their trails that allowed transport between the more populated areas of Waikīkī and Honolulu. Important chiefs such as Hua-nui-ka-la-la‘ila‘i were born in the area and conducted religious rites, and commoners traveled to the area to procure food and other resources; some commoners probably also lived in the area, possibly adjacent to the ponds and the trails. The study area is also associated with legendary accounts of the Waters of Ha‘o, Kapoi and the *heiau*, and the legend of Hi‘iaka and more.

10.2 Results of Community Consultation

Eighty-one community members (government agency or community organization representatives, or individuals such as residents, cultural and lineal descendants, and cultural practitioners) were contacted for the purposes of this CIA. Thirty-four people responded and 12 *kūpuna* (elders) and/or *kama‘āina* (native-born) were interviewed for more in-depth contributions to the CIA. Based on these consultations, there are five major concerns (and several ancillary ones) regarding potential adverse impacts on cultural, historic and natural resources, practices and beliefs as result of the proposed Mauka Area Plan:

1. The Mauka Area District and vicinity is likely to have surface and subsurface cultural and historic properties, including human burials. Several of the study participants indicated that there could be *iwi kūpuna* (ancestral remains) in or near the subject Mauka Area District. Phyllis "Coochie" Cayan of SHPD states, "As you know from past and current projects in the area and the ahupua‘a—the makai area is a high risk for human burials. There has been past inadvertent finds mauka, but not as numerous as the makai areas." Study participants made the following recommendations:

    a. Due to the fact that the Mauka Area District is likely to have surface and subsurface cultural and historic properties, Hui Mālama I Na Kūpuna O Hawai‘i Nei has recommended a

thorough, in-depth archaeology inventory survey. OHA recommended for every developer within HCDA's jurisdiction to conduct an archaeological inventory survey to identify *iwi kūpuna* within the Mauka Area District as the probability of burials in the Mauka Area District is high.

b. Cultural descendant Paulette Kaleikini has stated that, "any/all burials must be preserved in place and left undisturbed." She also requested that "a cultural monitor be on duty each and everyday during the survey and testing and also that a detailed record of any/all *moepū* (funerary objects) and artifacts be kept."

c. OHA, SHPD, Hui Mālama I Na Kūpuna O Hawai‘i Nei, Leimomi Khan, Charles Kapua, Dr. Claire Hughes, Paulette Kaleikini and Paulette Moore state that *iwi kūpuna* finds be protected and treated respectfully.

2. Several participants voiced negative feelings and concerns about the overall cumulative impacts of ongoing and future developments in Kaka‘ako and Mauka Area District environs as contributing to the loss of what is authentic and traditional about Kaka‘ako. Study participants mentioned factors such as: housing prices and rental space for businesses being beyond the reach of most *kama‘āina* and the displacement of local, family businesses by national "big dollar" chains. Additionally,

    a. A few participants provided suggestions for development projects that might generate more tourism to the area while maintaining a Hawaiian sense of place and the look and feel of "old Kaka‘ako" including:

        i. creating a pedestrian overpass over Ala Moana Boulevard to Kewalo Basin,

        ii. refurbishing the fish auction house,

        iii. creating a monument in Kaka‘ako as a repository for genealogies of the Hawaiian monarchy and,

        iv. creating a Hawaiian "cultural market" in the Mauka Area District.

        v. providing local businesses with lower rent..

3. A related concern is the loss of historic properties in the Mauka Area District and vicinity. The Historic Hawai‘i Foundation (HHF) referred CSH to an inventory study prepared by Fung Associates for General

> Growth Properties (2008) in which 13 parcels were identified within the master plan boundary that contain structures of historic integrity that will become eligible for designation on the State Register of Historic Places within the 30 year planning horizon. HHF emphasized that of the 13 parcels identified in the 2008 Fung Associates inventory for state and national registers of historic places, the IBM Building at 1240 Ala Moana Boulevard designed by Vladimir Ossipoff (1962) is significant for its distinctive architecture and the work of a master and is thus eligible for designation on the Hawai‘i Register of Historic Places. HHF further recommended for this CIA that,
>
> …similar study and evaluation of the remaining blocks to be conduced and that the findings from the GGP inventory be incorporated. Notable sites will include those already listed on the Hawai‘i State or Nation Registers of Historic Places, such as McKinley High School and the Ala Moana Pumping Station, as well as…the Dickey-designed theater, WWII-era and post-war Quonset huts, modernist structures at the Blaisdell complex, and other residential, commercial and industrial buildings throughout Kaka‘ako.

Community contacts interviewed for this study also noted the significance of historic properties in the Mauka Area District and vicinity and stated their desire to see the preservation and/or rehabilitation of properties in or near the Mauka Area District such as Fisherman’s Wharf, Ward Farmers Market (formerly, Ala Moana Fish Market), Mother Waldron Neighborhood Park, Kewalo Theater and buildings on Queen Street such as the Quonset huts and the Hamada H. Store.

4. Some participants voiced opposition to the development, construction or alteration of Kaka‘ako that threatens to negatively impact its view corridors and remaining green spaces (parks). Participants are concerned that more high rises will further obstruct *mauka-makai* views; one participant stated his concern that further high rises would create a wind tunnel; another participant recommended that building height be limited to 40 feet. Leimomi Khan commented that tall buildings in Kaka‘ako detract from the beauty of the ocean and green space and stressed that development changes the spirit of the *‘āina* and impacts our *‘ano* (character, spirit, way of life, standard of living). Clifford Garcia stressed, “Keep Kaka‘ako like Old Honolulu, like Chinatown…We don’t need another Kapi‘olani [Boulevard] with the same big dollar stores as everywhere….We have already lost the view of Tantalus. We are losing all the views of Hawai‘i.”

Two participants provided suggestions to help remediate the loss of green spaces and to protect the natural environment including: pursuing a green initiative by,

for example, using a deporter that transfers deep, cold ocean water to power air conditioners in buildings close to the shoreline; creating a Hawaiian garden with plants that people used and use in everyday life such as *kukui* (*Aleurites moluccana*) and *tī* (*Cordyline fruticosa*).

5. A few participants expressed concern about the Kaka‘ako’s overtaxed infrastructure mentioning, for example, streets in disrepair, traffic congestion and waste management problems as a result of current and future developments in Kaka‘ako.

10.3 Recommendations

For several of the participants in this CIA there is great concern that proposed developments for Kaka‘ako and the Mauka Area District may negatively impact Hawaiian resources and practices, particularly with regard to disturbance of burials or *iwi kūpuna*. Additionally there is concern about potential loss of a Hawaiian sense of place, the historic look, and the socio-economic vitality for *kama‘āina* and Hawaii’s residents, of old Kaka‘ako. A good faith effort to address the following recommendations may help mitigate potentially adverse effects on cultural, historic and natural resources and associated practices as result of future projects proposed in and near the Mauka Area District:

1. Based on the archival evidence and community consultation conducted for this assessment, it is likely that there are burial sites (*iwi kūpuna*, ancestral remains) as well as significant cultural and historic properties in the subject Mauka Area District; it is therefore recommended that:

    a. Cultural monitoring and/or continuous ongoing consultation with cultural descendants of the area be conducted during all phases of development including construction;

    b. Personnel involved in development activities in the Mauka Area District should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law;

    c. If human burials are found, cultural and lineal descendants of the area should be consulted in regard to burial treatment plans;

    d. A thorough, in-depth archaeological inventory survey should be conducted.

2. It is recommended that the proposed development should preserve and include themes from “old Kaka‘ako” and native Hawai‘i that enhance the

sense of place and that project proponents consider suggestions provided by community members on developments such as a fish market, Kewalo Basin overpass, etc.

3. It is recommended that the proposed development plans not impinge on view corridors and green spaces and that project proponents consider suggestions provided by community members on green initiatives, gardens, etc.

4. It is recommended that the project proponents address infrastructure concerns with community members before development begins.

5. Generally, it is recommended that project proponents pursue proactive consultation with community members and cultural and lineal descendants with connections to Kaka‘ako in order to address community concerns and integrate preservation and restoration ideas in the design and construction of any future developments in Kaka‘ako.

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Appendix A Sample of LCA testimony

F.R. = Foreign Register

F.T. = Foreign Testimony

N.R.= Native Register

N.T.= Native Testimony

No. 387*O, General Claim, Mission Claims continued from page 20 [Maui] F.R. 26-27v2

To the Board of Commissioners for quieting Land titles, Gentlemen:

The undersigned as agents of the Mission of the American Board of Commissioners for foreign missions a the Sandwich Islands beg leave to present for your examination, the accompanying documents; being statements of grants made to various individuals of the mission at sundry times & places, for the purpose of affording facilities for the prosecution of the Missionary work in these Islands by the Missionaries of the said A.B.C.F.M. to the end, that if upon examination, they shall be found valid, the said grants may be confirmed in such manner as the laws of the Sandwich Islands may require. The following is a list of claims to be considered, viz.

Kauai - Premises & lands at Waiole, Koloa & Waimea
Oahu - Premises & lands at Honolulu, Ewa, Waialua, Kaneohe, Hauula & Punahou
Molakai - Premises & lands at Kaaluaha & out stations - if any
Maui - Premises & lands at Lahaina, Lahainaluna, Kanipali, Wailuku & Hana
Hawaii - Premises & lands at Kailua, Kealakekua, Kau, Hilo, Kohala & Waimea.

The lands & premises at the above-mentioned stations are in care of the resident missionaries of the A.B.C.F.M. at said stations. We have thought it best to enumerate all the stations though some of the claims have not been received, & some have been already presented to the Board.
Signed, Samuel N. Castle, Edwin O. Hall, agents
Honolulu, March 125h, 1847

The claims herewith sent are for Waialua, Honolulu, Punahou, Kaneohe, Waiole, Koloa, Waimea, Kaui, Hilo, Kealakekua, Kailua, Waimea, Hawaii, Kohala.

I believe Kau, Lahainaluna, Lahaina, Wailuku, Hana & Molakai are already sent in.
S.N.C.

F.R. 31-33v2

[No. 387], Honolulu, Statement of Mission Lands Claims at Honolulu.

Premises occupied by Mr. Dimond, given by Kalaimoku to Reverend William Ellis of F. M. [Foreign Missions] Society, & by him to the Mission of A.B.C.F.M, at these islands. The original grant was much larger then the spot at present enclosed by Mr. Dimond.

2d. All the parcels of land enclosed by the mission in the district known as Kawaihao, which whole distinct was given by Kaahumanu, 1st to Mr. Bingham for the use of the mission & also any enclosed portions of said district, if there be any such, not in actual possession of the natives. The mission buildings & land upon said lands. Also a portion of ground enclosed & upon which stands an adobie school house, at present occupied by Mr. Wilcox.

In addition there is a land in Koolau called Kaluanui, given by Kaahumanu to Mr. Bingham. S.N. Castle, Edwin O. Hall, agents.

To the Board of Commissioners &c, Gentlemen:

In compliance with your public notice relative to claims of land &c I beg leave to state that I have no lease or written document of the Mission premises now occupied by myself in the Northwest part of Honolulu called Kaumakapili.

This station was commenced by myself soon after the general meeting of the American missionaries held in May 1837.

The land upon which the dwelling house, the station school house & meeting house are erected, was said to belong at that time to Konia, wife of Paki. Several of the chiefs then in authority, viz. Kinau, Kekuanaoa, Kona & Paki, after mature deliberation, informed me that they had set apart the yard in which the dwelling house is built, & the one where the station schoolhouse is erected, for a new missionary station & told me that I might commence operations at pleasure.

In the fall of 1838, the same persons set apart our meeting house yard as a place upon which to erect a house of worship to Almighty God. These 3 several yards are each enclosed with adobie walls, & their boundaries & dimensions are nearly as follows:

1st. Residence of the missionary measures about 46 yards & is bounded by a narrow lane. The mauka side is about 53 yards long, the northwest end is about 46 yards wide & the makai side is 60 yards long.

2d. The schoolhouse yard lies contiguous to the enclosure above described on the Southwest and is an oblong square, bounded on the Southeast side by the narrow lane & is 46 yard long and about 24 yards wide.

3d. The meeting house yard lies a few rods mauka of the mission dwelling house. The makai end is bounded by the public road & measures 48 yards, the northwest side is about 70 yards long &

the mauka end is 40 yards wide, the southeast side is 61 yards long
Signed, Lowell Smith
Honolulu, July 14, 1846

F.R. 33-34v2
[No. 387], Punahou [margin note illegible]

The undersigned claim in behalf of the mission of A.B.C.F.M. at the Sandwich Islands all that tract of land known as Punahou lot mauka & makai; to be used for the purposes for which it was granted.

That portion of said land which lies mauka of the Wai'un [?] road is said to be bounded nearly as follows: commencing by Allen's bridge which crosses the street near Allen's house & running inland to near the top of Ualakaa. Thence east into the valley near a certain rocky knowl [sic. knoll] pointed out by natives as the corner, thence toward the sea along a line running a short distance [illegible] east of that part of said land which is enclosed & extending to the road which runs from Honolulu to Waikiki just mauka of Allen's house, thence along said road to place of beginning.

The boundaries of that part which lies on the sea shore we cannot define so definitely, but presume there will be no difficulty in determining them as it is commonly known as pertaining to Punahou. This part embraces fishing grounds, coral flats & salt beds.

The above land was given by Boki to Mr. Bingham; then a number of the above named mission & the grant was afterwards confirmed by Kaahumanu. We have heard several persons mentioned as being acquainted with the facts & circumstances respecting this grant of land among whom are Reverend H. Bingham, Asa Thurston, William Richards, Levi Chamberlain, Governor Kekuanaoa, Laanui, John Ii, &c&c.
Signed, Daniel Dole, W.H. Rice.

I was told that Punahou extended from the road near to Allens, back to the top of Ualakaa, then the northern boundary was said to run from the top of Ualakaa eastward into the valley so far that the eastern line would include much of the rocky hill near the spring in passing down the road near Allens. There, there was a large flat on the sea shore embracing fishponds & salt beds & coral flats.
The above was written by Mr. Bingham from United States
W. Richards

F.R. 34-35v2
[No. 387], Kaneohe, Land connected with the mission station at Kaneohe

About 4 acres are held by the mission enclosed by a fence; it has been occupied about 12 years.

The station was taken by permission of the King & the land given by an agent of Liliha, widow of Boki, since deceased.

In addition to the above there is a taro land, known among the natives as an ili aina; not designated by any particular boundaries. This was given for the use of the mission by Liliha - widow of Boki.
(No signature)
Kaneohe, December 8,1846

F.R. 35-36v2
[No. 387], Ewa, April 20, 1847

To the Commissioner, &c, Gentlemen:
I hereby make application for confirmation of title to a piece of land called Kionaole, a small ili in the ahupuaa of Waiawa, Ewa. I hereby enclosed a draft of said land, the measurement of which is as follows: Beginning at Northwest course & running south 74 fathoms, thence east 70 fathoms, thence north 20 fathoms, thence west 26 fathoms, thence north 44 fathoms & thence west 40 fathoms to the place of beginning. Said land comprises about 3 acres more or less.

Also a fish pond situated near the river joining southeast corner on a piece of waste land reckoned as belonging to Manana, an ahupuaa on the opposite side of the river. Said fish pond was dug out for me by my church members in 1838 & measures 27 fathoms by 14 (see draft).

I would also ask for a grant to the Protestant Church at Ewa for the use of their pastor, one of the moo paahao, of which there are two in Waiawa. As they have not been cultivated for more than 3 years & are now overgrown with bulrushes, there is no probability that both will be wanted again for the aupuni. Each moo contains 3 or 4 acres each. The members of the church wish one of them to cultivate, the avails of which are to be devoted to religious purposes.

Also, my house lot within the ili aina of Waiawa called Panaio, & three or four acres of land adjoining the Protestant Chapel for a church yard and burying ground, to be confirmed by title in the same manner as similar grants are confirmed.

For authority respecting the grant of my land marked out i the enclosed draft. I beg to refer you to Governor Kekuanaoa executor of Kinau, who gave me the said land in 1836 or early in 1837.
Signed, A. Bishop

[DIAGRAM]

F.R. 28v2
No. 387, [American Board of Commissioners for Foreign Missions], [Oahu claims, continuation of claims from other islands]

Extract from a letter addressed to Mr. Castle dated February 17th, Waialua and Signed P.J. Gulick.

"P.S. I opened this to say a few words relative to the land connected with our premises. What it seems desirable to retain is a long narrow strip of probably 20 acres; bounded on the East by a road which crosses the river, or brook, Anahula, about 1/4 of a mile east of Mr. Emerson's residence, On the south by the brook Lanahula, On the west by the road which crosses said brook just opposite Mr. Emerson's house & On the north by a crooked stone wall built by Mr. Lock & Mr. Wilcox.

It has also been a stone wall on the east and a doby west, built by our Brethren. It is the better part of the land called Lokoea, but on the west & north it is said to fall considerably within the boundaries of Lokoea. With these data & the papers, I think you can make a more correct statement that I can; unless I get it surveyed. I don't know that I can do any better than I have now done.
Signed P.J. Gulick.

N.R. 229-231v2
No. 387, [Missionary claim]

Unirrigated farm land at Waialua, Oahu. Conveyance of a portion of land for dry farming at Waialua.

Because of my thought of the importance of knowledge and education which will benefit the Kingdom of Hawaii; and because I also think Mr. Loke /Mr. Looke/ has a good school at Waialua and the students are preparing to be educated to end the idleness and deficiencies of this land, therefore I agree and explain that a portion of land at Waialua shall be transferred to said school without payment or tax. the diagram of this land is below, however, the north side is not exactly like the diagram. The ancient boundary will prevail on that side until the time when I understand the correctness of the new move. The steam is not conveyed with the land. It is, however, the boundary on this side. If the supplies of the school are taken on the stream this is not a wrong, however, the fish are protected.

Furthermore, there are given some divisions of water for this land, three days in one week on the north side of the stream, and on the south side, two days. On those two days the water shall flow to irrigate the crops.

Furthermore, John Ii, the School Superintendent of Oahu, shall administer that land and he is also the perpetual custodian of that land.

It /the land/ is conveyed absolutely to that school; it shall not be arbitrarily taken, nor shall it be disturbed unless the school is at fault or its haole teacher or his successor, perhaps. The land shall

be administered so as to benefit the school. The land may not be given over to anyone else. It is given only for the benefit and to supply the needs of the school. Here is the diagram of the land:

/see diagram/ [No diagram in this text]

This diagram is not absolutely correct, as it was not surveyed with a transit. The beginning of the measurement is at the corner marked I, at a place close to the wooden road over the water /bridge or causeway?/

This word is recorded at Honolulu on the 14th day of September, 1841.
KEKUANAOA
Witness: Paalua, Limaikaika /Armstrong/

In accordance with Kekuanaoa's thought explained in this paper, giving me the administration of that kula farm land at Waialua, I agree that this land be conveyed to said school, and Locke or his successor, perhaps, the one who teaches at that school, to stimulate intellectual growth here in Hawaii.

Recorded at Honolulu this 14th day of September, 1841.
JOHN II, School Superintendent of Oahu

We two consent to all the words in this document.
KAMEHAMEHA III, KEKAULUOHI

F.T. 260v3
No. 387, American Mission, Part 1, Section 5, Division 1, 22 February, Emerson Waialua

1. Kuakoa, sworn, I know this land at Kawaipuole in Waialua.

It is bounded:
Mauka by Kukipa's land
Waianae by an old adobe fence
Makai by my fence
Waimea by land of mine and a kalo patch of Poli and a river called Anahulu, and a kalo patch of mine.

2. This land is in Olohana, an ili, the land is called Manawai. It is an orange garden

bounded:
Mauka by a stone wall and a dry stream
Waianae by stream of Kawailoa
Makai by konohiki's land
Kolauloa by a pali.

3. This piece is an ili aina of Kawailoa at Paalaa.

It is kalo and kula bounded:
by konohiki's land, Mauka
Waianae by a pali
Makai by konohiki's land
Kolauloa by a stream of Paalaa.

Claimant got the piece No. 1 from Kinau in 1832 and has lived there constantly ever since, and no one has ever disturbed him.

He got No. 2 from Gideon Laanui in Kinau's time, 1838, and has occupied it without disturbance in peace ever since.

He got the piece No. 3 from Kinau in 1835 and has held it ever since in peace.

Olopana, sworn, the preceding testimony is correct and true, which I now of my own knowledge, and that Mr. Emerson has lived there to the present time in peace.

Continued page 302.

No. 2. Mr. Emerson did not think required a survey and states it at less than acre.

F.T. 302v3
No. 387, Sandwich Islands Mission Claim, Part 1. Section 5, Division 1, J.S. Emerson, from P. 260 [p. 260 claim for Waialua Oahu]

Kilioe, sworn (from Kauikawaha's written Report to Claimant and translated by him for the Commissioner), I heard D. Oleloa & Kaukualii ,his wife, say the Kinau wrote to them at Kauai thus "Laanui sought for land for the Missionary located at Waialua & he has found it within your land viz. Hawailoa - Give Your assent that it be given him" To which we Daniela ma gave our assent in writing.

Kamalie, sworn, I heard the same things as Kilioe says - and I heard before, at a time when Hawailoa was our land as hoaainas - my mother's brother named Wana, one of Laanui's family, came to us and said "Your land is given by the foreigner, Mr. Emerson by Kinau - so says Laanui.
Continued 306 page, Division 2

F.T. 306-307v3
No. 387, Sandwich Islands Mission, Part 1, Section 5, Division 2, P.I. Gulick, from p. 302

Reverend I.S. Emerson, sworn, In about 1837 Kinau granted to me a certain part of the land now coccupied by Mr. Gulick to aid the Church. This grant included the Western end, containing probably 3 to 5 acres. It did not I think to include the spot of Mr. Gulick's house lot. that spot, as I understood Mr. Locke came into an unwritten contract between him & Laanui, by which Mr. L. [Locke] was to pay Laanui a certain sum per annum for the remainder of the land which Mr. Gulick now claims. This land has been in the possession & use of the Mission from about 1838 to this time.

Witness admitted Mr. Metcalf's survey [as] correct.

"E ike auanei na kanaka a pau ma keia palapala ke nana mai lakou.

Owau o M. Kekuanaoa ka makua Kane a kahu waiwai o Victoria Kamamalu. Ua Kuai lilo loa aku au no`u iho a no kuu poe hooilina a hope paha i kekahi mau Eka Umikumamaono a me ka hapa Eka aina e waiho la ma Kawailoa & Waialua Mokupuni Oahu. Aia keia aina maka aoao mauka iho o ka pa ona Gulicka la. Ua komo pu keia me kahi i Ku mua ai kona hale.

Eia ke kumu o ka lilo ana o keia aina no ka loaa ana mai ma kuu lima na Dala maikai $82.50. No laila aole o`u kuleana i koe. ua lilo loa ia Gulika a me kona mau hooilina a hopepaha.

No ka oiaio Kekakau nei au i kou inoa i keia la 23 October, 1850, M. Kekuanaoa
Ike maka, Kahiwalani

F.T. 341-343v3 [Claim 5877 of Keakaku]

F.T. 368v3
Cl. 387, American Mission, Part 1, Section 6, Ewa, May 14, 1856

Artemis Bishop testified that in 1836 this land called "Kianaole" in the district of Ewa was given to witness for the American Board of Missions and that the 2 surveys of T. Metcalf of the same, dated March 2, 1849, correctly desribe the lot which has been occupied & used for the Mission without interruption to the present time.

Note. Governor Kekuanaoa has seen these surveys & approved of them before the Commission.

See page 343

N.T. 592-593v3
No. 387, Honolulu Mission, Part 1, Section 5, Waialua, Emerson

Kuakoa, sworn, I have seen his land at Kawaipuolo in Waialua.

The boundaries are:
Mauka, Huki's lot
Waianae, the old mud wall
Makai, my fence
Waimea, Kuokoa's land, Poli's patch, Anahulu River and one patch for me.

2. Olohana ili land in Kawailoa named Manawai and is an orange grove.

Mauka, a stone wall and dry stream
Waianae, Kawailoa stream
Makai, the konohiki's land
Koolauloa, a precipice.

3. Hawaiiloa's ili land at Paalaa, a taro land and the pasture.
Mauka, the konohiki's land
Waianae, a precipice
Makai, the konohiki's land
Koolauloa, Paalaa's stream.

Section 1 from Kinau in the year 1833 and he has always lived there to the present. No one has objected.

Section 2 is from G. Laanui during Kinau's time in 1838 and life has been comfortable; No one has objected. Section 3 is from Kinau in 1835. No one has objected.

Olopana, sworn, The statements just made by Kuokoa are true, accurate and right and I have known the same way. Emerson has always lived there to the present. No one has objected.

N.T. 677v3
No. 387, Emerson, Part 1, Section 5, October 8, 1850

Kuokua, sworn, I have seen Emerson's land at Kawailoa Paalaa in Waialua. I have known the boundaries, but I have not known who had given him his land except that I had heard only it was given by Kinau and Kamekualii; however, I am not very sure.

F.T. 115-116v3
Cl. 387, part 1, americal Sandwich Island Mission, Oahu, 23 March [1849], section 2 Punahou, Oahu, [illegible], William H. Rice, agent, present

[Margin note: Mr. Lee's notes]

John Ii, sworn for claimant, I am well acquainted with Punahou and its boundaries. It consists of

two parts, one inland and the other a sea land.

It is bounded:
Mauka by the large land called Manoa
Waialae by Mauna Pohaku
Makai by kula land of Allen, Kapeau, myself & others.

I think it extends nearly down to the road leading from Honolulu past Allen's place, Honolulu side by the road leading from the old Allen place to Manoa and by my land.

The makai part of Punahou is bounded:
Mauka by Kewalo and Koula
Waititi side by Kalia
Seaward it extends out to where the surf breaks
Honolulu side by Honoliilii.

This land was given to Mr. Bingham for the Sandwich Island Mission by Governor Boki in 1829. It was given upon the same terms as all their other lands were given to them; and the Grant was confirmed, so far as silence proved it, for in truth she [he?] had no right to set aside this grant.

From that time to this, the Sandwich Island Mission have been the only possessors and konohikis of the land. I was a witness to the gift. The title of the Mission is perfectly clear.

The name of the makai part is Kukulaaeo. There are several tenants on the land of Punahou whose rights should be respected.

Z. Kaauwai, sworn, I know this land. I heard Boki say to Hoapili Kane concerning the gift of this land to Sandwich Island Mission that the had given it to Mr. Bingham.

Boki's wife made some objections to giving it to Mr. Bingham, claiming it has hers as received from her father, Hoapili Kane but Hoapili Kane confirmed the gift and it was adjudged to be right & propert.

From what I heard at the time of the boundaries, I should think Mr. Metcalf's survey correct.

[Award 387; (Oahu) R.P. 1600; Beretania St. Honolulu Kona; 2 ap.; 5.36 Acs; R.P. 1600; King St. Honolulu Kona; 1 ap.; .41 Ac.; King St. Honolulu Kona; 3 ap.; 6.66 Acs; no R.P.; R.P. 5698; Printers Lane Honolulu Kona; 1 ap.; .36 Ac.; R.P. 1947; Panaio; 3 ap.; 4.13 Acs. (A. Bishop); R.P. 1931, Punahou Manoa Kona; 1 ap.; 224.68 Acs; R.P. 1945; Punahou Manoa Kona; 1 ap.; 77 Acs; R.P. 1941, 1945, 1958 R.P. 1931; Punahou Honolulu; 1 ap.; 36.90 Acs (S.N. Castle and Amos S. Cooke); R.P. 1932; Kawaiahao Honolulu; 1 ap.; 1.23 Ac. (S.N. Castle); R.P. 1941; Kawaiahao Honolulu; 1 ap.; 1.30 Ac.(Maria P. Chamberlain); R.P. 1941 Punahou Honolulu; 1 ap.; 26.66 Acs (Maria P. Chamberlain); R.P. 1944; Kukuluaeo; 3 ap.; 77 Acs (Ephraim W. Clarke; R.P. 1944; Kawaiahao Honolulu; 2 ap.; 1.64 Ac. (Ephraim W. Clarke); R.P. 1934;

Kawaiahao Honolulu; 1 ap.; 1.5 Ac. (Amos S. Cooke); R.P. 1945; Kawaiahao & Punahou Honolulu; 3 ap.; 27.97 Acs (E.M. Rogers); R.P. 1933; Kaumakapili Honolulu; 1 ap.; .53 Ac. ; R.P. 1600; Kaumakapili Honolulu Kona; 1 ap.; .6 Ac.; R.P. 1600; Kaumakapili Honolulu Kona; 1 ap.; .19 Ac.; (Lowell Smith); R.P. 1938; Pukauki Kaneohe Koolaupoko; 1 ap.; 16.1 Acs; R.P. 1958; Waikapoki Kaneohe Koolaupoko; 1 ap.; 5.13 Acs (ABCFM); R.P. 1951; Kawailoa Waialua; 2 ap.; 10.81 acs (John S. Emerson); R.P. 1940; Kawailoa Waialua; 1 ap.; 24.56 acs. (Peter I. Gulick)]

No. 1502, Paele

N.R. 137v3

To the Land Commissioners, Greetings: I, the undersigned, hereby tell of my land claim for one house lot, three fish ponds and a salt bed. That is my claim of which I tell you.
PAELE X
Puukea at Kukuluaeo, December 6, 1847
[No. 1502 not awarded]

No. 1503, Puaa

N.R. 138v3

To the Land Commissioners, Greetings: I, the undersigned, hereby tell of my land claim, for three fish ponds, and also a house lot.
PUAA X
Kukuluaeo at Honolulu, December 6, 1847

F.T. 73v3
Cl. 1503, Puaa, December 29, 1848

Pahiha, sworn, I know this land. It is in Kukuluaeo, Waititi, consisting of:

1. One fish pond:
Mauka, Government kula land
Makai, Keo
Waialae, Kekuanaoa
Honolulu, a stream.

2. Two fish ponds:

Mauka is Government kula
Waialae, Paele
Makai, Puula
Honolulu, Kamukau.

Kauhi gave these lots to claimant in 1847. He got them from Mr. Amrstrong, the same year.

Refer to Mr. Armstrong.

N.T. 401-402v3
No. 1503, Puaa, December 29, 1848

Pahiha, sworn, I have seen Puaa's land at Kukuluaeo in Waikiki, where there are three fish ponds in two sections.

1 pond and a house site:
Mauka is the government school
Waikiki, Kekuanaoa's land
Makai, Keo's land
Honolulu, the stream which is at the end of Waikiki.

2 ponds:
Mauka is for the government
Waialae, Paele Puula's /land/
Honolulu, Kumukau's /land/.

Puaa received his land from Kauhi in the year 1847 and Kauhi had received his interest from Limaikaika at the time J. P. Judd had become Minister of Finance. Limakaika's interest is from Kauka.

[Award 1503; R.P.; 5591; Kewalo Honolulu Kona; 1 ap.; .16 Ac.; Kukuluaeo Honolulu Kona; 2 ap.; 1.09 Acs]

No. 1504, Pahiha

N.R. 138v3

To the Land Commissioners, Greetings: I, the undersigned, hereby tell of my land claim consisting of three lo`i, one fish pond, a salt bed and a house lot. The lo`is are in the `lli of Kaakaukukui in Honolulu, and the house lot and pond and salt bed are at Puukea, adjoining Waikiki.
PAHIHA X

Puukea at Kukuluaeo, December 6, 1847

F.T. 73-74v3
Cl. 1504, Pahiha, December 29, 1848

Nana, sworn, This land is in Kaakukui, Pauoa.

1. House lot. 1 house and no fence in Honolulu.
Mauka is Piikoi
Waititi, Kanekapolei
Makai, mahuka
Ewa, Puaa.

2. Five patches and auwai in Pauoa.
Mauka is Auku
Waititi, Mahuka
Makai, Kuinoino
Ewa, Kula of Piikoi.

Ioan Pehu gave these 2 lots to claimant in 1847. Pehu had these lands form Kekuanaoa, and is now dead this season.

Refer to Kekuanaoa. See 376 page.

F.T. 376v3
No. 1504, Pahiha, from page 73, September 6th 1852

Claimant appeared in person and stated that the two kalo patches surveyed for him by A.G. Thurston, in Kaakaukukui, Pauoa, belong to the konohiki, and he (Pahiha) give up all claim to said patches.

N.T. 401v3
No. 1504, Pahiha, December 29, 1848

Nana, sworn, I have seen this land at Kaaukukui in Pauoa, Honolulu district. Two patches and a house lot are in Honolulu. One house is on this lot.

Mauka is Piikoi's land
Waikiki, Kanekapolei's lot
Makai, Mahuka's land
Ewa, Puaa's /land/.

2 patches:
Mauka, Aukuu's land
Waikiki, Mahuka's land
Makai, Kuinoino's land
Ewa, Piikoi's land.

Pahiha's land and house lot are from Iona /Jonah/ Pehu given in the year 1837 and Pehu had received his land from Kekuanaoa.

[Award 1504; R.P. 5589; Kewalo Honolulu Kona; 1 ap.; .97 Ac.]

No. 1903, Lolohi

N.R. 293v3

To the Great President of the Land Commissioners,- William L. Lee, and his companions, Greetings to You and your commissioners: As directed by you to the claimants to state their claims I have some claims for salt works at Kukuluaeo:
2 salt beds
15 Hooliu /Literally - cause to leak, therefore, drains./
2 Poho kai /depressions where salt is gathered/
1 salt kuIa
A small farm is at lower Kaliu, close to the kawa /leaping place/ of Puehuehu.
4 lo`i
1 cultivated kula.
These are my claims.
I am, with thanks,
LOLOHI
Honolulu, 15 December, 1847

F.T. 220v3
Cl. 1903, Lolohi

Peka wahine, sworn, I know this place. It is on the salt plains, Honolulu, used for making salt.

Mauka is a stream of salt water
Waititi also several salt ponds, Napula, Kumiao and others own them.
Makai, Government road
Honolulu, Peke, Kaula, Lilea, Bolabola, Poe.

Claimant received this land from his father who died last year and held it a long time back in Kinau's time.

2. Honolulu aina, kalo.

Eseta, sworn, deferred, Witness being claimant's wife.
Paalua, sworn, confirmed the testimony in claim. 1
Resumed p. 223

F.T. 223v3
Cl. 1903, Lolohi, 26 November [1849], from page 220

Puhi, sworn, I know this place called Kaliulalo, Honolulu aina, consisting of 4 kalo patches & kula.
Mauka is Kanakaokai
Waititi, Puhana
Makai, same
Ewa, Keliula land, Kekualoa.

Claimant received this from Kuke - Tahitian in 1844 and has held it in peace ever since.

N.T. 549v3
No. 1903, Lolohi, November 23, 1849

Peke, sworn, I have seen his place at Kukuluaeo in Honolulu.

Salt land, the boundaries are:
Mauka, a salt water ditch
Waikiki, Napela
Makai, government road
Ewa, Kaula, Lilea, Polapola and my land.

Lolohi had acquired this interest from his parents when Haaliho had returned from Briton. Lolohi's parents had received it during the lifetime of Kinau and he has been living peacefully on this interest; no one has objected.

Paulua, sworn, Our testimonies are alike; no one has objected.

The hearing on Lohilohi's taro section will be heard on Monday. See page 550

N.T. 550-551v3
No. 1902!, Lolohi, From pg. 549, November 26, 1849
[should be 1903]

Puhi, sworn, I have seen his land at Kaliu in Honolulu district.

4 taro patches, 1 pasture:
Mauka, Kanakaokai

Waikiki, Paahana
Makai, Paahana also
Ewa, Kaliuluna which is Kekualoa's land.

Lolohi's land is from Kuke given in the year 1844 and he has been living comfortably. No one has objected.

Kelalaina, sworn, Our testimonies are alike. No one has objected.

[Award 1903; Land Patent 8174; Kaliu Honolulu Kona; 1 ap.; .69 Ac.; Land Patent 8237; Kukuluaeo Honolulu Kona; 1 ap.; .74 Ac.]

No. 9549, Kaholomoku

N.R. 477v4

Here are my claims at Kukuluaeo: three ponds, a salt mo'o. Those are my claims.
KAHOMOKU /sic./

F.T. 563v3
No. 9549, Kaholomoku, 11 August 1854

Pahiha, sworn, says he knows the kuleana of Kaholomoku, in Kukuluaeo, near Honolulu. It consists of one fish [pond] and some salt pans, in one piece.

It is bounded:
Mauka by M. Kekuanaoa
On Waikiki side by the konohiki
Makai by the same
Honolulu side by the same.

It formerly belonged to Hanau, elder brother of Kaholomoku, who received it from Kolau in the lifetime of Kinau. After Hanau died the place fell to the present claimant, who has held it ever since.

Cross examined. The salt pans claimed by Kaholomoku were made by Iaiki. The salt was divided with Mr. Bingham, the konohiki.

P. Naone, sworn, says he went with Kaholomoku and Mr. Clark, the present konohiki, last month, to the place in question, when the parties agreed to the size of this claim, viz. The fish pond and four salt pans lying on the Waikiki side of the pond.

[Award 9549; R.P. 2099; Kukuluaeo Honolulu Kona; 1 ap.; 1.8 Acs]

No. 7712B*O, M. Kekuanaoa, 20 April 1848

N.R. 390-391v3
[Listed in index as 7712, but that is also Victoria Kamamalu"s number]

Wm. L. Lee, President of the Land Commissioners

Greetings:
I was directed by the Premier to tell of the these `ilis which are written on the second of these pages, These `ilis are for the Government by agreement between the Mo`i and ourselves, the guardians of V. Kamamalu. These are for the Mo`i and also the Government.
I am, with thanks,
M. KEKUANAOA

The Fort Lands:
Puunui 1 ili for Honolulu Pauhuluhulu.
Puunui 2 Kona, Oahu Punana.
Puunui 3 Kailiili.
AlewaLaukalo
Kahapaakai Olomana
Kuwili Kuaipaako
Kapiwai 1 Kalia, `ili for Waikiki, Kona, Oahu
Kapiwai 2 Kahaole
Pilikea Kaluahole
Puiwa Kaluaalaea
Kawananakoa Kapuna
Kalokohonu Nukunukuaula
Kunawai Kaaumoa
AalaAuaukai
Palepo Waihinalo
Niupaipai Mookahi
Apowale Pawaa of Maalo
Kuaiula Kaluaolohe
Kaaleo Kaluahinenui
KuhiMana by Waiaka
Kaihikahi Kumuula
Oloku Kahoiwai 1
Hauhaukoi Kahoiwai 2
Kaukahoku Keonepanee
Kului Kaluaauau, `ili for Kalilhi.

This ends the fort lands.
N.R. 439-440v5
No. 7712, M. Kekuanaoa

The lands of Victoria Kamamalu, Mose Kekuaiwa, Lota Kapuaiwa, R. Keelikolani and Mataio Kekuanaoa, from the division by the Mo`i. The writing was arranged by J.W.H. Paalua, January 1848.

1. M. Kekuanaoa. Fort of Honolulu, January 4, 1848
Greetings to the Land Commissioners: As in the law, and your proclamation, there are presented the lands of my royal children, Victoria Kamamalu, Lota Kapuaiwa and Mose Kekuaiwa, and of Keelikolani, and of mine, and of my wahine, Kaloloahilani, their lands which remain from the division by the Mo`i. In these lands, my ali`is have rights, and the lunas whom I have appointed have rights on their lands, and the commoners have their rights. When the day comes when you think of working on this I will go. If on Kauai, I will go and work with my konohikis and the commoners living on these lands, which have been stated in this Book and so also with those of Oahu and of Maui and of Hawaii.
I am, with aloha, your fellow worker,
M. KEKUANAOA

N.T. 445v5
[No. 7712] Mataio Kekuanaoa
M. Kekuanaoa"s lands from the division by the Mo`i in the month of January 1848:

Keokea Ahupua`a Kona Hawaii
Waiapuka Ahupua`a Kohala Hawaii
Kunana `ili in Halawa Ewa Oahu
Paeaki `ili in Honolulu Kona Oahu
Kaakaukukui in Honolulu Kona Oahu

Eleele `ili in Hanapepe Kona Kauai.

N.T. 445-446v10
[No. 7712B], Mataio Kekuanaoa
[Listed as 7712]

M. Kekuanaoa"s lands from the division by the Mo`i in the month of January 1848:
Keokea Ahlupua`a, Kona, Hawaii
Waiapuka, Ahupua`a, Kohala, Hawaii
Kunana `Ili, in Halawa, Ewa, Oahu
Paeaki `Ili in Honolulu, Kona, Oahu
Kaakaukukui in Honolulu, Kona, Oahu
Eleele `Ili` in Hanapepe, Kona, Kauai.

2. Kalolowahilani"s
1/2 Upolu Ahupua`a, Kohala, Hawaii

Some house lots for M. Kekuanaoa were forgotten to be entered to quiet title. One house lot is in Waikiki, Oahu, and is cared for by Kamaukoli. One house lot is at Waiawa, Ewa, Oahu and is cared for by Kahauolono. One house lot is at Waianae, Oahu and is cared for by Kaapuiki. One house lot is at Waialua on Oahu and is cared for by Kuokoa. One house lot is at Lahaina, Maui and is cared for by Timoteo. One house lot is at Hilo, Hawaii, and is cared for by Unua. There is a lot for Lota Kapuaiwa at Wainee, Lahaina, Maui.

[Award 7712; (Oahu) R.P. 4491; Paeaki Honolulu Kona; 1 ap.; 9.25 Ac.; R.P. 4484; Kaakaukukui Honolulu Kona; 4 ap.; 40.487 Acres (no V. Kamamalu); R.P. 6717; ½ Halawa Ewa; 1 ap.; 8712 Acs (M. Kekuanaoa & Kamaikui) for M. Kekuanaoa; (Kauai) R.P. 4485; Eleele Hanapepe Kona; 1 ap.; no amount listed in index; (Hawaii) Waiapuka N. Kohala; R.P. 6852; Keokea S. Kona]

No. 10463, Napela, Honolulu, February 14, 1848

N.R. 557v4

Greetings to the Land Commilssioners: I hereby state my claim for a salt land at Kukuluaeo on Honolulu, but I do not know its size - that is up to you, the persons who know of the big and the small. I believe I have a right which I hereby state to you.
NAPELA

N.T. 445v10
No. 10463, Napela, 25 December 1854

Mahoe, sworn, I have seen this claim of Napela in Kukuluaeo in Honolulu, Oahu, of 2 ponds, a ditch, 2 deposits (water?), a house site and a salt land section in two pieces.

Section 1 - 2 ponds and ditch, 2 deposits and house site.
Mauka and all around by konohiki land.

Section 2 - Salt land.
Mauka by Kahelelua's land
Waikiki by road
Makai by Kaula's land
Ewa by Kanoniulaole's land.

Napela's land from Kauhi at the time Kinau was yet alive. No one has objected to him nor to his heirs.

(Postponed until P. Naone, the overseer konohiki is available.)

COPY
Greetings to you, Nailiili,
I have seen your correspondence relating to the claim of Pehu in the name of Napela. I have noted that you mentioned two deposits of fry - therefore Kalaka and I have agreed for only the two poinds, one house site and one salt land. If this should meet with your approval, then it shall be certified.
P. Naone, Tax Assessor, 26 December 1854

[Award 10463; R.P.; Kukuluaeo Honolulu; 2 ap.; 1.65 Acs]

No. 10605*O, Iona Piikoi, Honolulu, February 10, 1848

N.R. 563v4

Greetings to you the Land Commissioners: We hereby enter our claims for land, being the lands which passed to us by the division of lands of the Mo`i. Here are Iona Piikoi's:

1. Paa, with its lihis and its leles, Ahupua`a at Kona, Kauai
2. 2. Pualoalo and its lihi and leles, `ili at Honolulu, Oahu.
3. 3. Kaluaoopu, with its lihis and its leles, `ili at Waiawa, Ewa.
4. 4. Mikiola, with its lihis and leles, `ili at Kaneohe, Koolau.
5. 5. Kainehe, with its lihis and leles, Ahupua`a at Lahaina, Maui.

Here at Kamakee's:

6. Keapuka, lihis and leles, perhaps, `ili at Kaneohe, Koolau.
7. Kewalo, lihis and leles, perhaps, at Honolulu, Oahu.

Kindly award our claims, with their lihis and their leles, and all the places which wrongfully went to someone else, and which were trespassed upon and which were perhaps wrongfully occupied, and the places which were conveyed by lease, and all the rights which pertain in the names of those lands - the right to the protected fish and the wood and the water and everything which is said to pertain to these lands. That is what we give to you to work on and quiet title to us and to award in a way as to benefit the populace who are living on the land, and the lands which we occupy which also are for us. Here are these claims: a house lot in Honolulu, also, at Kamooiki, Honuaula, is a plantation of coconut trees.
I am, respectfully,
I. PIIKOI, KAMAKEE
/Translator's note: As far as I can determine, lihi is a pretty elastic term, meaning boundary or edge, but stretched to mean other areas not necessarily contiguous. Lele, of course, means "jump" areas./

F.T. 387-388v3
No. 10605, Kamakee Piikoi, September 28th, 1852

A portion of land in claimant's survey of Kewalo uka, called "Kapuni" is disputed by M. Kekuanaoa, also by the Government. Claimant avers that it is a part of Kewalo & therefore hers.

Kaia, sworn, says he is a kamaaina of Kewalo. Kaholoau was Luna of Kewalo in the time of Kaahumanu. After him were Mahina and Keaho. The name of the small piece of land now disputed is "Kapuni." It belonged to Kaahumanu. The above named Lunas were under Kaahumanu. "Kapuni" is a pauku aina in Kewalo. It does not belong to Kalokohonu, "Kapuni"

was always included in Kewalo in the collection of taxes, and the people of "Kapuni" always worked for the konohiki of Kewalo. Naone, the present tax collector has lately caused this pauku of Kewalo to be included in Kalokohonu.

Mahina, sworn, I was Luna of Kewalo in the time of Kaahumanu, after Kaholoau. This pauku of land now in dispute, called "Kapuni," always formed part of Kewalo. "Kapuni" was always included with Kewalo in taxation and the people of "Kapuni" worked for the konohiki of Kewalo. "Kapuni" never belonged to Kalokohonu until the decision given by Naone to that effect, last year.

Mahu, sworn, says he is a kamaaina of Kewalo, and knows the piece of land now in dispute, called "Kapuni." It has always formed a part of the ili of Kewalo, from ancient times.

Cross Examination. I have lived on Kewalo since the time of Kaio, the konohiki, in the time of Kamehameha I. I know the boundaries of Kewalo uka pretty well. I know Kailepulu who lives there, but he is a newcomer. Witness gave the names of a long line of konohikis.

Paoimuai, sworn (for the Government), I am a kamaaina of Auwaiolimu adjoiing Kewalo. When I was a boy, I lived on Kewalo, when Kapaukahi was konohiki in the time of Kamehameha I. I know the pauku aina called "Kapuni," now in dispute. "Kapuni" belonged to Kaahumanu, i.e. to her ili of Kewalo. She had her Lunas there. Witness named some of the lunas. The men of "Kapuni" worked for the konohiki of Kewalo. It is about 40 years since "Kapuni" was joined to Kewalo - shortly after the sickness which destroyed the people's hair. "Kapuni" always formed part of Kewalo from that time till Naone's decision about 18 months ago.

N.T. 21-22v10
No. 10605, J. Piikoi, 1 July 1851, See page 387, vol. 3

No. 3176, G. Kailaa for Kamakee vs Kaaukai

Kukahiko, sworn, I have seen this house lot in Honolulu,

the boundaries are:
Mauka by Kekualaula's lot, Kahanaumaikai's lot
Waikiki by Puowaina street
Makai by Kaaoaohuna lot, S. Reynold's lot
Ewa by Road.

Land from Kaauka (i [kane?]) in 1843, Kaaukai had received it in 1832. When Kamakee had it permanently, G. Kailaa lived on the land and Ihu had enclosed it. Kaaukai built the house and Ihu had helped also by buying the material for thatching. Kailai has lived there to the present time, no disputes.

I have heard Kaaukai had bequested this place to Kamakee at the time Kapili had returned the

deed of the land to Kaaukai. Kamaikaaloa had given this lot to Kaaukai, the chief had given her, her land. She had given orally to her brother Kamakee saying, "I am leaving for Hawaii, you are the chief's tenant, here is your house lot," Kaaukai lived on the land until her death.

Kanaulu, sworn for Kaaukai, I heard there were two of them on this place, Kamaikaaloa mauka and Kaaukai, Makai. This had been from the chief, later they had separate land. Then Kaaukai left for the island of Hawaii and I saw Kailaa living on that land. I have not known Kaaukai's bequest for anyone else and I have always seen Kailaa living there to the present time since the time of Kaahumanu I. Kailaa built his house and Pahua helped him to enclose the land. I have heard on Maui they had lived together and they had agreed that the land would be for the other should either one of them die, so at Kaaukai's passing, the land was possessed by Kamaikaaloa. I have not heard Kamaikaaloa's bequest.

Pahua (female), sworn, I have seen this coconut grove at Mooiki of Honuaula, Maui.
Mauka by Government land
Kipahulu by "Makeaka" land
Makai by sea
Lahaina by "Nahupaka" land.

Kamakee, the wife of J. Piikoi, had received this land from Kapili, her brother in 1842, he had received it from their father, Ihu in 1841. Ihu had received it from Kaikioewa at the time of Liholiho and he has lived comfortably. He has planted coconut trees, the children have them now, no one has disputed the government has retaken the land since the great Mahele, except for the coconut grove. They are for Kamakee.

Kaahumanu, sworn, as a child, I had seen Ihu himself and his men plant those coconut trees at the time of Liholiho to the present time, no disputes. Cont. page 161.

N.T. 161v10
No. 10605, Johan Piikoi (from page 21)

COPY
Na Paa ahupuaa, Kona, Hawaii
Pualoalo ili of Honolulu, Kona, Oah.
Kaluaoopu ili for Waiau, Ewa, Oahu.
Mikiola ili for Kaneohe, Koolaupoko, Oahu.
Kainehe ahupuaa, Lahaina, Maui.
This distribution is good, the lands listed above are for Jonah Piikoi, he has been permitted to present his claims before the land officers.
(signature) Kamehameha, Seal
This Palace, 28 January 1848
This is a true copy from the Mahele Book
A.G. Thruston, Secretary K.K. Interior Minister Office, 31 March 1852

No. 10605, Kamakee Piikoi

COPY
Kewalo ili for Honolulu, Kona, Oahu.
Keopuka ili for Kaneohe, Koolaupoko, Oahu.
This distribution has been approved, it is good. The lands listed above are for Kamakee Piikoi and has been permitted to present this before the land officers.
(signature) Kamehameha II, Seal
This Palace, 28 January 1848
See page 328, True copy from the Mahele Book
A.G. Thruston, Secretary K.K. Interior Minister Office, 31 November 1852

N.T. 328v10
No. 10605, Jonah Piikoi

Jonah Piikoi's land distributions.
Na Paa ahupuaa, Kona, Hawaii.
Puaaloalo ili, Honolulu, Oahu.
Kaluaoopu ili, Waiau, Oahu.
Mikiola ili, Kaneohe, Koolaupoko, Oahu.
Kainehe ahupuaa, Lahaina, Maui.
TRUE COPY
Interior Office, A. Thruston, Chief Clerk
November 17, 1853

[Award 10605; R.P.; 2672, Kewalo Honolulu; 3 ap.; 60.44 Acs; R.P. 5715, Kewalo Honolulu; 4 apana, 88 Ac. 5 Roods, 78 Rods (location index gives 3 apana; 60.44 Acres); R.P. 5716; Koula Honolulu Kona; 1 ap.; 270.84 Acs; (Kamakee Piikoi); R.P. 5567, Pualoalo Honolulu; 1 ap.; 3.37 (Ap. 2); R.P. 5569, Pualoalo Honolulu; 2 ap.; 8.65 Acres; (Ap. 1 & 3); R.P. 1739; Punchbowl St.; 1 ap.; 1.17 Acs; (Iona & Kamakee Piikoi); R.P. 8135; Mikiola Kaneohe Koolaupoko; 2 ap.; 43.5 Acs; R.P. 6557; Waiau Ewa; 2 ap.; 35.7 Acs; (Apana 5); R.P. 5611; Kaneohe Koolaupoko; (Maui) R.P. 8400; Kainehe Lahaina; (Kauai) no R.P. Paa Kona; 1 ap.; 3263 Acs 1 rood 33 rods (ahupua`a); See also Award 3176 for Oahu]

Appendix B Response from the Office of Hawaiian Affairs

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD08/3459B

August 21, 2008

Brian Cruz, Cultural Research Specialist
Cultural Surveys Hawai'i
P.O. Box 1114
Kailua, Hawai'i 96734

Re: Cultural Impact Assessment
Kaka'ako Community Development District Mauka Area Plan
Kaka'ako, Waikīkī Ahupua'a, Kona District, Island of O'ahu

Aloha e Brian Cruz,

The Office of Hawaiian Affairs (OHA) is in receipt of your July 31, 2008 letter initiating consultation ahead of a cultural impact assessment (CIA) for the proposed revisions to the Kaka'ako Community Development Plan (KCDP). The Hawai'i Community Development Authority (HCDA) initiated a comprehensive review of the KCDP in 2003 which resulted in the proposed revisions. The overall intent of the KCDP is to provide guidance in the planning and development of an urban community in Kaka'ako Mauka.

OHA notes that a draft Supplemental Environmental Impact Statement (SEIS) has already been offered for public review, absent a CIA generated according to the guidelines adopted by the Office of Environmental Quality Control (OEQC). Appendix B of the SEIS is titled *"Cultural Impact Assessment"*, but the actual document found within this appendix would be more accurately identified as a review of literature and archaeological documents related to the area which encompasses the KCDP. While the document certainly does provide a comprehensive overview of archaeological work conducted within Kaka'ako Mauka and certain accounts which provide insight into the traditional and historical significance of the area, glaringly absent from the document is consultation with community groups and organizations. The guidelines for CIA adopted by the OEQC place specific importance on consultation:

> *"The most important element of preparing Cultural Impact Assessments is consulting with community groups, especially with expert and responsible cultural practitioners within the ahupua'a of the project site. Conducting the appropriate documentary research should then follow the interviews with the*

experts…Once all the information has been collected and verified by the community experts, the assessment can then be used to protect and preserve valuable traditional practices."

In addition to the individuals listed within Table 1 of Appendix B, OHA recommends consultation also occur with the following individuals and 'ohana: Manuel and Leslie Kuloloio, Kealoha Kuhia, Halealoha Ayau, Paulette Kaleikini, the Keohokalole 'Ohana and the Keana'aina 'Ohana. Please remember that this list is not all encompassing and we are sure you will identify additional individuals and 'ohana as you move forward with your consultation process. Keeping in mind that the consultation effort could seek information which may be family tradition and mo'olelo, therefore consultation can only occur when a relationship and understanding has been established between both parties.

The requirement for the subject SEIS and CIA is being triggered by what could be practically described as a "paper" action, the proposed revisions to the KCDP. The actual impacts to sub surface cultural resources, namely iwi kūpuna, will not be identified until public and private development actions are initiated on specific tax map key parcels. The HCDA must require that any development activity within an area in Kaka'ako under their jurisdiction is subject to a review by the Department of Land and Natural Resources-Historic Preservation Division (SHPD) prior to the design and planning stages of development. Furthermore, the HCDA must realize that any recommendations made by the SHPD are designed to identify historic properties and cultural resources within a given project area. Therefore, the HCDA must ensure that any SHPD recommendations are implemented by a given developer.

Sub surface archaeological excavations conducted during an archaeological inventory survey will be the critical step in identifying iwi kūpuna within Kaka'ako Mauka. OHA respectfully asserts that the following statement within Appendix B of the SEIS borders on reckless inasmuch as it appears to promote the discovery of burials inadvertently to expedite their relocation:

"…Burials encountered during archaeological inventory surveys, which now typically test in the neighborhood of 3% of the project area footprint are "previously identified" burials subject to a sometimes lengthy process of advertising, preparation of a burial treatment plan, and presentation to the SHPD and O'ahu Island Burial Council. There is generally a higher likelihood of burial discovery during actual construction because of the typically much larger area of subsurface deposits opened up. Human skeletal remains encountered during construction are "inadvertent finds" and are typically resolved in a day or two. Re-location of inadvertent finds has certainly been the norm in the past, but concerns for preservation in place grow every year."

On multiple levels, this statement highlights the lack of application of the tragic lessons learned from past urban developments where iwi kūpuna have been encountered. The HCDA must ensure that archaeological inventory surveys do not merely follow the status quo in their

testing methodology. When iwi kūpuna are encountered, the paramount goal of archaeological testing strategies must be to determine the boundaries of the burial area, to minimize or ideally eliminate inadvertent discoveries during the ground disturbing phases of development. The *"sometimes lengthy process"* described above is mandated by State law and provides 'ohana the opportunity to share their mana'o with a group (the O'ahu Island Burial Council) knowledgeable in Hawaiian burial practices. The O'ahu Island Burial Council can then in turn consider the mana'o of the 'ohana and, if needed request specific information from both the SHPD and a given developer before making an informed determination whether to preserve in place or relocate burials and provide recommendations to the SHPD on appropriate mitigation measures.

There are numerous cases within Kaka'ako Mauka and neighboring Kālia which offer sad testimony as to the ineffectiveness and cultural insensitivity of the process when large concentrations of burials are identified "inadvertently" during the ground disturbing phases of development as opposed to during a comprehensive archaeological inventory survey. 'Ohana who were laid to rest together are first disturbed by backhoes, pile caps and trenchers and then separated from each other because SHPD staff is forced to make difficult decisions due to development timeframes and other constraints. The living descendants of these kūpuna are then forced to live with decisions that are out of their control. The 'eha and kaumaha these descendents must endure and persevere through is indescribable. Many times these inadvertent cases are not resolved within *"...a day or two"* and two of the more high profile cases in Kālia and Kaka'ako Mauka resulted in litigation. All of those involved with these cases from the developers and consultants to SHPD staff, Burial Council members, 'ohana and those who labor on the project sites in some way, carry the experiences of these heartbreaking situations with them.

OHA will rely on assurances within the SEIS that any undertakings within Kaka'ako Mauka which have Federal involvement will be in full compliance with Section 106 of the National Historic Preservation Act. Meaningful consultation by Federal agencies or their designee should be initiated as early as possible to ensure organizations and individuals have ample opportunity to provide input and participate in the Section 106 process.

We look forward to seeing the KCDP fully implemented, which will result in a thriving urban community which incorporates a diverse cultural heritage and environmental sustainability into its design concepts. As we have previously mentioned, Appendix B of the SEIS does provide an excellent overview of certain accounts which provide insight into the traditional and historical importance of Kaka'ako to the Hawaiian people. It is our hope that these accounts can be incorporated into the planning and design of this community, perhaps through interpretive signage and other educational opportunities so that the resident and visitor alike may have the opportunity to learn about the area's cultural significance.

The SEIS acknowledges that *"...The probability for additional burials in the project area is high"*. Thus, OHA looks forward to seeing a paradigm shift in the methodology of archaeological inventory survey level testing in urban areas which focuses on the identifying the true extent of iwi kūpuna and other sub-surface cultural resources early in the development process. OHA maintains the position that all parties bear a responsibility in contributing to this new paradigm which will prevent the unacceptable and tragic lessons of the past from being repeated in the future.

Thank you for initiating consultation at this early stage in the CIA process. We look forward to the opportunity to review the completed CIA. Should you have any questions, please contact Keola Lindsey, Lead Advocate-Culture at (808) 594-1904 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Administrator

C: Hawai'i Community Development Authority
677 Ala Moana Boulevard, Suite 1001
Honolulu, Hawai'i 96813
Attn: Ms. Susan Tamura

Department of Land and Natural Resources-Historic Preservation Division

Members, O'ahu Island Burial Council
c/o Department of Land and Natural Resources-Historic Preservation Division

Appendix C Kaka‘ako Fire Station Material provided by Dennis Lewis

The Monarchy

The History of the fire department dates back to about 1820, when missionaries started to arrive into the Hawaiian Islands. Construction materials changed as missionaries became established and businesses fluorished. Many islanders lived in thatched homes, and when consumed by fire, were easily pulled down and extinguished. By 1845 a letter was written from Robert Davis to Governor Kekuanaoa requesting powers and privileges forming a Fire Department. By July 8, 1848, firefighting was organized that bystanders would get paid $3.00 when called upon by the Marshal to assist in extinguishment. One man was arrested for refusing to work until he got paid, this action prompt the attention to the importance to organizing a fire department.

The night of 13th of December 1849, a Brig Potapsco, Captain West, bound for San Francisco anchored outside of Honolulu Harbor trying to ride out a severe S.W. gale storm. By morning, the Brig's cables parted and was wrecked on the reefed and some of her cargo was salvaged. One piece of salvaged cargo was a fire truck, thru the Privy Council, the Minister of the Interior purchased it for $380.00 paid by the King's exchequer. An article in "The Polynesian" newspaper, the fire engine be ready for anyone to organize a fire company. On November 11, 1850 the newly formed Fire Company headed by Volunteer Fire Brigade Fire Engineer (Fire Chief) William Cooper Parke fought their first fire. On December 27, 1850, King Kamehameha III signed a proclamation establishing the Fire Department. This proclamation became law when it was published in the newspaper "the Polynesia" in English and in Hawaiian, on January 11, 1851. The Honolulu Fire Department celebrates January 11 as its birthday.

King Kamehameha IV and King Kamehameha V, whenever there were large fires in the City of Honolulu both rolled up their sleeves and fought fires along the side of the citizens of Honolulu.

On February 19, 1861, made up of native Hawaiians, twenty-six names were attached to form a new fire company called "Hawaiian Engine Company No. 4". David Kalakaua was elected to be the first secretary for this fire company. With the motto "Holo Ka Hana"

Prince Albert Edward Kauikeaouli Leiopapa A Kamehameha became a member of The Hawaiian Engine Company No.4, making him the youngest fireman. On February 11, 1854, for his father's birthday, he rode the Hawaiian Engine Company fire truck. He died at the age of four.

Picture of monarchy Kamehameha III , Kalakaua, Prince

Fire Alarm Telegraph System

Fire Alarm Telegraph System for the City of Honolulu, H.T.
Purchased March 19, 1901,
From A.J. Coffee
#230 Keary Street, San Francisco, Cal
8 and 65 fire alarm boxes
$20,000.00 in gold coins

How Fire Alarm was sounded

On most corners of the streets in Honolulu City, a red fire alarm box was either located on the electric/telephone poles or on a pedestal. When a fire was seen, one would pull on the fire pullbox and that electrical pulse was sent to all fire stations. The Fire indicator Gong would strike the number of times coincides with the fire alarm box number. At the same time as the gong sounded the ticker tape was punched indicating the number of the box pulled. For instance; Box #318 was pulled, the Fire Indicator Gong would ring three times then stop, ring one time then stop, continue eight times then stop. At the same time the ticker tape would be punch three times and space, one time and space, and eight times and stop. Most firemen would know the common number fire alarm boxes, because false alarms were frequent. If a fireman did not know where the box number was at, he would look and the index cards located under the black counter. On the index card it indicated which fire company and truck are to respond to this alarm. If the Fire Indicator Gong rang again and rang 222 it was a second alarm to that pullbox, 333 would be the 3rd Alarm.

This Gamewell System was purchased in Eight 65 fire alarm boxes

Picture of original GONG, pullbox on pole and pedestal

Kakaako Fire Station No. 9

This is the original Station 9 Kakaako Fire Station, located at 620 South Street. This building was added to the National Historic Registry in 1980, Building #80001277. The fire station was officially occupied by an Engine Company on October 1, 1929, with a cost of the building of $37,224.00. A ladder truck building was added and a Ladder Company was put in service on March 1, 1930 costing $4,652.00 for the building. The Mechanic Shop building was located at the rear of Station 9, in 1931 cost $8,500.00. The Mechanic Shop building housed the Mechanic shop, Radio Shop and the Storeroom. During a period of time the Rescue Squad was located at Station 9.

In 1929, the Engine Company consisted of a 1928 Seagrave Hosewagon and a 1928 Seagrave Engine. The Hosewagon was purchased on September 24, 1928 for $10,230.00. This Original Fire Truck can be seen in the left apparatus bay. This Hosewagon fought multiple fires in the City of Honolulu on December 7, 1941, the day of the attack on Pearl Harbor. Because the Hosewagon doesn't have a fire pump, many of the fires were extinguished by men connecting the fire hoses directly to the hydrants and connecting a nozzle on the other end, using the hydrant pressure to expel the water. The Seagrave Engine purchased on September 17, 1928 for $13,330.00. The Ladder Truck was made by Seagrave, purchased on May 4, 1925 for $17,535.00, formerly Ladder Truck No. 1. Other fire Apparatuses that was housed at Station 9 was a Ford Utility truck purchased October 30, 1929 for $690.00 and another Ford Utility Truck, purchased on July 3, 1931 for $740.00.

Kakaako Fire Station closed its doors on June 24, 1974 and moved to its present location on Queen Street.

The old Kakaako Fire Station Building was completely restored by Okada Trucking Company in 2006.

PICTURE OF STATION 9

Pompier Ladder

Pike poles

No. 9 Hose Wagon

1928 Seagrave

Assigned to Kakaako Fire Station
Purchased: September 24, 1928
$10,230.00

This 1928 Seagrave is identical to the No. 4 Hose Wagon that fought fires at Hickam Air field. This Hosewagon responded to numerous fires throughout the City of Honolulu on December 7, 1941, during the attack on Pearl Harbor. Firefighting lines were connected directly to the hydrant and used "hydrant pressure" to extinguish fires because of the lack of available pumpers. Besides the dangers of firefighting, men and apparatus' were continuously exposed to anti-aircraft shells falling back into the City and to unexploded bombs.

No. 1 Engine

1937 Seagrave

Assigned to Central Fire Station
Purchased: November 26, 1937
$14,515.00

This is the only remaining Honolulu Fire Department apparatus which fought fires under wartime conditions at Hickam Air Field on December 7th, 1941. Upon arrival at Hickam Air Field, all hydrants were unusable because a bomb had ruptured the water main. Drafting from the water filled bomb crater, Engine 1, Engine 4 and 6 pumped water thru 6,400 feet of hoses to extinguish aircraft fires. During the second wave of attacks the No.1 Engine was scarred with machine gun fire, shrapnel, and bomb fragments and all six tires were punctured. This apparatus continued to supply water after repairs were made.

Appendix D Response from State Historic Preservation Division, History and Culture Branch Chief, Phyllis “Coochie” Cayan

LINDA LINGLE
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LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

November 10, 2008

LOG NO: 2008.4600
DOC. NO: 0811PC02

MEMORANDUM

TO: Mishalla Spearing, Cultural Research Specialist
Lisa Gollin, Ph.D.
Cultural Surveys Hawaii, Inc.
P.O. Box 1114, Kailua, Hawaii 96734

FROM: Phyllis Coochie Cayan P. Coochie Cayan
History and Culture Branch Chief

Subject: KAKAAKO 5: HCDA Mauka Area Plan Cultural Impact Assessment (CIA)

Mahalo for your email inquiry dated November 4, 2008 for additional comments on your KAKAAKO 5: HCDA Mauka Area Plan Cultural Impact Assessment. Previous comments were received from Kaleo Paik of SHPD in June, 2008.

This memo will document the additional information emailed to you due to a printing deadline last Friday. As you all know, it is the people who will recall the traditional and cultural uses of the places. As you noted, your area will encompass the Kona District in general. Some of the suggested folks to speak about include the following 'ohana – some of whom are recognized claimants in the ahupua'a:

The Van Diamond 'Ohana, The Nalani Olds 'Ohana, The Richard Papa 'Ohana, The Kahanamokus and The Paoa 'Ohana (relations who lived where the Hilton is built), The Norman 'Ohana, The Paulette Kaleikini 'Ohana, The Les Kuloloia 'Ohana (live on Maui – fishing traditions), The Hawaiian Civic Club Association, The Civic Club of Honolulu, Jalna Keala (retired OHA), Desoto Brown at Bishop Museum, The Kupuna Group at the Waikiki Community Center, Jeff Apaka at the Waikiki Community Center, The Musicians Union (old timers who played music in Waikiki), Dr. Kekuni Blaisdell and Uncle Louis Agaard (fisherman) and the families who currently live in upper Makiki Valley on state conservation lands.

You may want to put an ad in the OHA newspaper "Ka Wai Ola" to attract more input from former families of the ahupua'a. The practice of fishing and gathering- those makai and mauka practices were important for the families to survive through the social and economic changes. The beginnings of Kakaako with its diverse families are evidence of the area's potential to live, work and play. Many of the old family businesses would be interesting to contact regarding the past cultural diversity. One of the first plumbing businesses was with the Tamura family – a son, Derek Tamura who may be contacted at the East O'ahu Sun newspaper office.

As you know from past and current projects in the area and the ahupua'a -- the makai area is a high risk for Hawaiian burials. There has been past inadvertent finds mauka, but not as numerous as the makai areas. We encourage you all too also consult with the O'ahu Island Burials Council when there is more information for the proposed plans in this area. Any questions, please call me at 808-692-8015 or via email Phyllis.L.Cayan@hawaii.gov

c: Pua Aiu, Ph.D., Administrator
Nancy McMahon, Deputy SHPO

Appendix E

Infrastructure Plan

Kakaako Community Development District
MAUKA AREA INFRASTRUCTURE PLAN

Honolulu, Oahu, Hawaii
TMK: (1)2-1-029–032, 044, 046–056 & (1)2-3-001–011

MARCH 2009

Prepared for:

State of Hawaii
Hawaii Community Development Authority
677 Ala Moana Boulevard
Suite 1001
Honolulu, Hawaii 96813

EDAW, Inc.
Davies Pacific Center, 841 Bishop Street
Suite 1910, Honolulu, Hawaii 96813

Prepared by:

M&E Pacific, Inc.

METCALF & EDDY | AECOM

Davies Pacific Center, 841 Bishop Street
Suite 1900, Honolulu, Hawaii 96813



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EXECUTIVE SUMMARY

In 1976, the Hawaii State Legislature created the Hawaii Community Development Authority (HCDA) to assist in the revitalization of underutilized urban communities in the State. The area demarcated by Piikoi Street, Ala Moana Boulevard, Punchbowl Street and South King Street was designated as the first community development district of concern for the HCDA, and was called the Kakaako Community Development District. In 1982, the HCDA completed the *Kakaako Community Development District Plan* (existing Mauka Area Plan), to establish development and master planning criteria and goals for this district. In 1983, the HCDA issued the *Final Environmental Impact Statement for the Kakaako Community Development District Plan*, which corresponded to elements of this plan. Also in 1983, the Kakaako Community Development District was extended southward to encompass Kewalo Basin, the entire Kakaako Peninsula and the waterfront areas between Fort Armstrong and Aloha Tower all oceanside of Ala Moana Boulevard, and the HCDA adopted the *Kakaako Community Development District, Makai Area Plan*, to address development and master planning criteria and goals for this area. In 1985, the HCDA drafted *A Final Supplemental Environmental Impact Statement for the Kakaako Community Development District Plan*, to address this plan.

The HCDA manages the two subdistricts (original area and southern added area) separately. The original area of concern is referred to as the Mauka Area, whereas, the southern added area is considered to be the Makai Area. To address development and master planning criteria and goals for the Mauka Area, the HCDA developed the *Kakaako Community Development District, Mauka Area Plan and Rules*, and subsequently initiated a comprehensive review and update of this document in May 2003. Plan Pacific, Inc. was retained for this project and prepared a draft "Concept Plan" (Draft Mauka Area Plan) for the Mauka Area that focused on the following concepts:

- Development of the Draft Mauka Area Plan around key Smart Growth concepts.
- Promotion of mixed-use neighborhoods.
- Strengthening of connections with surrounding neighborhoods and districts.
- Definition and development of specific objectives for neighborhoods, corridors and streets—including small lot development.
- Building on existing assets and planned investments—including Mother Waldron Playground, transit lines, and Queen and Kamakee Streets improvements.

The current working version of the Draft Mauka Area Plan (May 2007), represents a significant change in the latest version of the Environmental Impact Statement (EIS), as amended, and thereby warrants a Supplemental Environmental Impact Statement (SEIS), which is currently being completed.

This Infrastructure Plan complements the SEIS and will assess the existing infrastructure's adequacy under current and future development, propose improvements as needed to meet future demands, and prepare an infrastructure master plan as a result of these assessments. The following infrastructure elements are assessed in this document:

- Storm Drain Systems;
- Sanitary Sewer Systems;
- Solid Waste Disposal Program;
- Water Systems;
- Synthetic Natural Gas Systems;
- Electrical Power Systems;
- Telephone and Communications Systems;
- Cable Television Systems;
- Traffic Signal Systems;
- Roadway Street Light Systems; and,
- Roadways.

Sections within the Mauka Area that have major utilities are areas of primary focus when analyzing existing conditions. With an analysis of these major utilities, it is possible to evaluate the existing flows, pressures, capacities, etc. of the components at the "secondary" areas. Available information on existing and proposed conditions of the utilities and infrastructure within the study area was obtained from appropriate government agencies and utility companies. The design projection basis for this report is the year 2030 population.

The existing infrastructure is assessed to verify whether the general conditions, service lives and capacities would be able to support density and population forecasts out to the year 2030. If the infrastructure could support these projections, then they are recommended to remain unaltered; otherwise, they are recommended for improvement through replacement with larger lines. Recommended utility improvements would meet current design criteria and standards to conform to regulatory government agency and utility company codes and standards. Design and construction within the Mauka Area fall under the regulation and approval of the City; thus, any required municipal infrastructure improvements shall conform to City guidelines and standards

Under the HCDA, several State-funded projects—Improvement District Projects—were developed from late 1980 through 2002, which implemented roadway improvements, involving reconstructed and widened streets with new curbs, gutters, and pavement; expanded drainage, sewer and water lines; and, placed telephone, electric, and cable television lines underground. These projects improved approximately a third of the total roadways and utilities in the Mauka Area.

The main recommendations provided in the Infrastructure and Utilities Plan are summarized as follows:

- *Storm Drain Systems*: The design storm for the City for the Mauka Area is the 50-year recurrent, 1-hour duration rainfall. The existing drainage system within the Mauka Area is adequate to accommodate and dispose of flow from this rainfall, in addition to the more frequent, day-to-day rainfall occurrences and intensities. The Mauka Area is a subsystem within an overall, rainfall-catchment watershed basin that encompasses surrounding areas from mountain to ocean.

The existing drainage system within the entire Kakaako District is inadequate to accommodate the City design flows for both the existing and future conditions when taking flow from outside the district within the same rainfall-catchment watershed basin into account that contribute to the existing storm drain system. However, the existing drainage system is able to accommodate and dispose of the more frequent, day-to-day rainfall occurrences and intensities.

Improvements and upgrades by the City to bring the drainage system up to a size large enough to accommodate both Kakaako District flow in addition to the off-site flow are not practicable due to budgetary and space constraints. Nonetheless, the flow contribution to the drainage system by the Mauka Area is anticipated not to increase due to the relative, impermeable character of the developed land (percentage of hard surface) not altering significantly by the year 2030 (as development and redevelopment would be primarily vertical, which does not affect runoff quantities).

Practical roadway improvements compliant with City requirements are proposed to mitigate localized stormwater ponding within uncurbed roads. Water capture and reuse by developments and redevelopments, and increased plantings of groundcover and vegetation within roadway ROWs, lots, building decks and rooftops would reduce surface runoff and improve stormwater quality.

- *Sanitary Sewer Systems*: Upgrades of branch sewer lines are proposed to meet City standards. Approximately 18,000 feet of sewer trunk lines within the Mauka Area are recommended to be replaced with larger trunk lines to accommodate year 2030 demands. Additionally, segments of sewerlines along Queen Street, South Street and Ward Avenue were inspected using a closed circuit television (CCTV) system in January 2009 to determine the existing conditions of the lines. This inspection, in conjunction with existing CCTV of the Sheridan Neighborhood area taken during the late 1990's for the City were together viewed as a representative samples of existing sewerline conditions within the Mauka Area. The percentage of any pipe segments in need of improvement based on its deteriorated condition in comparison to the overall length of inspected lines of that particular pipe size and material would be applied as the overall percentage to that particular line size and material that is recommended for system improvements of the entire Mauka Area.
- *Solid Waste Disposal Program*: Specific improvements and modifications to the solid waste disposal program within the Mauka Area other than expansion of service coverage area as required are not proposed. The existing mix of private and public collection services would be able to meet future collection demands generated by increases in land use and population.
- *Water Systems*: Approximately 16,000 feet of new waterlines and related upgrades and improvements to the existing water distribution system are proposed to meet projected domestic water consumption and fire protection demands projected for the year 2030. Additionally, recommendations to replace existing waterline segments are proposed, based on locations and frequencies of waterline break occurrences.
- *Synthetic Natural Gas Systems*: Upgrades and improvements are not proposed for the synthetic natural gas transmission and distribution systems. The Gas Company has indicated that they expand and upgrade their systems on their own to accommodate any required coverage expansions or increases in service demand. This is accomplished either through the

installation of larger or new mains, service laterals and meters, or through the provision of containerized gas.

- *Electrical Power Systems*: Future power demands are anticipated to be met through the installation of either one, or possibly two, new electrical power substations to expand power capacity. Due to factors such as, but not limited to, land acquisition requirements and available construction funding, specific siting for additional substations is not indicated. Methods for meeting future electrical needs would be decided by the governing electrical power company. To the maximum extent practicable as limited by budgetary and space constraints, new electrical power and telecommunication lines would be located underground within public street ROW, and existing overhead lines shall be phased out to enhance the overall general visual aesthetics and safety of the streetscape.
- *Telephone and Communications Systems*: Telephone requirements are forecasted to increase to 70,000 service lines necessitating associated cable plant expansion by the telephone company into existing or new conduit systems within the Mauka Area roadways. Methods for meeting future communications needs would be determined by the governing telephone company.
- *Cable Television Systems*: Future cable television improvements are not forecasted. Methods for meeting future cable television service demands would be determined by the governing cable television company.
- *Traffic Signal Systems*: Traffic signalization devices are proposed at three four-way stop intersections. The installation of these devices shall be in compliance with applicable regulatory agency standards, codes and guidelines.
- *Roadway Street Light Systems*: Street lighting and traffic signal timing systems are proposed along new roadways, as required. The installation of these facilities shall be in compliance with applicable regulatory agency standards, codes and guidelines.
- *Roadways*: Existing streets are proposed to be brought up to City standards wherever possible and not limited by space. New streets, space permitting, are proposed to be designed to City codes and criteria governing pavement section, lane widths, sidewalks, bike lanes (in accordance with the State's *Bike Plan Hawaii*), curbs, gutters, planter areas, sight distance requirements, stopping distance requirements, radii, Americans with Disabilities Act (ADA) curb ramps, accessible routes, signage, crosswalks, and pavement marking and striping. Additionally, recommendations to repair areas of asphalt pavement are proposed, based on observed surface cracking, to minimize the potential for pothole formation, worsening of pavement distress, or eventual pavement failure.

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LIST OF ABBREVIATIONS

AC—asphalt concrete
ADA—Americans with Disabilities Act
Ala Moana WWPS—Ala Moana Wastewater Pump Station
AMPS—Ala Moana Pump Station (Defunct)
BWS—City and County of Honolulu, Board of Water Supply
CCTV—closed-circuit television
cfs—cubic feet per second
City—City and County of Honolulu
Co.—Company
DBEDT—Department of Business, Economic Development and Tourism
DDC—Department of Design and Construction
DOT—Department of Transportation
EIS—Environmental Impact Statement
ENV—City Department of Environmental Services
FAR—floor area ratio
FSEIS—Final Supplemental Environmental Impact Statement
GIS—Geographical Information System
GASCO—Gas Company
GPD—gallons per day
HCDA—Hawaii Community Development Authority
HECo.—Hawaiian Electric Co.
HFD—Honolulu Fire Department
HTCo.—Hawaiian Telcom
ID—Improvement District
ITS—intelligent transportation system
kcmil—kilo circular mils
kV—kilo-Volt
LEED—Leadership in Energy and Environmental Services
LF—linear feet
MFF—Maximum Flow Factor

List of Abbreviations (continued)

MGD—million gallons per day

MS4—municipal separate storm sewer system

Msf—Million square feet

MSL—mean sea level

MUZ—Mixed-Use Zone

MVA—Mega Volt-Ampere

Mw—Megawatt

NPDES—National Pollutant Discharge Elimination System

Oceanic—Oceanic Time Warner

P—Park

psi—pounds per square inch

PU—Public Use Zone

R—Residential

ROH—Revised Ordinances of Honolulu

ROW—right-of-way

SEIS—Supplemental Environmental Impact Statement

sf—square foot/feet

Sand Island WWTP—Sand Island Wastewater Treatment Plant

SNG—Synthetic Natural Gas

SPS—Sewage Pump Station

TAZ—traffic analysis zone

Tm—recurrence interval

TMK—Tax Map Key

WWD—Wastewater Division

1.0 INTRODUCTION

1.1 Background

In 1976, the Legislature created the Hawaii Community Development Authority ("HCDA") to assist in the revitalization of underutilized urban communities in the State. The Kakaako Community Development District was designated as the first community development district for HCDA. The original district was bound by Piikoi Street, Ala Moana Boulevard, Punchbowl Street and South King Street. The original *Kakaako Community Development District, Mauka Plan and Rules* (1982) covered only the present-day Mauka Area. An associated Final Environmental Impact Statement for the original plan was approved in 1983. The 1982 Legislature amended the district boundary to include land makai of Ala Moana Boulevard between Ala Moana Park and Aloha Tower. The additional area was designated as the Kakaako Development District, Makai Area (refer to Figure 1—Project *Location and Boundary Map*) by the HCDA in 1983. The Makai Area includes Kewalo Basin, the entire Kakaako Peninsula and the waterfront areas between Fort Armstrong and Aloha Tower. In 1983, HCDA drafted the *Kakaako Community Development, Makai Area Plan* and in 1985, the *Final Supplemental EIS, Kakaako Community Development District Plan* followed which amended the previous Final EIS with discussion covering the Makai Area Plan.

The Makai Area boundary was amended in 1987 and 1990, and was followed in 1998 by a *Final Supplemental EIS for Kakaako Community Development District, Makai Area Plan*. The latest amendment to the Makai Area Plan was done in a 2005, *Final Environmental Assessment for the Makai Area Plan Amendment,* which covered the latest State projects completed in the Makai Area.

The Draft Mauka Area Plan is currently being amended, and its latest working version is dated May 2007. This document represents a significant change in the existing Mauka Area Plan, as amended, which warrants an associated supplemental EIS that will validate the improvements proposed.

1.2 Improvement District Program

Since its establishment in 1976, one of the main foci of the HCDA has been to improve the Kakaako District's network of streets and infrastructure to facilitate and encourage redevelopment and growth and maintain a safe, active community where its visitors and residents may comfortably and conveniently live, work and recreate. The HCDA has progressed toward accomplishing this through a segmented plan of action referred to as the Improvement District (ID) Program, which was used to implement roadway and utility improvements in specific, targeted areas within the Kakaako District. This program was largely funded by the Hawaii State Legislature, with contributions from property owners and public utility companies, and focused on reconstructing and/or widening streets; installing streetlights, curbs, gutters and sidewalks; improving drainage, sewer and water systems; and, upgrading and undergrounding electrical power and telecommunication. Approximately $203 million has been expended to complete ten Kakaako District ID Projects, five of which were within or partly within the Mauka Area. This has resulted in over $2 billion of investment in private-sector projects in the area.

Infrastructure development has recently invoked some concerns by the Kakaako community, particularly from small businesses and small lot owners in central Kakaako. A sixth ID Project within the Mauka Area was planned to improve Queen Street between Ward Avenue and Kamakee Street, but was cancelled in January 2007 by the HCDA to allow for more coordination with the community. The HCDA hopes to continue their Improvement District Program through continued coordination with the community to develop approaches to implement infrastructure and roadway improvements while supporting and creating increased economic opportunities for small business owners and owners of small land parcels in the Mauka Area.

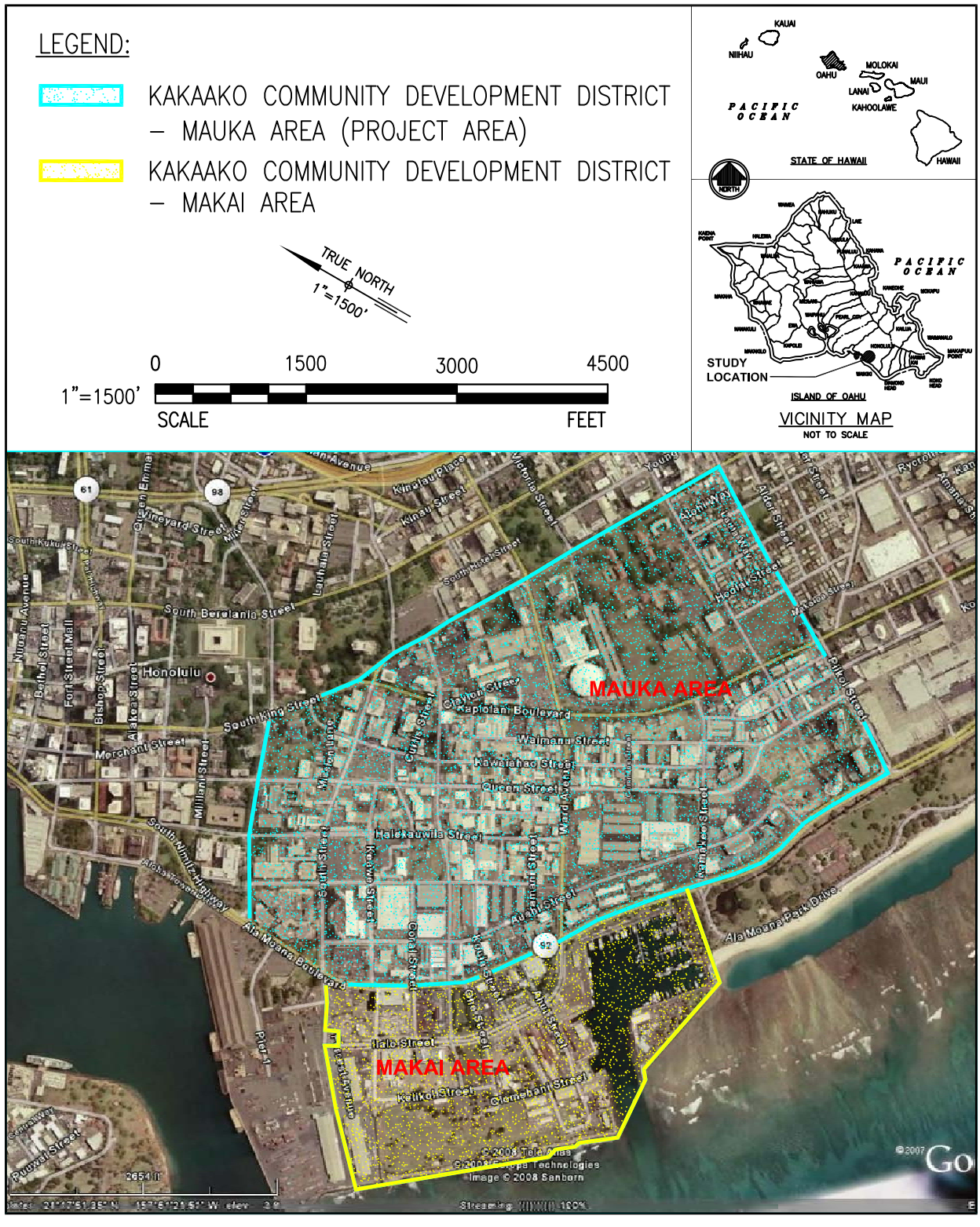
1.3 Draft Mauka Area Plan

In May 2003, the HCDA initiated a comprehensive review and the possible updating of the *Kakaako Community Development District, Mauka Area Plan and Rules*. Plan Pacific, Inc. was retained for this project and prepared a draft "Concept Plan" for the Mauka Area focusing on the following concepts:

- Develop the Mauka Plan around key Smart Growth concepts.
- Promote mixed-use neighborhoods.
- Strengthen connections with surrounding neighborhoods and districts.
- Define and develop specific objectives for neighborhoods, corridors and streets—including small lot development.
- Build on existing assets and planned investments—including Mother Waldron Playground, transit lines, and Queen and Kamakee Streets improvements.

The Draft Mauka Area Plan proposes the development of a neighborhood framework that identifies development parameters and design characteristics for sub-districts within Kakaako. This plan is the basis for analysis in the Supplemental Environmental Impact Statement that EDAW, Inc. has been tasked to prepare. AECOM (formerly M&E Pacific, Inc.) is a subconsultant to EDAW, Inc. and tasked with the evaluation of the infrastructure and utilities for the Draft Mauka Area Plan. DMJM Harris is also assisting EDAW, Inc. in developing a traffic study (*Kakaako Mauka Area Plan, Supplemental Environmental Impact Statement, Transportation Analysis*) to support the SEIS and further evaluate traffic recommendations set forth in the Draft Mauka Plan.

Through the use of this Infrastructure Plan, the *Kakaako Mauka Area Plan, Supplemental Environmental Impact Statement, Transportation Analysis*, the Draft Mauka Plan, and the SEIS, the HCDA would reassess their plans for infrastructure and roadway improvements within the Mauka Area, and prioritize tasks to develop effective approaches to continue their ID Program.



Kakaako Mauka Area Infrastructure Plan

FIGURE 1 - PROJECT LOCATION AND BOUNDARY MAP

METCALF&EDDY | AECOM

Sources: State of Hawaii, City & County of Honolulu, HCDA, PlanPacific, M&E Pacific, Inc.

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2.0 PURPOSE AND SCOPE

2.1 Objective

The purpose of the *Kakaako Community Development District, Mauka Area Infrastructure Plan* is to:

1. Assess the existing condition and service life for each infrastructure component:

    - Storm Drain Systems;
    - Sanitary Sewer Systems;
    - Solid Waste Disposal Program;
    - Water Systems;
    - Synthetic Natural Gas Systems;
    - Electrical Power Facilities;
    - Telephone and Communications Systems;
    - Cable Television Systems;
    - Traffic Signal Systems;
    - Roadway Street Light Systems; and,
    - Roadways.

    This assessment is accomplished through:

    - Visual site inspections and reconnaissance in the field to gain familiarity with site conditions and identify infrastructure development opportunities and constraints;
    - Data gathering, research and review of available references, development plans, relevant studies, planning documents, as-built plans, and record information, data and drawings on file with the HCDA and knowledgeable and appropriate government agencies and utility companies regarding the development of infrastructure within and adjacent to the project area; and,
    - Coordination and consultation with the HCDA and knowledgeable and appropriate government agencies and utility companies.

2. Verify and determine existing flows, pressures and capacities of each infrastructure component through:

    - Compilation of an inventory of the existing infrastructure in the project area and systems adjoining it where existing and future improvements could be connected.

- Coordination with knowledgeable and appropriate government agencies and utility companies to determine adequacy and limitations of existing infrastructure.
- Preparation of a preliminary hydrology study to determine storm runoff quantities under the existing condition, and comparison to completed, past hydrology studies and their design criteria.

3. Assess the existing infrastructure to accommodate the demands of the proposed development and land use through:

    - Establishment of infrastructure master planning criteria and standards for each utility, including flow generation, demand and frequency of demand.
    - Determination of requirements for upgrading, increasing or replacing existing infrastructure including recommendations for bypass relief lines, and new installations.
    - Coordination with knowledgeable and appropriate government agencies and utility companies to determine and identify future condition components.
    - Preparation of a preliminary hydrology study to determine storm runoff quantities under the post-development condition.

4. Prepare an infrastructure master plan based on the assessment of the existing infrastructure and the demands of the proposed development and land use through:

    - Determination of future demands based on a projection of the proposed development out to the year 2030.
    - Conceptualization of an infrastructure master plan for the various utilities to include location, alignment, pipe size and special considerations.
    - Addressing of requirements for points of connection and location of discharge.

5. Prepare order-of-magnitude, present-dollar costs for construction of recommended infrastructure development and improvements through:

    - Calculation of approximate quantity estimates and take-offs for the recommended infrastructure development and improvements.
    - Inclusion of soft costs—land planning fees, and design and permitting fees as a percentage of the recommended infrastructure improvements.
    - Exclusion of any vertical construction costs.

2.2 Methodology

Within the Mauka Area of the Kakaako Community Development District lies a matrix of utility services and numerous pipelines, conduits and appurtenant structures. Although it is difficult and impractical to analyze all utilities in a detailed manner, appropriate assumptions and cross-referencing make it possible for the task at hand to be completed accurately. Sections within the Mauka Area that have major utilities are the areas of primary focus when analyzing existing conditions. By identifying the major infrastructure

sections and locations, it is possible to evaluate the existing flows, pressures, capacities etc. of all the components at each section of interest.

The existing Kakaako District infrastructure is evaluated to be able to support land use density and population forecasts out to the year 2030. Available information on existing and proposed conditions of the utilities and infrastructure within the Mauka Area is obtained either from the appropriate government agencies and utility companies, or reconnaissance in the field. Any identified infrastructure inadequacies shall be recommended for upgrade and improvement to accommodate the year 2030 projection demands. Recommended utility improvements shall meet current design criteria and standards to conform to regulatory government agency and utility company codes and standards. Design and construction within the Mauka Area fall under the regulation and approval of the City; thus, any required municipal infrastructure improvements shall conform to City guidelines and standards. This combination of existing utilities to remain and recommended improvements to support year 2030 forecasts comprise the infrastructure master plan. This Infrastructure Plan also investigates approximate construction cost estimates associated with recommended utility improvements in 2008 dollars.

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3.0 INVENTORY OF EXISTING INFRASTRUCTURE

Under the HCDA, several State-funded ID Program projects were implemented from the late 1980's through 2002 which completed roadway improvements, involving reconstructed and widened streets with new curbs, gutters, and pavement, and expanded drainage, sewer, water, and placed telephone, electric, and cable television lines underground. Projects ID 1 through ID 3 improved the major roadways in the area bounded by Punchbowl Street, South King to Kapiolani Boulevard to Cooke Street, and Ala Moana Boulevard. Projects ID 4 and ID 7 improved and realigned Kamakee Street. These projects improved approximately a third of the roadways and utilities in the study area.

3.1 Utilities

3.1.1 Storm Drain Systems

The rainfall-catchment drainage basin contributing storm runoff into the Mauka Area storm drain systems from within the Mauka Area, as well as, from neighboring areas, is approximately 2,000 acres (refer to Figure 2—Drainage *Basin*). This drainage basin stretches from the slopes of Punchbowl Crater to Ala Moana Boulevard (north to south) and roughly from Punchbowl Street to Sheridan Street to Kalakaua Avenue (west to east). Drainage surface runoff flows generally from the mountains to the ocean by gravity.

Figure 3—Existing *Storm Drain Systems*, shows the locations of the existing drainage facilities within the Mauka Area. Nine major drainage trunk lines are located within the rights-of-way of each major mauka-makai street sloping from the mountains to the ocean:

1. 8′-wide × 4′-high box drain along Piikoi Street.
2. Double 14′-wide × 8′-high box drain along Pensacola Street.
3. 12′-wide × 4′-high box drain along Kamakee Street.
4. 10′-wide × 9′-high box drain that transitions to an 11′-wide × 8′-high box drain along Ward Avenue.
5. 7′-wide × 4′-high box drain that transitions to an 8′-wide × 5′-high box drain along Cooke Street.
6. 16′-wide × 9′-high box drain along Coral Street.
7. 8′-wide × 4′-high box drain along Keawe Street.
8. 10′-wide × 9′-high box drain that branches off of South Street toward Ala Moana Boulevard.
9. 3½′-wide × 2′-high box drain along Punchbowl Street.

An additional, tenth drainage trunk line—a 99-inch drainline—lies between Ward Avenue and Cummins Street.

Flat terrain within the Mauka Area and the relatively low elevation (near the ocean) of the area necessitate the large size of the underground drainage system required to reduce the frequency of flooding during

larger rainfall events. Associated with the flat slope is the chronic build-up of sediment in the pipes and box culverts which require periodic cleaning by the City to minimize blockages and flow backup.

Collectively the existing major drainage trunk lines are estimated to be able to discharge approximately 2,400 cubic feet per second (cfs) of storm runoff to the ocean from the entire rainfall-catchment drainage basin, which encompasses both the Mauka Area and its surrounding areas. Under the design criteria of the City's storm drainage design standards (100-year recurrent storm with a 24-hour duration for drainage area greater than a 100 acres: Plate 6, "Design Curves for Peak Discharge Vs. Drainage Area"), this flow capacity would be adequate to service a 500-acre drainage area. Thus, the existing drainage system is adequate to manage the storm water contribution from the 450-acre Mauka Area only based on City design standards.

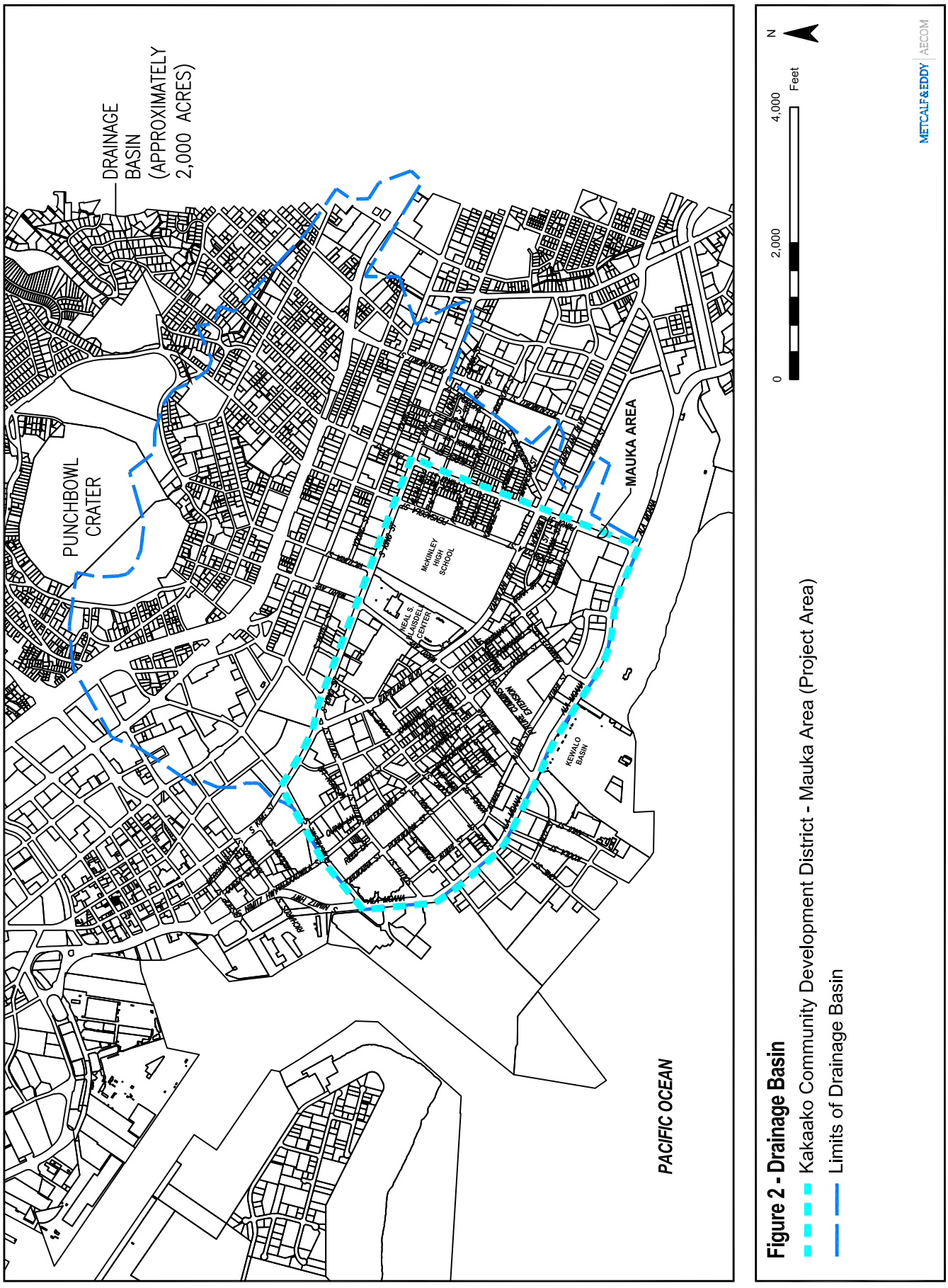

Figure 2 - Drainage Basin

Kakaako Community Development District - Mauka Area (Project Area)

Limits of Drainage Basin

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Figure 3 - Existing Storm Drain Systems

Existing Drain Line to Remain

Mauka Area (Project Boundary)

8' X 4.5' Box Drain Size and Callout Tag Leader

× 4.29 Existing Spot Elevation With Respect to Mean Sea level (MSL)

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.2 Sanitary Sewer Systems

The wastewater collection system servicing the Mauka Area collects sewage generated from within the Mauka Area, combines it with wastewater from adjacent areas, and conveys flow to the Ala Moana Wastewater Pump Station (Ala Moana WWPS) located on the makai side of Ala Moana Boulevard and the defunct Kakaako Ala Moana Pump Station (AMPS), where wastewater is pumped to the Sand Island Wastewater Treatment Plant (Sand Island WWTP) for processing and disposal to the Pacific Ocean. The entire collection and conveyance system is a gravity pipe (sewer) system that consists of smaller pipes that transition to larger diameter sewer branches to accommodate wastewater flows in accordance with City requirements for hydraulic flow. The City Department of Environmental Services (ENV) maintains the existing collection and conveyance sewer system and operates both the Ala Moana WWPS and Sand Island WWTP. A considerable portion of the original sewer system that was installed in the 1930s has been replaced during the mid-1980s under the ID Program by the HCDA.

The current capacity of the ALA MOANA WWPS is about 61.9 million gallons per day (MGD) with a force main capacity of approximately 107.5 MGD. The SAND ISLAND WWTP daily average capacity is approximately 82.0 MGD with a wet-weather capacity of about 200 MGD. The SAND ISLAND WWTP is currently undergoing construction modifications, which will increase its average daily capacity to approximately 90.0 MGD with wet-weather capacity of approximately 270.0 MGD. Refer to Figure 4—Existing *Sanitary Sewer Systems*, for the locations of existing sewer facilities within and adjacent to the Mauka Area.

The Mauka Area is serviced by the following nine existing sewer mains:

1. A 32-inch sewer that runs along Ala Moana Boulevard from the Ewa side of the Mauka Area and intercepts trunk sewers from Punchbowl and South Streets. This 32-inch sewerline increases to a 36-inch pipeline as it reaches the ALA MOANA WWPS. This sewerline was constructed in circa 1902 and was rehabilitated in 2004 with a cast-in-place pipe method. This collective sewer main services the downtown area east of Nuuanu Stream and makai of School Street.
2. A second sewer main that runs along South Street from South King Street to Ala Moana Boulevard. Between South King Street and Kapiolani Boulevard the sewer is an 18-inch line (installed in the late 1890s). At Kapiolani Boulevard and Kawaiahao Street, the sewer increases to a 24-inch line (installed in 1985) that runs from Kawaiahao Street to Queen Street. From Queen Street to Auahi Street, the sewer is a 30-inch line (installed in 1985) that transitions up to a 36-inch line (installed in 2001) that runs to Ala Moana Boulevard. This collective sewer main services approximately 148 acres.
3. A third sewer main that follows South King and Cooke Streets. The South King Street segment from Punchbowl Street to South Street is an 8-inch sewer (installed in the late 1890s) that transitions up to 12-inch line and eventually up to 18-inch at the South Street intersection. This 18-inch sewerline runs along South King Street from South Street to Piikoi Street. The Cooke Street Relief Sewer (installed in 1966) diverts all the sewage from the South King Street sewer east of Cooke Street. The Cooke Street Relief Sewer begins as an 18-inch line that runs from South King Street to Kapiolani Boulevard, transitions up to a 21-inch line from Kapiolani Boulevard to Kawaiahao Street, and increases up to a 24-inch line from Kawaiahao

Street to Auahi Street. At Auahi Street it connects to the 78-inch Auahi Trunk Sewer (installed in early 1990s). This collective sewer main services an area generally along South King Street and makai of the freeway.

4. A fourth sewer main that begins as an 8-inch line (installed in the late 1890s) on Ward Avenue makai of South King Street and transitions up to a 10-inch line (installed in 1919) before Kapiolani Boulevard that continues on until Queen Street. The sewer transitions up to a 12-inch line (installed in 1919) at Queen Street that runs until Auahi Street, where it enlarges up to a 14-inch line just before joining the 78-inch Auahi Trunk Sewer (installed in 1991) that runs along Auahi Street and down Keawe Street. This collective sewer main serves areas within the Mauka Area and terminates at the ALA MOANA WWPS.
5. A fifth sewer main that runs parallel to the aforementioned fourth sewer main along Ward Avenue. The 60-inch Ward Avenue Relief Sewer (installed in 1975) collects sewage flows from Kalihi and Manoa-Kaimuki interceptor sewers through the Kakaako District and does not collect sewage flows along Ward Avenue. At Auahi Street, the sewerline joins the 78-inch Auahi Trunk Sewer (installed in 1991, parallel to the East End Relief Sewer segment) that runs along Auahi Street.
6. A sixth sewer main known as the East End Relief Sewer, is comprised of a 78-inch segment along Auahi Street (installed in the late 1980s) and a 48-inch line (installed in 1959) along Rycroft Street that runs along Pensacola Street, Kapiolani Boulevard, Cummins Street, Queen Street, and Auahi Street. This collective sewer main relieves the South King Street sewer at Piikoi Street, 36-inch sewer on Kapiolani Boulevard, and other areas outside and adjacent to the Mauka Area.
7. A seventh sewer main is a 36-inch line (installed in 1925) located along Kapiolani Boulevard between Piikoi Street and Kamakee Street. This sewer continues along Kamakee Street to Auahi Street. Makai of Auahi Street, the sewer transitions up to a 48-inch (installed in 1996) that runs to Ala Moana Boulevard. This sewer joins a 69-inch line (installed in 1963) on Ala Moana Boulevard that runs to Keawe Street, where it enlarges to a 78-inch line (installed in 1991) that runs to the ALA MOANA WWPS. This collective sewer main conveys sewage originating from the Fort DeRussy Sewage Pump Station in Waikiki.
8. An eighth sewer main is a 69-inch line (installed in 1964) that traverses Ala Moana Beach Park and connects the Beachwalk (Waikiki) and Moana Sewage Pump Station (SPS) at Ala Moana Beach Park to the ALA MOANA WWPS.
9. A ninth sewer main is a 78-inch line (installed in early 1990s) located along Auahi Street from Ward Avenue to Keawe Street that runs down Keawe Street to the ALA MOANA WWPS. This collective sewer main conveys sewage flow from Keawe Street, Cooke Street, and the Ward Avenue Relief Sewer, which connects to it at Ward Avenue.

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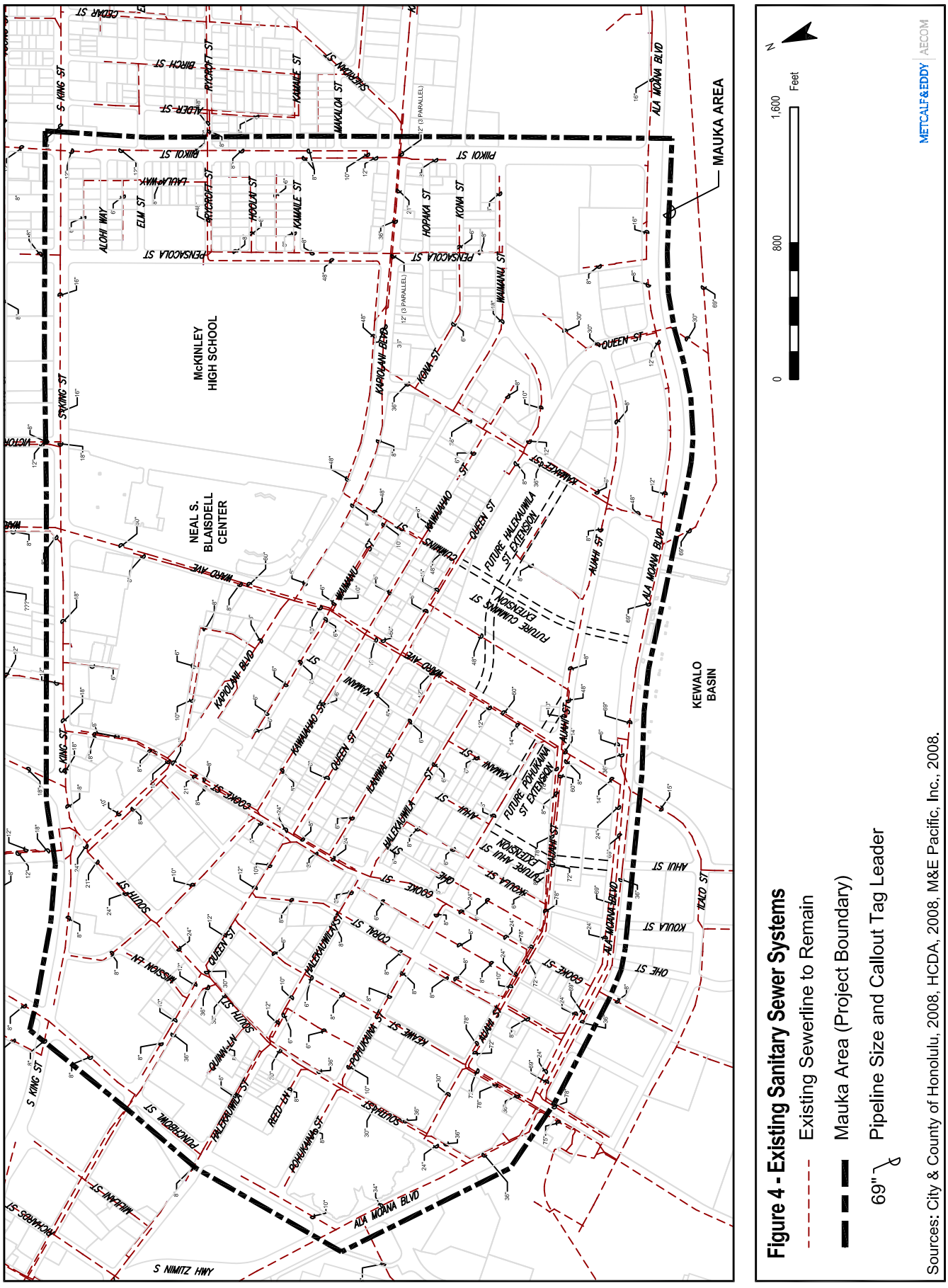

Figure 4 - Existing Sanitary Sewer Systems

Existing Sewerline to Remain

Mauka Area (Project Boundary)

69" Pipeline Size and Callout Tag Leader

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.3 Solid Waste Disposal Program

The trash and rubbish generated by residences and businesses are called "solid waste." The City ENV Refuse Division manages the collection, disposal and recycling operations for the bulk of the solid waste. The City does not collect industrial or hazardous waste (such as, auto parts, batteries, oil filters, etc.). Industrial or hazardous waste must be disposed of by other privately-contracted services.

The City ENV collects solid waste twice a week (Tuesday and Friday) primarily from residences in the Mauka Area while private contractors to the City collect solid waste from businesses. Private contractors that currently collect solid waste from the Mauka Area for disposal include Rolloffs Hawaii, Waste Management and Honolulu Disposal Service. Refer to Figure 5—Existing *Solid Waste Disposal* Program, for the existing municipal and private service areas of the solid waste disposal program within the Mauka Area.

No existing or proposed solid waste disposal facilities are located within the Mauka Area. All solid waste is collected then disposed of outside of the Mauka Area to recycling/composting facilities, landfills or the HPower facility in James A. Campbell Industrial Park (Kapolei), where combustible waste is incinerated to produce electricity.

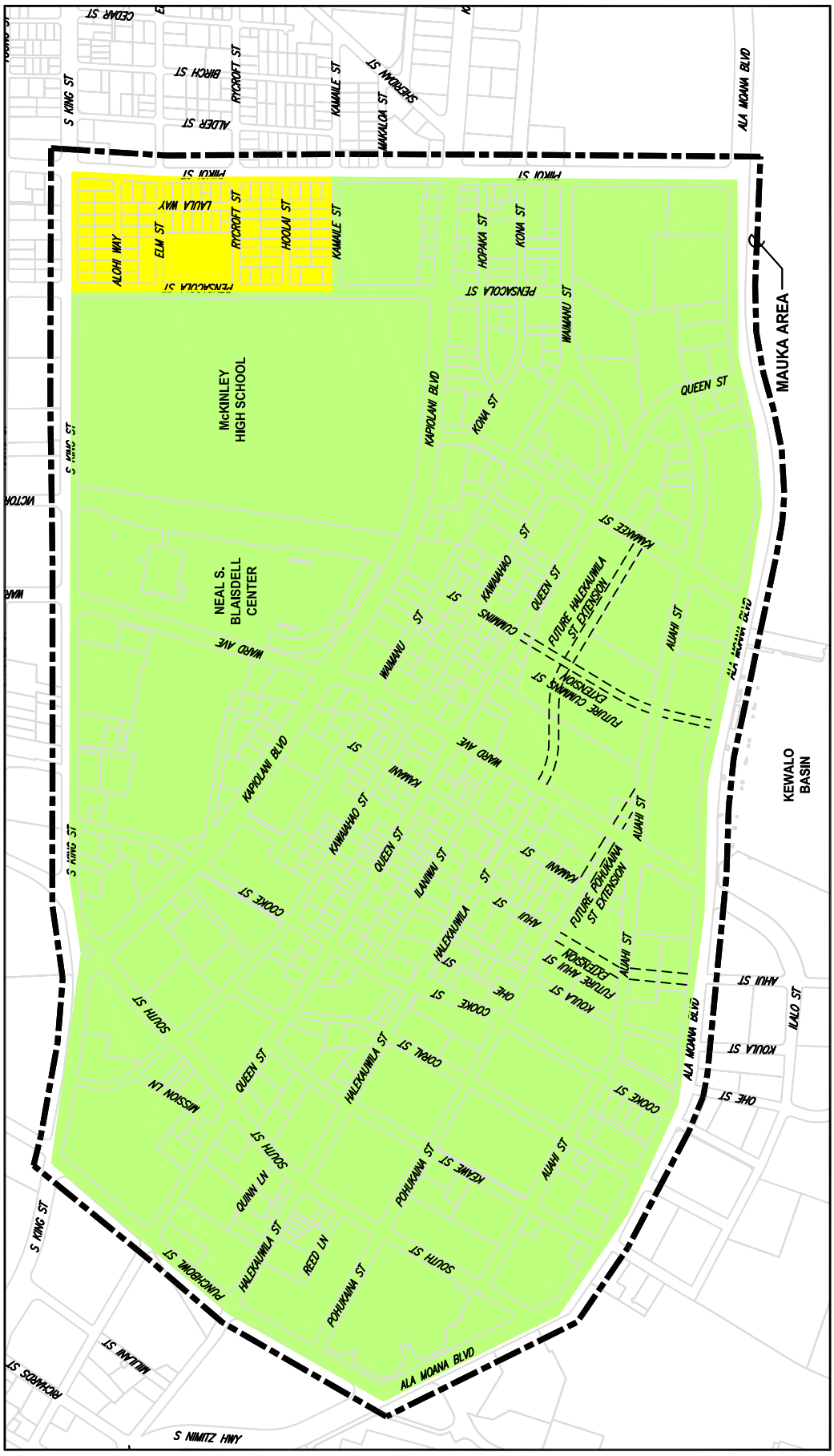

Figure 5 - Solid Waste Disposal Program

- Area of Solid Waste Collection Service by the City and County of Honolulu (Tuesday & Friday)
- Area of Solid Waste Collection Service by Private Companies
- Mauka Area (Project Boundary)

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.4 Water Systems

The Kakaako water system that encompasses the Mauka Area is part of the City Board of Water Supply's (BWS's) Honolulu Low Service Area, which stretches from Red Hill to Makapuu Point. Refer to Figure 6—Existing *Water Systems*, for the existing water system facilities within the Mauka Area. No wells are located within the Mauka Area except for an artesian well located on parcel TMK: (1)2-1-048:018. The major sources of water for the Mauka Area are the Punanani Wells, Kalauao Wells, Halawa Shaft, and Kaamilo Wells, all located in the Pearl Harbor District. Other sources of water that serve the Mauka Area are the Wilder Wells, Kalihi Shaft, Kalihi Station and Beretania Station, all located in the Honolulu District. The water pumped from these sources are stored in reservoirs and then distributed by gravity transmission and distribution lines to users.

Transmission and distribution lines within the Mauka Area consist of the following waterlines:

- 20″ pipeline along Kapiolani Boulevard from South King Street and South Street to Cooke Street.
- 20″ pipeline along Cooke Street from Kapiolani Boulevard to Pohukaina Street.
- 12″ pipeline along Cooke Street from Pohukaina Street to Ala Moana Boulevard.
- 16″ pipeline along Piikoi Street between South King Street and Kapiolani Boulevard.
- 12″ pipeline along Ala Moana Boulevard, Kapiolani Boulevard, Ward Avenue, Pensacola Street, and Piikoi Street.
- 8″ or smaller-size pipelines on all other streets.

Existing fire hydrants are spaced at a maximum distance of 350 feet in accordance with BWS design standards. All waterlines (mains and service laterals) and appurtenances (water meters) are maintained by the BWS.

The water system has been improved and upsized by the BWS as required to generally meet the current water demand in accordance with the prevailing water system design standards. Some areas within the Mauka Area contain segments of existing six-inch water mains, which will get upgraded to the BWS-minimum standard size of eight inches, as necessary, by the BWS.

During the planning phase, each proposed development has an estimated water demand that is reviewed and evaluated by the BWS using their computer modeling. Based on their analysis, the BWS will approve the new water service or recommend necessary improvements to the water distribution system as required.

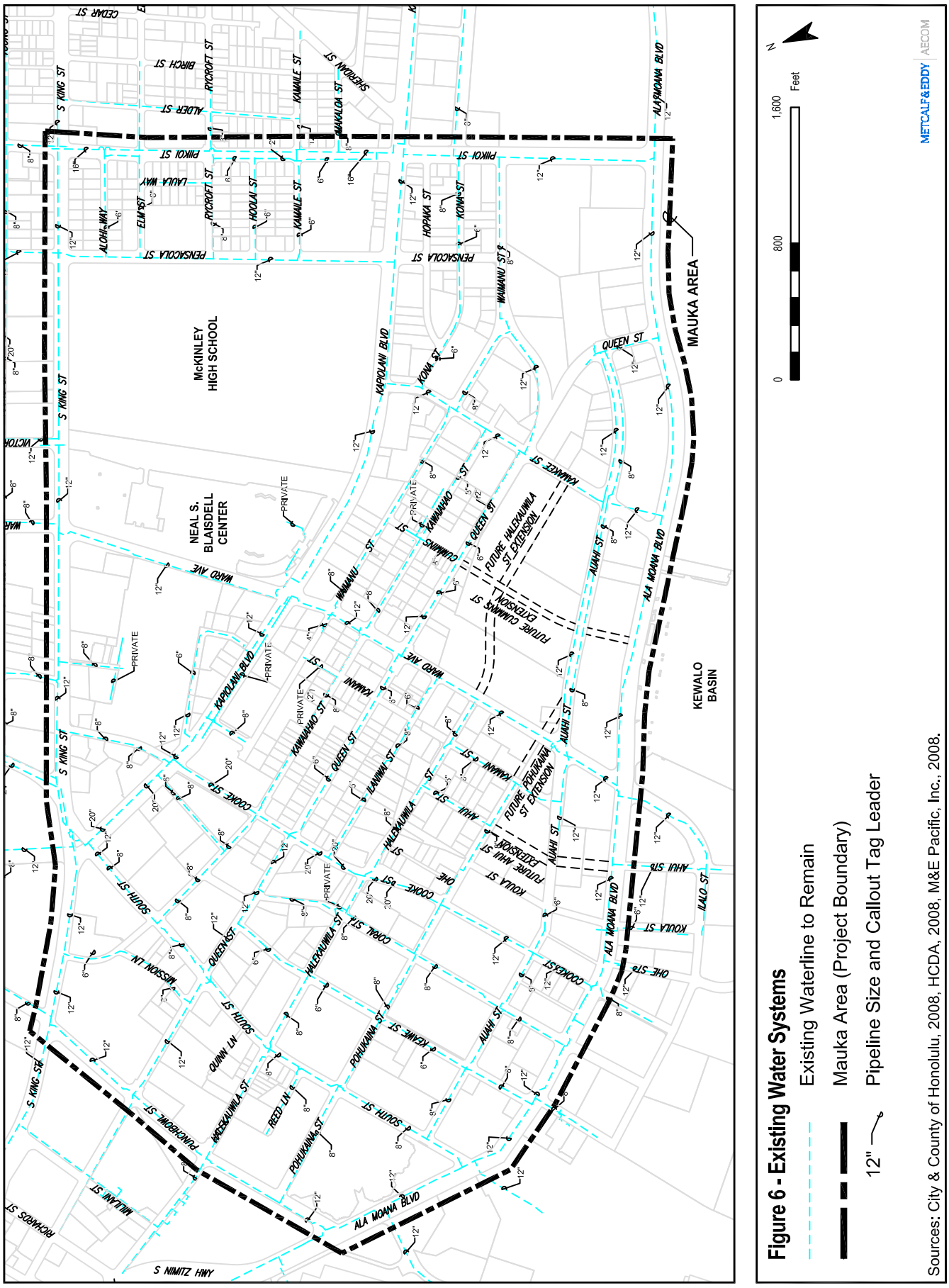

Figure 6 - Existing Water Systems

Existing Waterline to Remain

Mauka Area (Project Boundary)

12" Pipeline Size and Callout Tag Leader

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.5 Synthetic Natural Gas Systems

The main supplier of synthetic natural gas (SNG) to the entire Honolulu area, including the Mauka Area, is The Gas Company's (GASCO's) SNG Plant, which is located at Barbers Point on southwestern Oahu (Ewa). The gas supplied from the Barbers Point SNG Plant is conveyed by 16-inch transmission lines to GASCO's staging plant at Pier 38 in Honolulu Harbor. From Pier 38, the gas is transmitted throughout the Honolulu service area by 6-inch, 8-inch and 10-inch supply lines to their respective distribution systems, including the system servicing the Mauka Area.

The SNG distribution system within the Mauka Area consists of a network of two-inch, three-inch and four-inch main lines connected to smaller-size service laterals to users. Synthetic natural gas is provided to individual parcels through service lines that terminate at meters inside property lines. Refer to Figure *7—Existing Synthetic Natural Gas Systems*, for the layout of transmission and distribution lines of the existing SNG system within the Mauka Area.

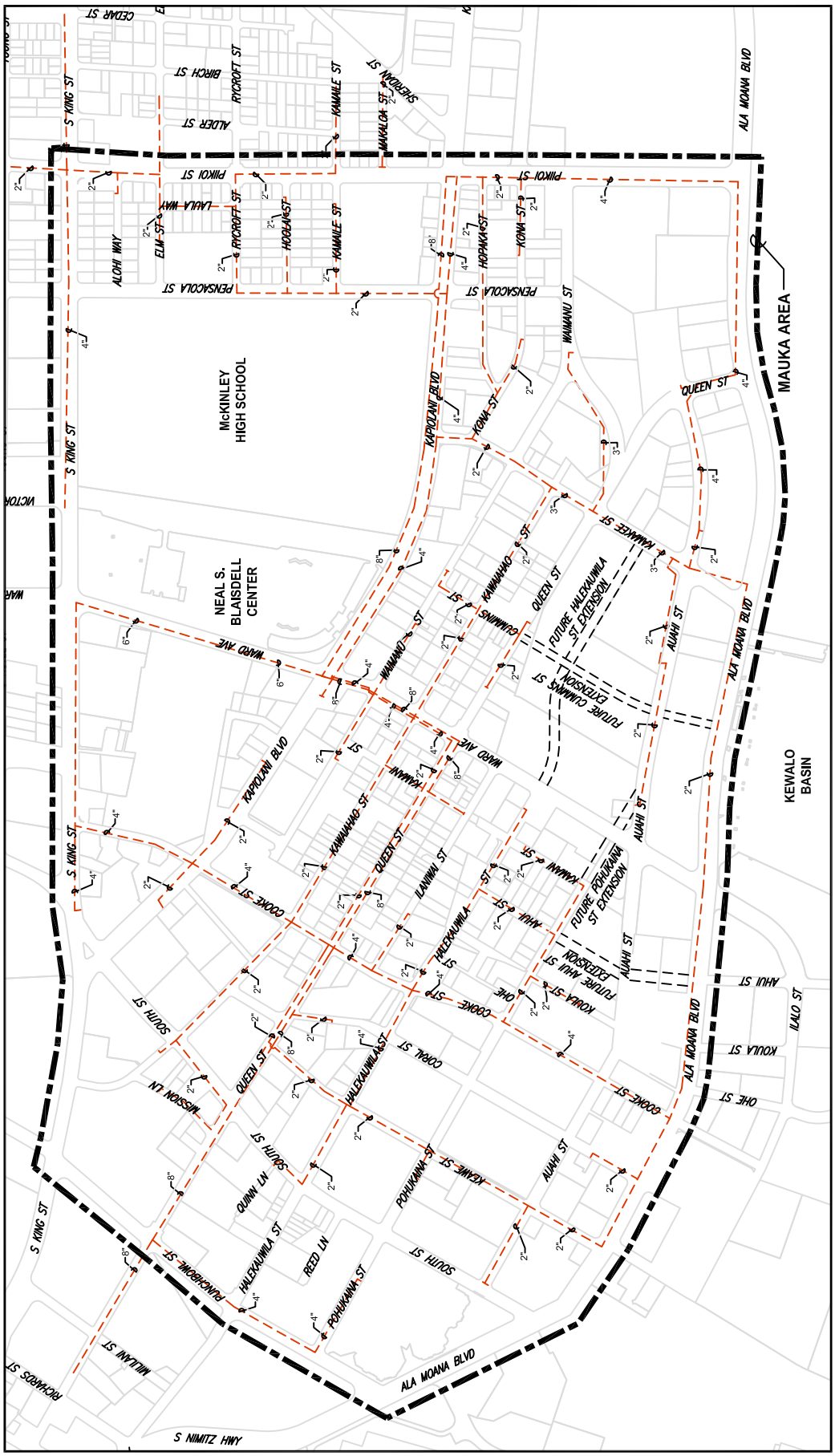

Figure 7 - Existing Synthetic Natural Gas Systems

- Existing Gas Line
- Mauka Area (Project Boundary)
- 4" Pipeline Size and Callout Tag Leader

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, GASCO, 2007, M&E Pacific, Inc., 2008.

3.1.6 Electrical Power Facilities

Hawaiian Electric Co.'s (HECo.'s) existing generation system is currently capable of providing approximately 1,238 Megawatts (Mw) of power with independent power producers capable of providing an additional 434 Mw of power for a total generating capacity of 1,672 Mw. Current peak demand, as of December 2007, is 1,261 Mw.

Three existing HECo. substations presently serve the Mauka Area: Kewalo Substation, located on Kona Street between Kamakee and Piikoi Streets; Kakaako Substation, located on Ilaniwai Street between Cooke Street and Ward Avenue; and Honolulu Power Plant substation, located on the Honolulu Power Plant site along Nimitz Highway. Refer to Figure 8—Existing *Electrical Power Facilities*, for the existing electrical facilities within the Mauka Area. Based on discussions with HECo., the capacity of each of the substations is 50 Mw, 45 Mw and 20 Mw, respectively. The current peak demand experienced at each of these substations is 25 Mw, 30 Mw and 13 Mw, respectively.

HECo. presently distributes power throughout the Mauka Area at two primary voltages, 11.5 kilo-Volt (kV) and 12.47 kV. HECo's Kakaako Substation and Honolulu Power Plant Substation distribute power at 11.5 kV and the Kewalo Substation distributes voltage at 12.47 kV. The HECo. primary and secondary distribution systems within the Mauka Area currently consist of a blend of overhead and underground lines. In addition to these lines, HECo. also has 46-kV and 138-kV transmission lines routed through the Mauka Area. The 46-kV transmission lines are used to energize the primary side of HECo's substations which then step-down the transmission voltage to the 12.47 kV or 11.5 kV distribution voltages. Pole-top and ground-mounted HECo.-owned transformers further step-down the distribution voltage to secondary voltages, which are directly useable by HECo's customers. The 138-kV transmission line within the Mauka Area has been installed completely underground and extends from HECo's Archer Substation, located just off Kapiolani Boulevard, along Kapiolani Boulevard, Kamakee Street and Kona Street to HECo's Kamoku Substation.

Existing roads along Waimanu Street, Kona Street, Hopaka Street, and unimproved portions of Pohukaina Street, Queen Street, Halekauwila Street, Kawaiahao Street and Keawe Street are paved but lack curbs, gutters and sidewalks. The predominant land use along these roads consists of small businesses whose electric service is extended from existing overhead lines. Along Auahi Street, Piikoi Street, Alohi Way, Rycroft Street, Hoolai Street and Kamaile Street the existing road improvements consist of City standard curb, gutter, sidewalk and asphalt concrete (AC) pavement. The predominant land use along Alohi Way, Rycroft Street, Hoolai Street and Kamaile Street are single family homes whose electric service is extended form existing overhead lines. Most of the land along Auahi Street has been consolidated into larger parcels whose electric service is extended either from the existing overhead lines on Auahi Street or Ala Moana Boulevard.

Unless determined by HECo. to be inadequate, applicable duct systems along South, Cooke, Coral and Kamakee Streets and portions of Pohukaina, Queen, Halekauwila, Kawaiahao and Keawe Streets that were placed underground under previous projects would remain and would not be impacted by future developments. HECo. will evaluate the adequacy of the duct system on a project-by-project basis. Further, under a State DOT/Federal Aid project, existing overhead lines along Ala Moana Boulevard

between Cooke Street and Queen Street will be undergrounded. Any impacts and mitigation measures necessary for this proposed utility work will be addressed by the State DOT.

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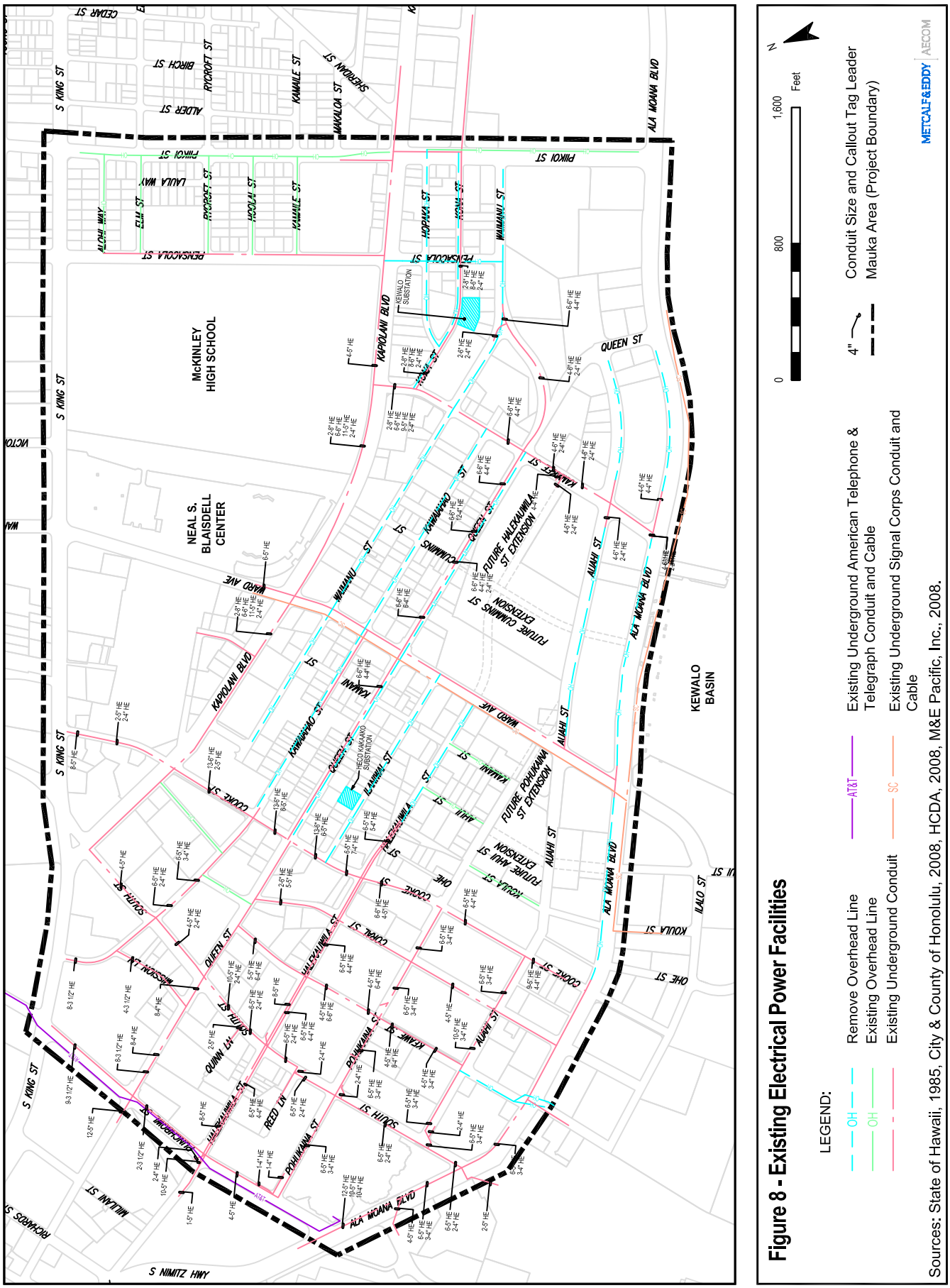

Figure 8 - Existing Electrical Power Facilities

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.7 Telephone and Communications Systems

Hawaiian Telcom (HTCo.) presently serves the Mauka Area from its Alakea and Kakaako Central Offices. The Alakea Central Office is located within the HTCo. headquarters building on Alakea Street. HTCo.'s Kakaako Central Office is located on Kawaiahao Street near its intersection with Kamakee Street. The HTCo. distribution system within the Mauka Area currently consists of a blend of overhead and underground lines. Existing HTCo. facilities include both fiber optic cables for trunking and high-bandwidth uses and copper twisted pair cables which carry voice grade and medium bandwidth signals. Refer to Figure 9—Existing *Telephone and Communications Systems*, for the existing HTCo. facilities within the Mauka Area.

Unless determined by HTCo. to be inadequate, applicable duct systems along South, Cooke, Coral and Kamakee Streets and portions of Pohukaina, Queen, Halekauwila, Kawaiahao and Keawe Streets that were placed underground under previous projects would remain and would not be impacted by future developments. HTCo. will evaluate the adequacy of the duct system on a project-by-project basis. Further, under a State DOT/Federal Aid project, existing overhead lines along Ala Moana Boulevard between Cooke Street and Queen Street will be undergrounded. Any impacts and mitigation measures necessary for this proposed utility work will be addressed by the State DOT.

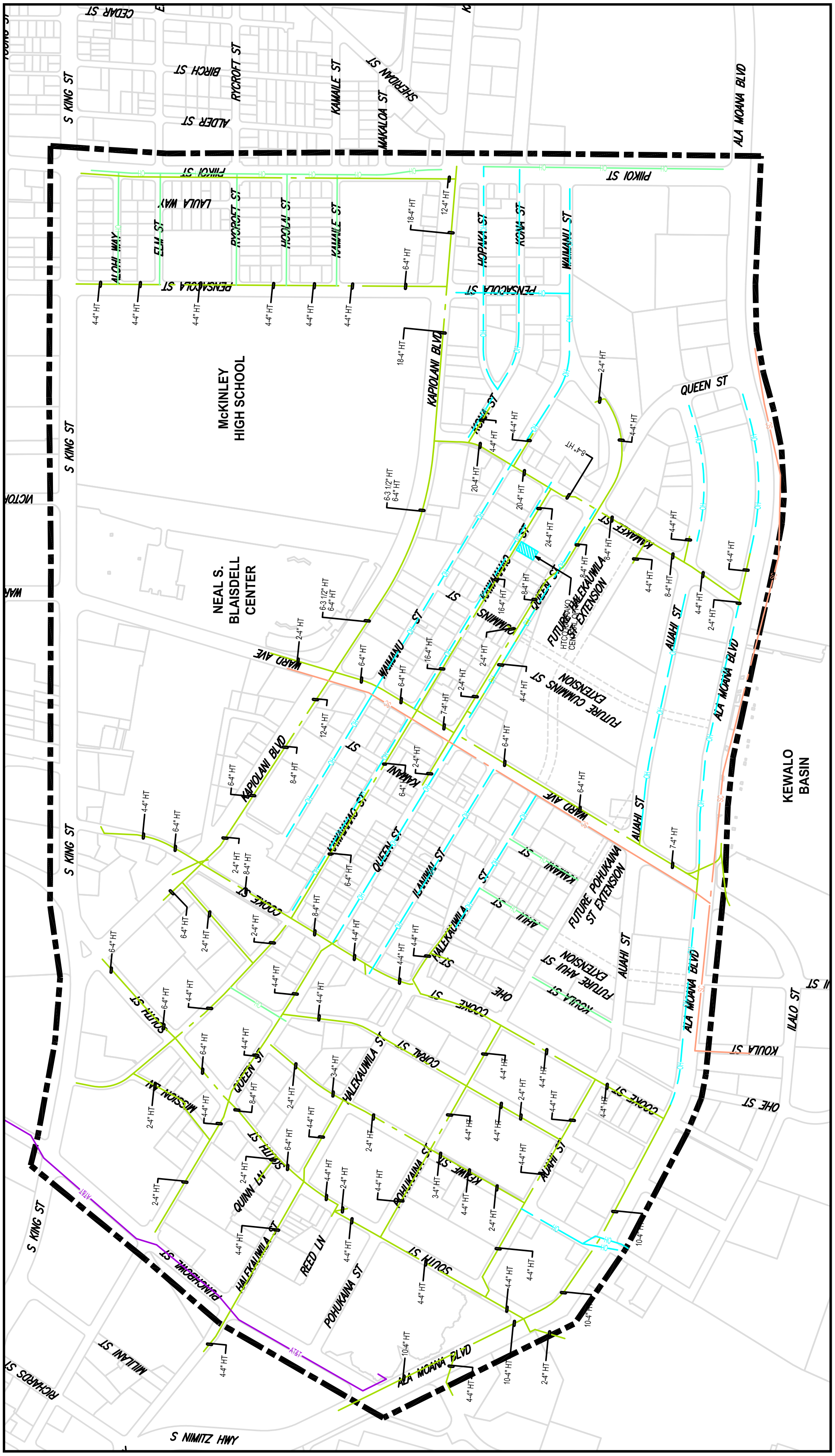

Figure 9 - Existing Telephone and Communications Systems

LEGEND:

- OH — Remove Overhead Line
- OH — Existing Overhead Line
- Existing Underground Conduit
- AT&T — Existing Underground American Telephone & Telegraph Conduit and Cable
- SC — Existing Underground Signal Corps Conduit and Cable
- 4" — Conduit Size and Callout Tag Leader
- Mauka Area (Project Boundary)

0 800 1,600 Feet

N

METCALF & EDDY | AECOM

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.8 Cable Television Systems

Oceanic Time Warner (Oceanic) presently serves the Island of Oahu from its head end facility located in Mililani Technology Park. The Oceanic trunking system consists of fiber optic cables, which are connected to power supplies located at various nodes throughout Oahu. From these nodes a blend of coaxial cables and fiber optic cables distributes Oceanic's signal to end-users. Typically, power supplies are deployed on an "as-needed" basis to provide adequate signal strength throughout Oceanic's system. Refer to Figure 10—Existing *Cable Television Systems*, for the existing Oceanic cable television (CATV) facilities within the Mauka Area.

Unless determined by Oceanic to be inadequate, applicable duct systems along South, Cooke, Coral and Kamakee Streets and portions of Pohukaina, Queen, Halekauwila, Kawaiahao and Keawe Streets that were placed underground under previous projects would remain and would not be impacted by future developments. Oceanic will evaluate the adequacy of the duct system on a project-by-project basis. Further, under a State DOT/Federal Aid project, existing overhead lines along Ala Moana Boulevard between Cooke Street and Queen Street will be undergrounded. Any impacts and mitigation measures necessary for this proposed utility work will be addressed by the State DOT.

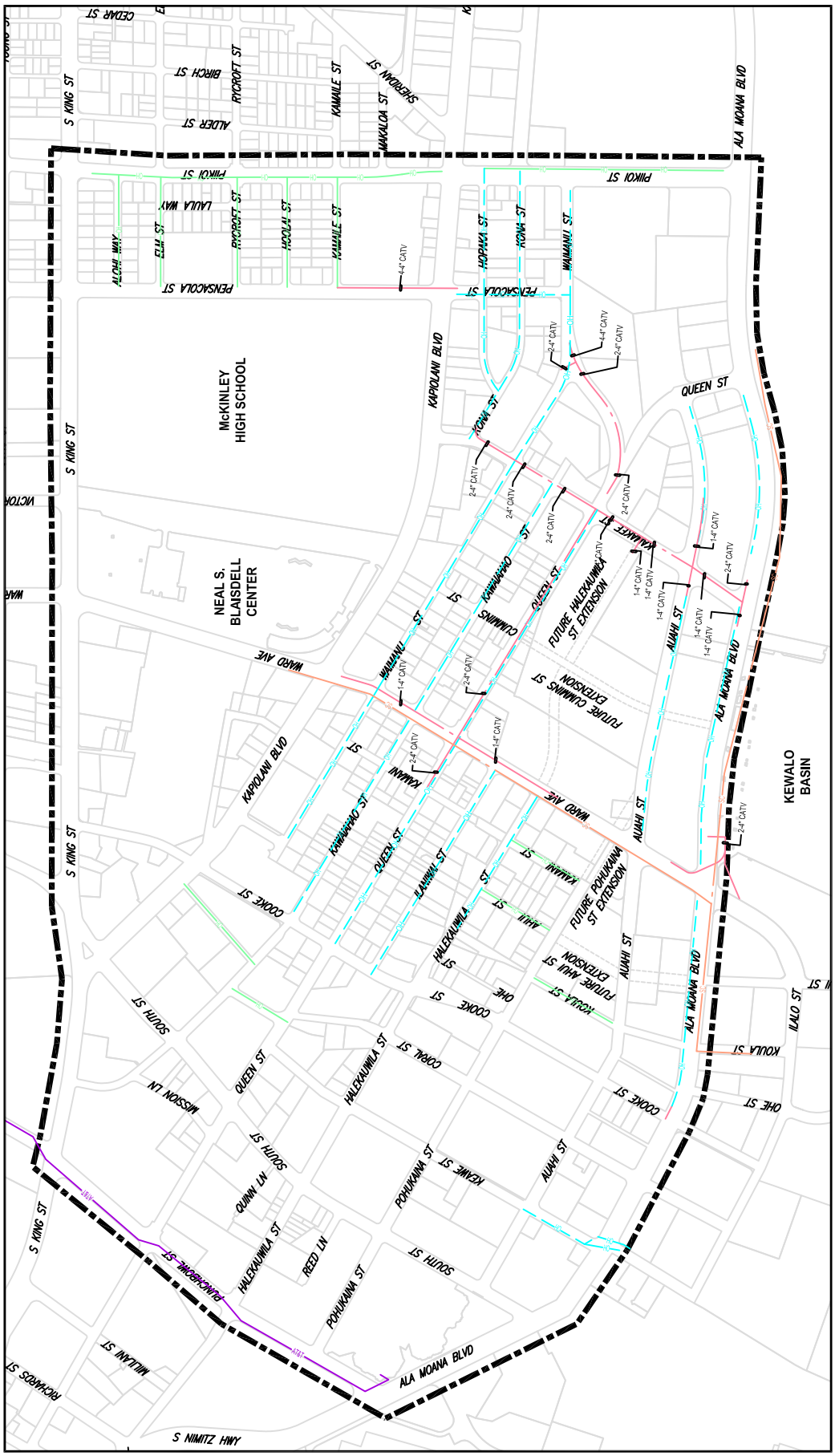

Figure 10 - Existing Cable Television Systems

LEGEND:

- Remove Overhead Line
- Existing Overhead Line
- Existing Underground Conduit
- Existing Underground American Telephone & Telegraph Conduit and Cable
- Existing Underground Signal Corps Conduit and Cable

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.9 Traffic Signal Systems

Within the Mauka Area, the City Department of Transportation Services (DTS), Traffic Signal and Technology Division, owns and maintains existing traffic signals at the following intersections:

- Punchbowl and Halekauwila Streets;
- Punchbowl and Queen Streets;
- Punchbowl and South King Streets;
- Kapiolani Boulevard and South King Street;
- Queen and South Streets;
- South and Halekauwila Streets;
- South and Pohukaina Streets;
- Cooke Street and Kapiolani Boulevard;
- Cooke and Queen Streets;
- South King Street and Ward Avenue;
- Kapiolani Boulevard and Ward Avenue;
- Ward Avenue and Queen Street;
- Ward Avenue and Halekauwila Street;
- Ward Avenue and Auahi Street;
- Kamakee Street and Kapiolani Boulevard;
- Pensacola and South King Streets;
- Kamakee and Auahi Streets;
- Pensacola Street and Kapiolani Boulevard;
- Pensacola and Waimanu Streets;
- Piikoi and South King Streets;
- Piikoi Street and Kapiolani Boulevard;
- Piikoi and Kona Streets; and,
- Piikoi and Waimanu Streets.

In addition the City owns and maintains three mid-block signals, two located along Auahi Street at entrances into Ward Warehouse and Ward Center, and one located at the Piikoi Street entrance into Ala Moana Shopping Center.

The traffic signals at the following Ala Moana Boulevard intersections are owned by the State Department of Transportation (DOT) and maintained by the City:

- Punchbowl Street;
- South Street;
- Keawe Street;
- Coral Street;

- Cooke Street;
- Koula Street;
- Ward Avenue;
- Kakaako Waterfront Park Access Road;
- Kamakee Street;
- Queen Street; and,
- Piikoi Street.

Additionally, the City also owns and maintains a closed-circuit television (CCTV) system, which terminates at the City Traffic Management Center located on Kinalau Street near Ward Avenue. The CCTV cameras are used in conjunction with other monitoring devices as part of an intelligent transportation system (ITS) to regulate traffic flow through metropolitan Honolulu. At present, the City controls the timing of both City-owned and State-owned traffic signals. Refer to Figure 11—Existing *Traffic Signal Systems*, for the existing traffic signal systems within the Mauka Area.

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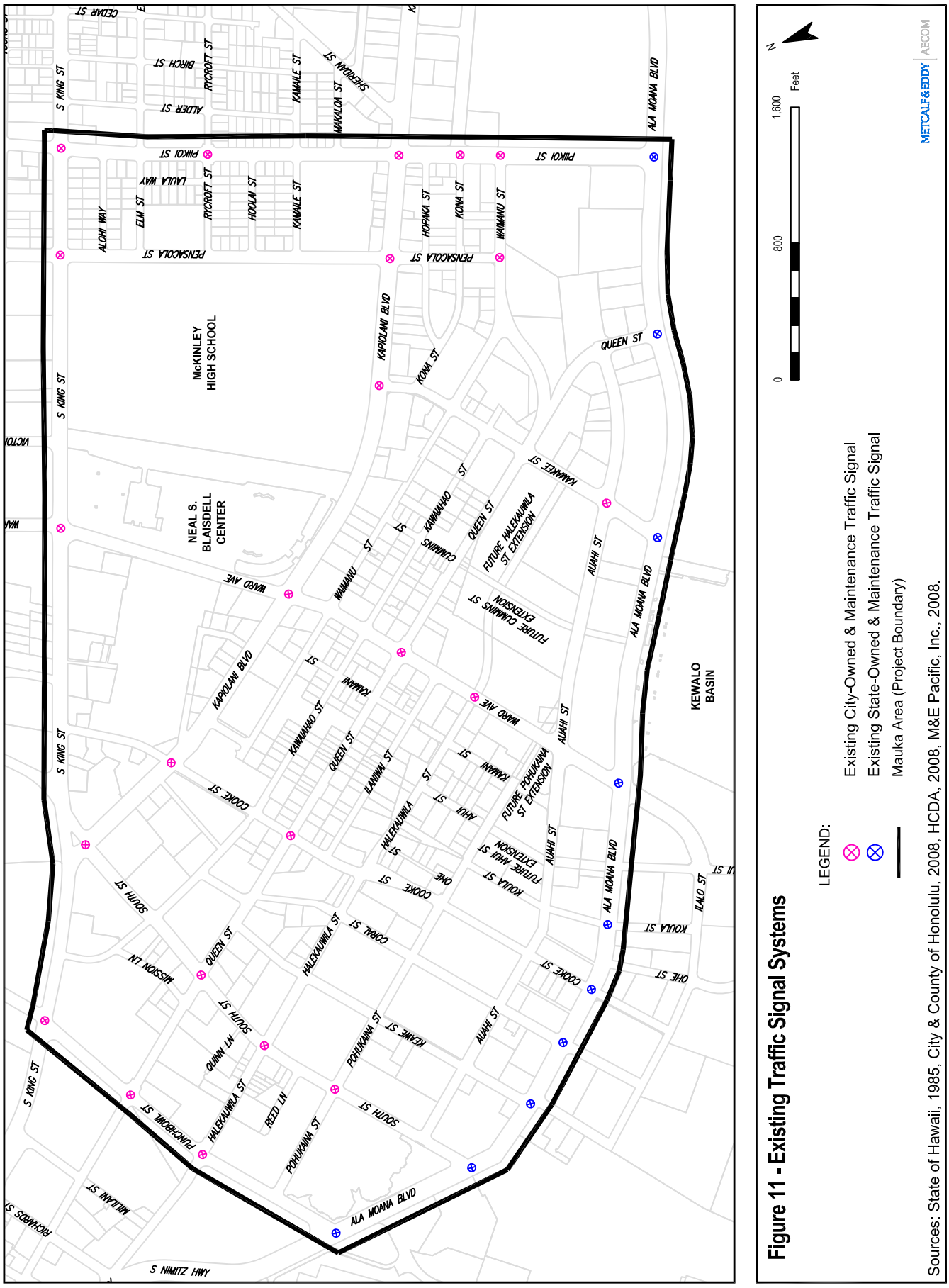

Figure 11 - Existing Traffic Signal Systems

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.1.10 Roadway Street Light Systems

With the exception of Ala Moana Boulevard, all street lights, along roadways with curb, gutter and sidewalk improvements, bordering on and lying within the Mauka Area are under the jurisdiction of the City. The highway lights along Ala Moana Boulevard are under the jurisdiction of the State DOT. Along City roadways with overhead utility lines, the street lights are mounted jointly onto the utility poles. The standard City street light installation for the joint pole-mounted street lights consist of galvanized steel bracket arm with a high-pressure sodium luminaire and photoelectric control. Along the City roadways where all of the utility lines have been placed underground, the street light wiring system has, likewise, been placed underground. The standard installation for an underground connected street light system consists of a concrete foundation, galvanized steel pole and bracket arm and a photoelectric-controlled, high-pressure sodium luminaire. Refer to Figure 12—Existing *Roadway Street Light Systems*, for the existing roadway street light systems within the Mauka Area.

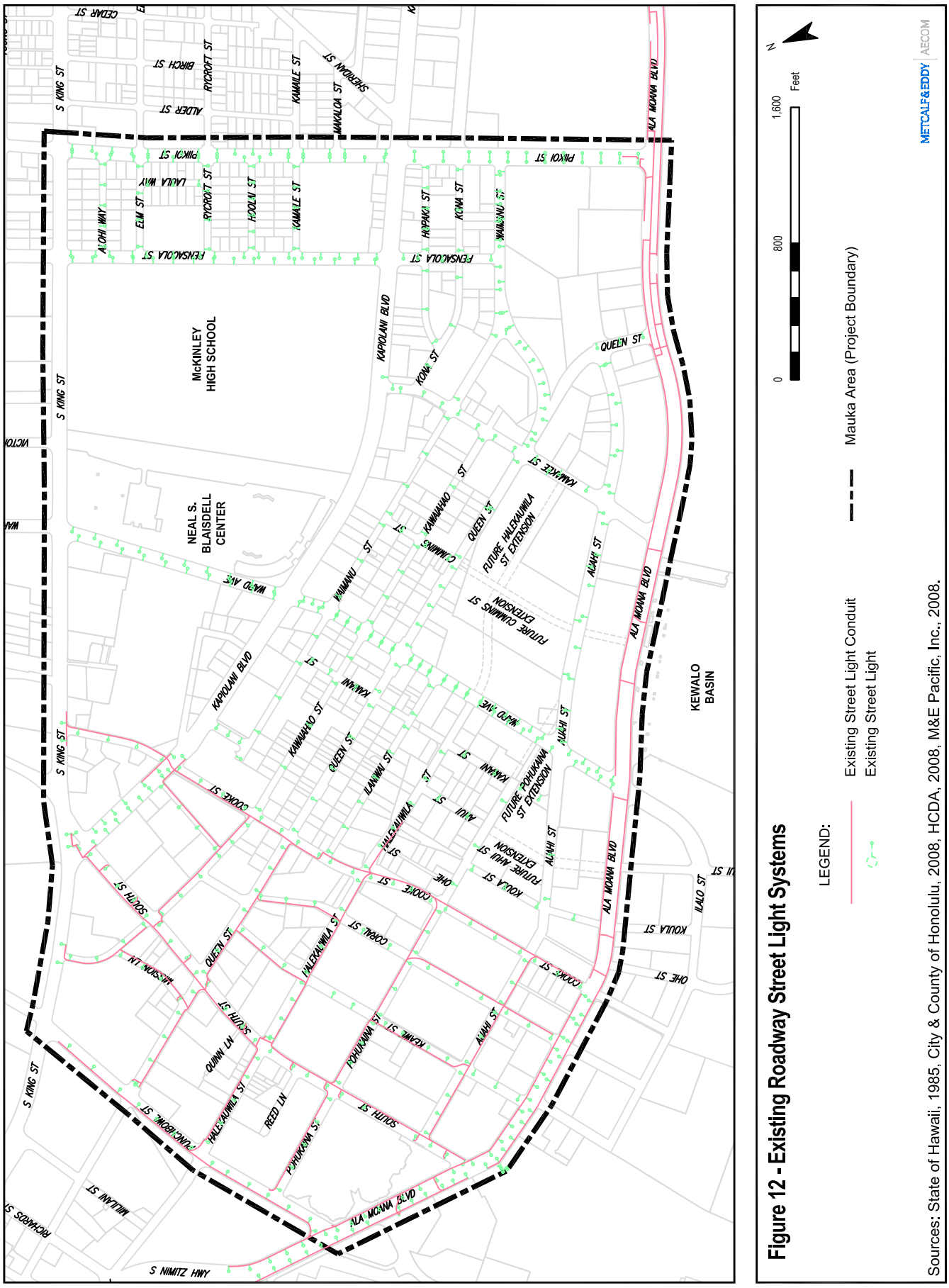

Figure 12 - Existing Roadway Street Light Systems

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

3.2 Roadways

The roadways within the Mauka Area are maintained by the City with the exception of Ala Moana Boulevard, which is a State highway maintained by the State DOT. The roads within the Mauka Area are comprised of the following types:

- Two-way, two-lane minor streets:
  - Kona Street;
  - Hopaka Street;
  - Kamaile Street;
  - Hoolai Street;
  - Rycroft Street;
  - Elm Street;
  - Alohi Way;
  - Laula Way;
  - Kamani Street;
  - Pohukaina Street;
  - Ilaniwai Street;
  - Waimanu Street between Dreier Street and Kamakee Street;
  - Halekauwila Street;
  - Keawe Street;
  - Emily Street;
  - Curtis Street;
  - Coral Street;
  - Clayton Street;
  - Dreier Street; and,
  - Kawaiahao Street.
- Two-way, two-lane secondary streets:
  - Queen Street between Cooke Street and Kamakee Street; and,
  - Auahi Street between South Street and Cooke Street.
- Two-way, four-lane secondary streets:
  - Queen Street between South Street and Cooke Street;
  - South Street between Ala Moana Boulevard and Pohukaina Street; and,
  - Kamakee Street between Kapiolani Street and Queen Street.
- One-way, multi-lane secondary street:
  - Punchbowl Street.

- Two-way, multi-lane major streets:
  - Ward Avenue;
  - Auahi Street between Ward Avenue and Kamakee Street;
  - Kamakee Street between Ahui Street and Queen Street;
  - Kapiolani Street; and,
  - Ala Moana Boulevard.
- One-way, multi-lane major streets:
  - South Street between Pohukaina Street and South King Street;
  - Piikoi Street;
  - Waimanu Street between Pensacola Street and Piikoi Street;
  - Pensacola Street; and,
  - South King Street.

Although most of the main roadways within the Mauka Area have been improved by the HCDA under their ID Program, several existing roadways (mostly smaller, minor streets) are aged, flat and subject to localized ponding occurrences that present concerns to motorists, pedestrians and bicyclists. Pedestrian walkways and bicyclist access are limited along these streets, and motorists do not have pavement striping, marking or reflective markers to guide their driving on some of these streets. Signage is also limited and vehicular parking along some of these streets hinders traffic circulation and causes concern for travel safety. Roadway right-of-way (ROW) widths of some of these streets are narrower than City standards and they lack curbs and sidewalks.

3.3 Historic Sites

The region encompassing the Kakaako Community Development District, in general, is known to have previously supported a Hawaiian community, with agricultural terraces, residences for alii (royalty), and docks for foreign ships. The 1987 report, *Kakaako: Prediction of Sub-surface Archaeological Resources, Detailing Archival Research and Archaeological Assessment of the Kakaako Community Development District*, listed three sites within the Mauka Area which are historically significant and are located in the vicinity of the constructed Queen Street extension project:

- Site 50-80-14-6658 had a cluster of 28 burials within the Queen Street Extension and was likely used as a discrete cemetery by native Hawaiians in the 19th century;
- Site 50-80-14-6659 had two burials found at least 328 feet east of the eastern boundary of the previously mentioned Site 6658; and,
- Site 50-80-14-6660 is a historic dump area on the edge of the cemetery area and the edge of a pond where bottles from the 1920s to 1930s were found.

3.4 Developed Sites

The entire Mauka Area is developed or under redevelopment. Approximately 258 acres are developed parcels, 83 acres are public roadways, and 109 acres are public parks, schools or cultural facilities.

3.5 Projects Under Construction

Currently, three projects are under construction:

1. Ward Village Shops, a multi-family (165 residential units) commercial development;
2. Vanguard Lofts, a multi-family (35 residential units) commercial development; and,
3. Moana Vista, a multi-family (492 residential units and 124 reserved housing units) commercial development.

The project—Keola Lai, a multi-family (352 residential units and 63 reserved housing units) commercial development—has recently completed construction and is open to the public.

4.0 BASIS OF MASTER PLAN

4.1 General

The planning basis for this Infrastructure Plan is drawn from various completed documents, guidelines, plans and reference material. These documents include the following:

1. Available as-built improvement district plans.
2. Draft Mauka Area Plan, May 2007.
3. Kakaako Mauka Area Plan Supplemental Environmental Impact Statement, Transportation Analysis, Draft 2, DMJM Harris|AECOM, March 21, 2008.
4. Kakaako Community Development Plan Project, Sewerage and Drainage Systems, 1979.
5. Kakaako Community Development Plan Project, Water and Gas Systems, 1979.

4.2 Proposed Land Use Plan

The proposed land use plan provides for approximately 4.5 acres of park lands and approximately 278 acres of potential commercial office and retail shopping lands within the 450-acre Mauka Area. Table 4-1 presents a land use summary of the various zones within the Mauka Area.

Table 4-1 Mauka Area Land Use Zones

Land Use Description	Acres
Mixed Use Zone	278.2
Residential	13.8
Park at Grade	4.5
Public	70.5

4.3 Land Use Zones

4.3.1 Mixed-Use Zone

The Mixed-Use Zone (MUZ) allows for the development of commercial, residential and industrial use projects. It is anticipated that commercial, residential and industrial uses may coexist within the same developments, but not all projects need to be mixed use. This zone encompasses approximately 278.2 acres with a developable potential floor area estimated between 30.3 and 42.4 million square feet for the Mauka Area.

4.3.2 Residential

The Residential Zone (R) within the Mauka Area consists of an area in the Sheridan Neighborhood, which is a predominantly residential neighborhood, comprised of small, fee simple lots.

4.3.3 Park Zone

Park Zones (P) are areas intended for public parks.

4.3.4 Public Use

Public-Use Zone (PU) lands are publicly owned. The purpose of this zone is to allow public facilities to be developed to support community redevelopment. Public uses include projects that are developed by public entities for public purpose.

5.0 STORM DRAIN SYSTEMS

5.1 Criteria

The storm drainage standards of the City Department of Environmental Services (ENV) provides necessary guidelines, basis and criteria for the hydrologic estimation and hydraulic analysis pertinent to the storm drain master plan of the area. Parcel development and redevelopment, and Improvement Districts are assumed to be 100 acres or less each. Relevant criteria are as follows:

- Recurrence Interval (Tm) is 10 years (drainage area of 100 acres or less without sump or tailwater effect); 50 years (drainage area of 100 acres or less with sump or tailwater effect).
- Runoff quantities are calculated using the Rational Method.
- The entire Mauka Area is assumed to have runoff coefficients characteristic of complete build-out area.
- Time of concentrations are estimated to be equivalent to overland flows.
- Rainfall intensity and correction factors are based on City storm drainage design standards.

The criteria and assumptions used to make these projections are described.

5.1.1 Hydrology Criteria

The hydrology analysis is based on a 50-year storm runoff with a 1-hour rainfall intensity. The Rational Method was used to determine peak discharges for the existing and proposed conditions of drainage areas within the Mauka Area as they contribute to drain lines and drainage structures.

5.1.2 Hydrology Analysis (Rational Method)

The runoff flows were determined by the rational method expressed as:

- $Q = C \times I \times A$,

where:

- Q = Flow rate, in cubic feet per second.
- C = Runoff Coefficient.
- I = Rainfall intensity, in inches per hour for a duration equal to the time of concentration.
- A = Drainage Area, in acres.

5.1.3 Drainage Area

The limits of the drainage areas were drawn based on topographic data available for the area. These drainage areas were determined through the use of a computer digitizer. The rainfall-catchment drainage areas are based on drain inlet/catch basin spacing and grades.

5.1.4 Time of Concentration

The overland flow times for the paved areas were determined from Plate 3 of the City storm drain standards.

5.1.5 Rainfall Intensity

The runoff times of concentration and correction factors were determined in accordance with plates 3 and 4 of the City storm drain standards, respectively. A rainfall intensity of 2.5 inches/hour was based on a 50-year, 1-hour rainfall.

5.1.6 Runoff Coefficient

The runoff coefficients for the given area were derived using previous reports, references and City storm drain standards.

5.2 Runoff Quantity

Collectively the existing major drainage trunk lines are estimated to discharge approximately 2,400 cfs of storm runoff to the ocean. Under the City storm drainage design standards, this will adequately service the 450-acre Mauka Area.

5.3 Proposed System

For this plan, the existing downstream drainage improvements are taken as a given constraint, which were constructed based on a 50-year design storm (reference the 1982 and 1985 SEIS). Segments of existing drain lines were analyzed hydraulically to confirm that they could accommodate the 50-year design drainage flows. Upsizing of lines are recommended where year 2030 capacities are not met. With discretionary considerations to what is practical and feasible, current City regulations relating to storm drainage standards state that when downstream drainage systems cannot accommodate peak runoff rates from design storms, runoff rates discharged downstream from new developments will be limited to predevelopment values unless improvements to the downstream system are made. Runoff volume from the design storm shall be limited to predevelopment flow amounts unless it can be shown that the runoff can be safely conveyed through existing or planned conveyances, the increased volume would not have adverse impacts downstream, and provided further that the final receiving waters are open coastal waters. Future planned developments must comply with these regulations. Any additional storm water discharge generated by proposed developments above the existing condition shall be retained on-site for individual, site-specific projects.

The drainage improvements proposed in this plan will be confined to mitigating the existing localized ponding conditions, on existing roadways which do not have curbing. Refer to the photographs in the appendices of this report for pictures of localized ponding occurrences.

Improvements are recommended to improve the local drainage along the uncurbed segments of roads in old central Mauka Area where significant pondings develop within the travelways during significant storms. The general terrain of these areas is flat. These roads should be resurfaced to create crowns at paved road centerlines to sheet flow surface runoff toward shoulder areas and minimize water spreads in the vehicle travelways. Resurfacing could also provide some positive longitudinal gradient along existing

flat travelway edges to direct surface water in a pattern toward existing drain inlets and catch basins. Pavement resurfacing will also tend to reduce ponding that could weaken the pavement and cause pot holes. Recommended locations for potential pavement resurfacing to relieve identified substantial ponding concerns include the following areas:

- Waimanu Street between Ward Avenue and Kamakee Street.
- Cummins Street between Waimanu Street and Queen Street.
- Hopaka Street between Kona Street and Pensacola Street.
- Kona Street between Kamakee Street and Piikoi Street.

To discourage redirected runoff from leaving the roadways and entering lots, asphalt concrete berms/curbs, swales or concrete curbs and/or gutters are recommended to be constructed along the edges of the travelways. The installation of berms or swales are recommended to maintain vehicular access to the lots. Additionally, the installation of drain inlets and/or catch basins with drainline connections to existing drainage structures, such as, manholes, inlet boxes or catch basin manholes, are recommended to reduce the frequency of surface ponding and convey surface water underground for disposal. The contribution of the storm water from these drain inlets and catch basins would not represent overall increases in flow volume to the existing drainage system, but rather offer more inlets into the system for the same overall flow quantity. The following drain inlets and/or catch basins are recommended to be installed at localized ponding areas to help relieve ponding development from the more frequent, day-to-day rainfall events:

- Waimanu Street between Drier Street and Kamakee Street.
- Kawaiahao Street between Cooke Street and Kamakee Street.
- Queen Street between Cooke Street and Kamakee Street.
- Ilaniwai Street between Cooke Street and Ward Avenue.
- Halekauwila Street between Cooke Street and Ward Avenue.
- Koula Street between Halekauwila Street and Pohukaina Street.
- Ahui Street between Halekauwila Street and Pohukaina Street.
- Kamani Street between Halekauwila Street and Pohukaina Street.
- Kona Street between Kamakee Street and Pensacola Street.
- Hopaka Street between Kona Street and Pensacola Street.
- Cooke Street between Kapiolani Boulevard and South King Street
- Mission Lane between Queen Street and Kawaiahao Street

The existing drainage system is inadequate to manage, accommodate and dispose of design stormwater quantities in both the existing and future conditions. Nonetheless, resurfacing and the installation of new berms, swales, curbs, gutters, drain inlets and/or catch basins would mitigate the more frequently recurrent, smaller intensity, shorter duration rainfall drainage volumes by reducing the occurrence of ponding, which consequently would improve the safety of all road users—pedestrians, motorists and bicyclists. Refer to Figure 13—Proposed *Storm Drain Systems*, for the proposed drainage improvements within the Mauka Area.

The general impermeable, hardscape character of the ground within the Mauka Area and its surrounding areas are not anticipated to alter or worsen considerably from the existing condition to future conditions (year 2030) as the area is thoroughly developed, and the existing percentage of impermeable surface to permeable surface will not change substantially as a result of increases in projected land use and population diversification and densification. Most changes over time are anticipated to be vertical development and buildup. Thus, drainage flow quantities (overall total runoff volume for the Mauka Area) are not anticipated to increase substantially from increases in projected land use and population diversification and densification, and differences in future surface runoff amounts from existing volumes are anticipated to be negligible. As such, the surface water ponding concerns and existing inadequacy of the drainage system will not be exacerbated.

Future surface runoff quantities can be reduced and consequently ponding concerns potentially improved through the implementation of the following prospective measures:

- Capture and reuse of rainwater (instead of allowing it to leave the sites) by buildings and developments for cooling systems, irrigation, nonpotable water fixtures, etc. (an element in sustainable design and Leadership in Energy and Environmental Design [LEED]). For example, runoff from roof and parking lot drains could be collected via downspouts and piping to reuse systems (filter/water treatment, storage tank, pump station, etc.) and used as nonpotable source water for the building and irrigation rather than drawing from the potable water system.
- Reduction of impermeable surface, such as, installing grass, groundcover or vegetative landscaping rather than concrete, pavement or gravel. Runoff from roof and parking lot drains could be disposed of through downspout, pipe, or direct percolation or injection into the ground via graveled sumps or small drywells instead of allowing it to leave the sites. Similar to the aforementioned use, rather than being disposed of into the ground, collected water could be used directly for irrigation of the grounds and landscaping.
- Optimization of impermeable surface use, such as, constructing smaller-footprint multi-level parking structures rather than larger-footprint, single-level, open-lot type paved parking areas.
- Encouraging evapotranspiration use of water through increased vegetation along roads, open decks and rooftops, and through the establishment of vegetative landscaping. This method would also improve the quality of the runoff water by filtering out and using suspended solids and impurities in the water.

Federal, State and City regulations require a minimum level of stormwater quality treatment for the stormwater collected and conveyed by a private drainage system (from new development or redevelopment disturbing more than one acre of land) before discharging into the City's drainage system within the public roadways. For the Mauka Area, the drainage system ultimately discharges to receiving coastal waters. The purpose of the water quality criteria is to reduce the discharge of pollutants carried by storm water to receiving waters to the "maximum extent practicable." The methods of reducing surface runoff quantities above would improve the quality of drainage water they accommodate. Each individual applicant for a City Building Permit shall need to address storm water quality requirements for their specific project in accordance with Section II of the City's "Rules Relating to Storm Drainage Standards."

Existing catch basins within the public roadways have no designed capability to remove sediments and pollutants carried by storm water runoff. Commercially available filters are recommended for insertion directly into existing catch basins or extensive retrofit modifications are recommended to the structures that are capable of removing oil and grease, trash, debris and sediment. These filter inserts would need to be regularly inspected and replaced to maintain their effectiveness.

Each individual applicant for a City Building Permit shall be required to submit for approval a "Site Development Master Application for Drainage Connection License," for their project-specific drain connection. Other City permits may be applicable—trenching permit for work within the City's rights-of-way for their specific project, as applicable; and a dewatering permit to discharge dewatering effluent into the City's municipal separate storm sewer system (MS4) for their specific project, as applicable.

All wastewater plans submitted for projects in the Mauka Area shall meet the State Department of Health (DOH) Rules, Hawaii Administrative Rules (HAR) Chapter 11-62, "Wastewater Systems." Detailed wastewater plans shall be submitted on a project-by-project basis to the DOH for review and conformance with applicable rules. Standard comments for the different DOH regulatory branches—Wastewater Branch (WWB), Clean Water Branch (CWB), etc.—are available on the DOH website (http://hawaii.gov/health/environmental/env-planning/landuse/landuse.html). Any project in the Mauka Area and its potential impacts to State waters must meet the Antidegradation policy outlined in HAR, Section 11-54-1.1; designated uses outlined in HAR, Section 11-54-3; and, water quality criteria outlined in HAR, Sections 11-54-4 through 11-54-8. National Pollutant Discharge Elimination System (NPDES) permits shall be obtained on a case-by-case basis for applicable projects that involve discharge(s), including storm water runoff, in or to State waters. Notice of Intent (NOI) forms for different types of discharge shall be submitted to the DOH on a case-by-case basis for projects that would discharge in or to Class A or Class 2 State waters. Examples of applicable discharge include:

- Storm water associated with construction activities that result in the disturbance of equal to or greater than one acre of total land area;
- Treated effluent from leaking underground storage tank remedial activities;
- Once-through cooling water less than one million gallons per day;
- Construction activity dewatering;
- Hydrotesting water; and,
- Circulation water from decorative ponds or tanks.

A separate NOI shall be submitted for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when a project is applying for coverage for discharges of storm water associated with construction activity. For any wastewater discharge type not mentioned herewith, an NPDES individual permit shall be obtained and its application submitted for processing no less than 180 days prior to the start of the discharge activity. All individual project applicants shall submit a copy of their NOI or NPDES individual permit application to the State Department of Land and Natural Resources (DLNR), State Historic Preservation Division (SHPD) for review, and subsequently demonstrate to the satisfaction of the CWB that the DLNR, SHPD issues a no-adverse effect determination for the subject project undertaking.

Individual projects in the Mauka Area shall be required to coordinate with the DOH and submit applicable NOI or NPDES individual permit application(s) for their proposed undertaking. Part of this process is to address potential project impacts to any affected impaired water bodies (Clean Water Act Section 303[d]). Identified pollutants of concern are nutrients, suspended solids, pathogens and metals.

Aforementioned Federal, State and City programs on storm water quality treatment required for individual projects within the Mauka Area will collectively help to protect the long-term water quality of receiving waters. All discharges related to project construction or operation activities of individual projects, whether NPDES permit(s) and/or Section 401 Water Quality Certification are required, must comply with applicable water quality standards.

5.4 Condition Assessment

The general structural conditions of the existing major storm drainage structures are satisfactory and appear to be able to last through the year 2030. During a field investigation (see Appendix D) conducted in January 2008 a significant amount of debris and litter accumulation was observed in a storm drain along Keawe Street between Auahi Street and Ala Moana Boulevard. On-going periodic scheduled maintenance by the City to remove debris in major drainage structures should be stressed to mitigate the chance of possible backup of water which could eventually cause runoff to backup out of catch basins and manholes and cause concerns by pedestrians, vehicles and buildings.

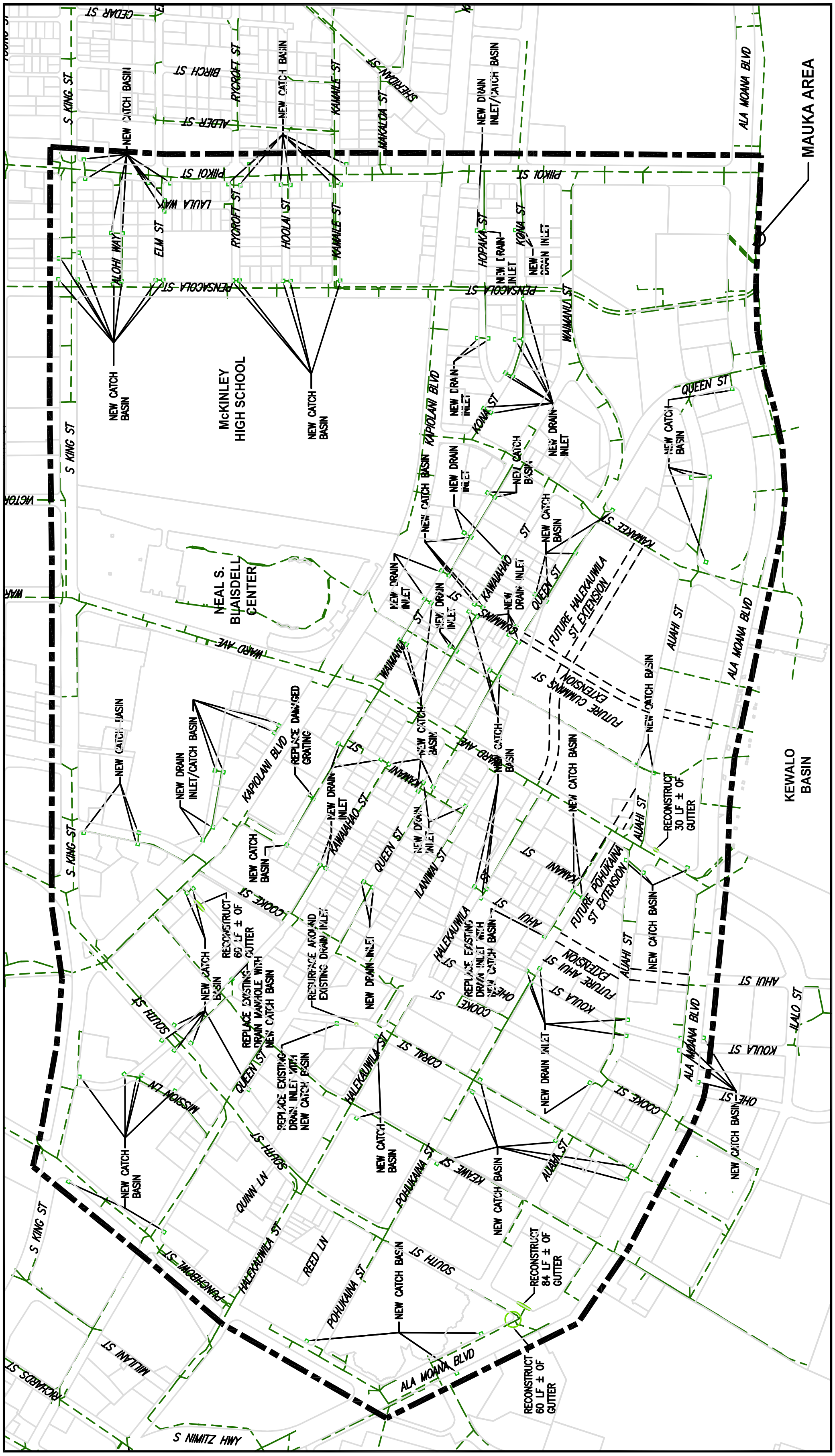

Figure 13 - Proposed Storm Drain Systems

- Existing Drain Line to Remain
- Existing Drain Manhole or Catch Basin
- Mauka Area (Project Boundary)
- New Drain Line
- New Drain Inlet/Catch Basin

0 800 1,600 Feet

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METCALF&EDDY | AECOM

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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6.0 SANITARY SEWER SYSTEMS

6.1 Criteria

The hydraulic capacities of the existing sewer system for existing and projected populations within the Mauka Area based on the proposed development standards stated in the Draft Mauka Area Plan is evaluated with the current City INFIX 3.0 (August 2002) computer program (adopted and used by the City Department of Design and Construction [DDC], Wastewater Division [WWD] to determine design sewer flow estimates), which contains a model of the existing sewer system including existing sewage flows and future sewage flows (projected to the year 2020). Based on the City's *Sewer Rehabilitation and Infiltration & Inflow Minimization Study* (December 1999), adjusted design parameters were determined for the average per capita wastewater flow, flow factor, dry-weather infiltration rate, and wet-weather infiltration rates. These adjusted design parameters were incorporated in the INFIX program. Also, the City's geographical information system (GIS) data files are used for reference.

The HCDA will revise the wastewater master plan as their Improvement Districts are determined, identified, and proposed for construction.

6.1.1 Sewage Concentration Rate

The City ENV standards prescribe an average daily per capita flow of 80 gallons per day.

Table 6-1 Mauka Area Land Use Zones

Land Use Description	Average Daily Flow per Capita (gallons per day)
Mixed Use Zone – Industrial	80
Commercial	80
Public Use – Retail	80
Park	80
Waterfront Commercial	80

6.1.2 Maximum Flow Factor

Babbitt's Formula was used to determine the Maximum Flow Factor (MFF), with the maximum MMF not exceeding 5.0.

$$MFF = \frac{5}{p(0.2)}$$

p = population, in thousands

The MMF is multiplied to the projected average flow to obtain the projected maximum flow.

Based on the City's *Sewer Rehabilitation and Infiltration & Inflow Minimization Study* (December 1999), the adjusted design parameter for the max flow factor was determined and incorporated in the INFIX program.

6.1.3 Dry Weather Infiltration/Inflow

In reference to the City's *Sewer Rehabilitation and Infiltration & Inflow Minimization Study* (December 1999), the dry-weather Infiltration/Inflow rate used is 22.4 MGD.

6.1.4 Wet Weather Infiltration/Inflow

In reference to the City's *Sewer Rehabilitation and Infiltration & Inflow Minimization Study* (December 1999), the wet-weather Infiltration/Inflow rate used is 107 MGD.

6.1.5 Projected Peak Flow

The projected peak flow for each parcel is the sum of the projected maximum flow, the dry-weather Infiltration/Inflow and wet-weather Infiltration/Inflow.

6.2 Demand

The table below summarizes the results for the Ala Moana WWPS.

Table 6-2 Projected Population and Sewage Flow – Ala Moana Sewage Pump Station

Description	Year 2000	Year 2030 INFIX Model	Year 2030 TAZ Estimate (Design Scenario)
Population (Thousands)	535	814	755 (65+690)
Average Per Capita Flow (GPD)	54	44	44
Average Sewage Flow (MGD)	28.7	35.8	33.2
Dry Weather Infiltration (MGD)	22.4	25.0	23.2
Design Average Flow (MGD)	51.1	60.8	56.4
Design Max Hourly Flow (MGD)	65	79	73
Wet Weather Infiltration (MGD)	107	110	110
Design Peak Flow (MGD)	172	189	183

Note: INFIX 3.0 population projection for Ala Moana SPS is 739,832 for year 2020. A 10% population increase was applied to project the population to year 2030 based on Table 1-1, Resident and De facto Population by Status, 1980–2030 (as of July 1) of the DBEDT, "Population and Economic Projections for the State of Hawaii to 2030," August 2004.

The tributary area for the Ala Moana WWPS is 12,024 acres of which the Mauka Area encompasses approximately 450 acres (approximately 4 percent of tributary area). The INFIX 3.0 program projects an overall Ala Moana WWPS tributary population of about 814,000 in the year 2030 for the Mauka Area and its surrounding areas. Based on City DPP traffic analysis zone (TAZ) geography, the year 2000 population within the Mauka Area was approximately 32,000 (6,000 residents and 26,000 nonresident visitors—workers or others). The estimated year 2030 population within the Mauka Area based on TAZ geography is 65,000 (30,000 residents and 35,000 nonresident visitors—workers or others).

The DBEDT's "Population and Economic Projections for the State of Hawaii to 2030," August 2004, estimates a 37-percent increase in the State's population from 2000 to 2030. The year 2000 population of 535,000 consisted of about 32,000 within the Mauka Area, and 503,000 within the outside, remaining areas. Assuming the largest growth rate will occur in the Mauka Area, a normal growth rate is expected for the outside, remaining area that amounts to approximately 690,000 (37-percent increase) by the year 2030.

The year 2030 tributary population based on TAZ geography is about 8 percent smaller than the 814,000 from the INFIX 3.0 model and the corresponding Design Peak Flow is less by only 3 percent. This small difference is not significant in affecting the sizing of the sewer pipes for planning purposes. A reason for the small effect on the Design Peak Flow is that population does not affect the wet-weather infiltration, which is approximately 60 percent of the Design Peak Flow. Therefore, the design wastewater flows as determined by the INFIX 3.0 model is in line with population projections based on TAZ geography for the year 2030, and is established as the design basis to evaluate the sewer system.

The table below summarizes the adequacy for the Mauka Area wastewater system.

Table 6-3 Adequacy of Major Sewers within the Kakaako Mauka Area

Sewer	Size (Inches)	Year Installed/ Age of Sewer or Rehab. (Years)	Design Peak Flow (MGD)	Capacity (MGD)	Adequacy
ALA MOANA BOULEVARD					
At: Punchbowl Street	34	1900 / 7	16.29	8.77	N
At: South Street	36	1900 / 7	3.00	9.92	Y
SOUTH STREET					
At: Kapiolani Boulevard At:	18	1897 / 111	1.63	3.24	Y
Kawaiahao Street	24	1985 / 23	2.11	6.54	Y
At: Queen Street	30	1985 / 23	2.56	7.49	Y
At: Pohukaina Street	30	1986 / 22	2.99	8.35	Y
SOUTH KING STREET					
At: Piikoi Street	16	1915 / 93	2.83	1.81	N
At: Cooke Street	18	1897 / 111	5.58	2.48	N
COOKE STREET RELIEF					
At: South King Street	18	1966 / 42	5.58	4.41	N
At: Kapiolani Boulevard	21	1966 / 42	5.62	10.74	Y
At: Kawaiahao Street	24	1966 / 42	6.09	5.09	N
At: Queen Street	24	1966 / 42	6.47	5.09	N
At: Pohukaina Street	24	1966 / 42	6.77	5.08	N

Sewer	Size (Inches)	Year Installed/ Age of Sewer or Rehab. (Years)	Design Peak Flow (MGD)	Capacity (MGD)	Adequacy
WARD AVENUE					
At: South King Street	8	1919 / 89	0.05	0.43	Y
At: Waimanu Street	10	1897 / 111	0.26	0.48	Y
At: Queen Street	12	1897 / 111	0.39	0.85	Y
At: Halekauwila Street	12	1919 / 89	0.62	0.85	Y
At: Auahi Street	14	1897 / 111	0.85	2.41	Y
WARD AVENUE RELIEF SEWER					
At: South King Street	60	1975 / 33	87.22	138.69	Y
At: Kapiolani Boulevard	60	1975 / 33	87.23	67.53	N
At: Auahi Street	60	1990 / 18	87.24	107.02	Y
EAST END RELIEF SEWER					
At: Piikoi Street	48	1959 / 49	13.35	24.95	Y
At: Pensacola Street	48	1959 / 49	13.93	24.72	Y
At: Cummins Street	48	1969 / 39	16.38	32.39	Y
At: Queen Street	48	1969 / 39	16.54	29.70	Y
At: Auahi Street	48	1969 / 39	16.55	29.45	Y
At: Cooke Street	72	1973 / 35	16.57	93.35	Y
At: Keawe Street	72	1973 / 35	16.59	85.74	Y
KAPIOLANI Boulevard-KAMAKEE STREET-ALA MOANA BLVD					
At: Piikoi Street	36	1925 / 83	13.33	9.60	N
At: Kamakee Street	36	1925 / 83	12.59	9.72	N
At: Waimanu Street	36	1995 / 13	13.23	9.09	N
At: Queen Street	36	1925 / 83	14.14	9.47	N
At: Auahi Street	48	1996 / 12	14.66	75.42	Y
At: Ala Moana Boulevard	48	1996 / 12	14.66	17.61	Y
At: Ahui Street	69	1963 / 45	41.60	59.53	Y
At: Keawe Street	69	1963 / 45	41.61	37.47	N
AUAHI STREET TRUNK SEWER	78	1991 / 17	87.88	78.32	N
At: Ward Avenue	78	1989 / 19	94.02	78.04	N
At: Cooke Street	75	1990 / 18	94.13	113.88	Y
At: Keawe Street	78	1991 / 17	96.58	75.03	N
At: Ala Moana Boulevard					

6.3 Proposed System

The existing gravity sewer system is undersized to accommodate land use and population projections out to the year 2030. Wastewater will tend to backup into residential units and businesses if no improvements and pipe upsizing are made to the sewer. A total of approximately 18,000 feet of sewer trunk lines within the Mauka Area are recommended to be replaced with larger trunk lines. Refer to Figure 14—Proposed *Sanitary Sewer Systems*, for the recommended sanitary sewer improvements within the Mauka Area. Construction limits/extents and locations would depend on the sequence or phasing of actual development and associated infrastructure improvements. The proposed improvements will minimize the possibility of wastewater backup.

The following improvements are recommended to alleviate the constraining sections of the existing sewer system within the Mauka Area:

- The existing sewer along Ala Moana Boulevard between Punchbowl Street and Ward Avenue should be enlarged. The existing sewer segment from Punchbowl Street to Keawe Street ranges in size from 34 inches to 36 inches and should be replaced with 150-linear feet (LF) of 36-inch pipe and 1,200-LF of 48-inch pipe. The existing 36-inch sewer segment from Ward Avenue to Keawe Street should be replaced with 1,900-LF of 48-inch pipe.
- The existing sewer along South King Street between Cooke Street and Piikoi Street should be enlarged. The existing sewer segment ranges in size from 16-inch to 18-inch and should be replaced with 2,300-LF of 21-inch pipe and 1,100-LF of 24-inch pipe.
- The existing sewer along Cooke Street between South King Street and Auahi Street should be enlarged. The existing sewer segment ranges in size from 18-inch to 24-inch and should be replaced with 1,200-LF of 24-inch pipe, 250-LF of 27-inch pipe, and 1,600-LF of 30-inch pipe.
- Approximately 83% of the existing 60-inch sewer along Ward Avenue should be enlarged. Approximately 2,660-LF of 60-inch pipe from Auahi Street to approximately 540 feet makai of South King Street should be replaced with 66-inch pipe.
- The existing 36-inch sewer along Kapiolani Boulevard between Piikoi Street to Kamakee Street and along Kamakee Street to Auahi Street should be enlarged. Approximately 2,770-LF of 36-inch pipe should be replaced with 330-LF of 48-inch pipe and 2,440-LF of 42-inch pipe.
- The existing 78-inch sewer along Auahi Street between Ward Avenue to Keawe Street and down Keawe Street to Ala Moana Boulevard should be enlarged. The approximately 2,400-LF of 78-inch pipe should be replaced with approximately 1,200-LF of 84-inch pipe and 1,200-LF of 90-inch pipe.

City wastewater projections and planned improvements for the Sand Island WWTP take in to account a region extending from Red Hill to Niu Valley and incorporating most of the nonresidential floor area on Oahu. This is generally the region within which Kakaako will capture a significant share of future growth. Hence, concentration of development in Kakaako will not significantly change the load on Sand Island WWTP. The enormous peak capacity of planned City improvements to Ala Moana WWPS and the force main between the Ala Moana WWPS and Sand Island WWTP will ensure sufficient capacity for the future needs of their total service area, which includes Kakaako.

Several segments of the existing gravity sewer lines need to be replaced with larger sewerlines. Approximately two miles of pipe ranging in diameter from 42 to 90 inches and approximately one mile of pipe ranging in diameter from 21 to 36 inches need to be installed. No adverse, negative impacts to the wastewater system are anticipated from the proposed improvements to the branch sewer lines since downstream facilities are adequate to accommodate the proposed increases in both pipe sizes and flows.

The City ENV regulates industrial wastewater discharges by permits and surcharges pursuant to Chapter 11 of the Revised Ordinances of Honolulu (ROH). All future industrial and commercial activities within Kakaako will be subject to the provisions of ROH Chapter 11. Depending on the type of wastewater constituents, businesses may be required to provide pretreatment devices (such as, grease

interceptors) to prevent the discharge of certain types of effluent into the municipal sewer system. All pretreatment devices must be approved by the City ENV in order to meet industrial effluent limitations. Therefore, existing City regulations will ensure all industrial discharges are within acceptable limits.

Lessee(s) of the historic (defunct) Ala Moana Pump Station will be made aware that the adjacent Ala Moana WWPS may emit fugitive odors and noise that could adversely impact operations. The lessee will also be encouraged to take appropriate measures, as needed, such as enclosing the building, providing air conditioning, and sealing manhole covers to mitigate potential adverse odor and noise impacts.

All wastewater plans submitted for projects in the Mauka Area shall meet the State DOH Rules, HAR Chapter 11-62, "Wastewater Systems." Detailed wastewater plans shall be submitted on a project-by-project basis to the DOH for review and conformance with applicable rules. Standard comments for the different DOH regulatory branches—Wastewater Branch (WWB), Clean Water Branch (CWB), etc.—are available on the DOH website (http://hawaii.gov/health/environmental/env-planning/landuse/landuse.html).

Each individual applicant for a City Building Permit shall be required to submit for approval a "Site Development Master Application for Sewer Connection," for their project-specific sewer connection. Other City permits may be applicable—trenching permit for work within the City's rights-of-way for their specific project; and a dewatering permit to discharge dewatering effluent into the City's municipal separate storm sewer system (MS4) for their specific project. The City's "Design Standards of the Department of Wastewater Management, Volume 1," dated July 1993 currently provides the basis and criteria for individual applicants of City Building permits on a project-by-project basis. Additionally, this document, as amended, will provide the wastewater design basis for the HCDA as their Improvement Districts are determined.

6.4 Condition Assessment

A City and County of Honolulu project to complete CCTV inspection of approximately 75% of the existing sewerlines in the Mauka Area is planned for 2009. The resulting videos of the sewerline interiors will provide a valuable planning tool for the City to assess the condition of the sewerlines, and will assist the HCDA in planning for the next improvement district. Refer to Appendix E for the scope of work of the referenced City CCTV.

CCTV inspection video tapes of the existing sewerlines in the Sheridan Neighborhood area (bounded by Pensacola Street, South King Street, Piikoi Street, and Kapiolani Boulevard) were taken during the late 1990's for the City. These video tapes were viewed to get a sampling of sewerline conditions which typically exist in the Mauka Area. Additionally, existing sewerline segments along Queen Street, South Street and Ward Avenue were closed-circuit televised in January 2009 to ascertain the conditions of these representative lines for the remainder of the Kakaako Mauka Area.

The viewed sewerlines ranged from 8-inch (cast-iron pipe [CIP] and vitrified clay pipe [VCP]), 21-inch (VCP) and 36-inch (reinforced concrete pipe [RCP]). The 36-inch RCP along Kapiolani Boulevard showed a corroded surface (tuberculated) along crown of the pipe and the top third of the pipe; however, no steel reinforcing was exposed. The tuberculated surface at the interior crown of the pipe is indicative of the formation of hydrogen sulfuric acid vapors forming above the spring line (fluid surface) and

accelerating corrosion of the exposed pipe surface in the vicinity of the crown of the pipe. Minor and sporadic infiltration/inflow (I/I) was observed mostly at pipe joint locations or connections to other pipes. Since rebar exposure was not observed and moderate cracking was not observed, pipe segment failure is not assumed and repair or replacement is not recommended. If rebar were exposed or significant pipe cracking or I/I were observed, then pipe rehabilitation (i.e. new lining installed) or reconstruction (replacement) would have been recommended; however, rebar exposure, significant pipe distress or I/I was not observed.

The 21-inch VCP along Kapiolani Boulevard had fats, oils and grease (FOG) at its invert for a short segment. The accumulation of hardened FOG is a major concern, because the conveyance capacity of the sewerline is reduced; coagulation and build-up of FOG constricts the flow in the pipe by reducing the cross-sectional area. The 8-inch CIP had corroded surfaces and periodic small wet blisters indicating light infiltration. The 8-inch CIP had frequent FOG formed on rough surfaces, and wall defects. The 8-inch VCP had noticeably less incidence of FOG, because the walls are inert and not subject to corrosion. Coordination with the City should be done to mitigate FOG buildup in the sewerlines.

A CCTV inspection video, done in January 2009 of existing sewerlines along South Street indicated small accumulation of debris and FOG along walls and practically no I/I. The RCP sewerline along Queen Street adjacent and upstream of the South Street inspection revealed more accumulation of debris and FOG along the walls and practically no I/I. Refer to Appendix F for a copy of the associated CCTV report.

The existing VCP sewerlines are inert and do not show corrosion to the extent of RCP sewerlines. Generally, RCP sewerlines are prone to more wall and joint defects where debris/FOG can start to accumulate and build-up. Scheduling periodic CCTV inspections of the smaller-diameter sewer lines are recommended to monitor the build-up of debris/FOG and prevent blockage and backup of wastewater. Additionally, if corrosion ever becomes severe enough and steel reinforcement in the RCP is exposed, the pipe segment should be re-lined or replaced.

Based on these CCTV results, no sewerline segments are recommended to be rehabilitated or replaced based solely on condition. The conditions of the sewerlines appear to be sufficient to last through the year 2030. However, restrictions on the FOG contribution to the sewer should be enforced. Oil/grease separators (grease traps) should be installed for high-FOG-generating facilities, such as, restaurants and cafeterias. Existing FOG build-up should be reduced in approximately 50% of existing sewerlines, primarily those not VCP, through the application of hot steam or water, chemical treatment, etc. to maintain proper operation and capacity of sewerlines. No backup or surcharge in the sewerlines was evident from the CCTV videos; however, accumulation of FOG was evident in most lines, especially near lateral connections to the mains. Coordination with the City is recommended to mitigate FOG buildup in Mauka Area sewer lines.

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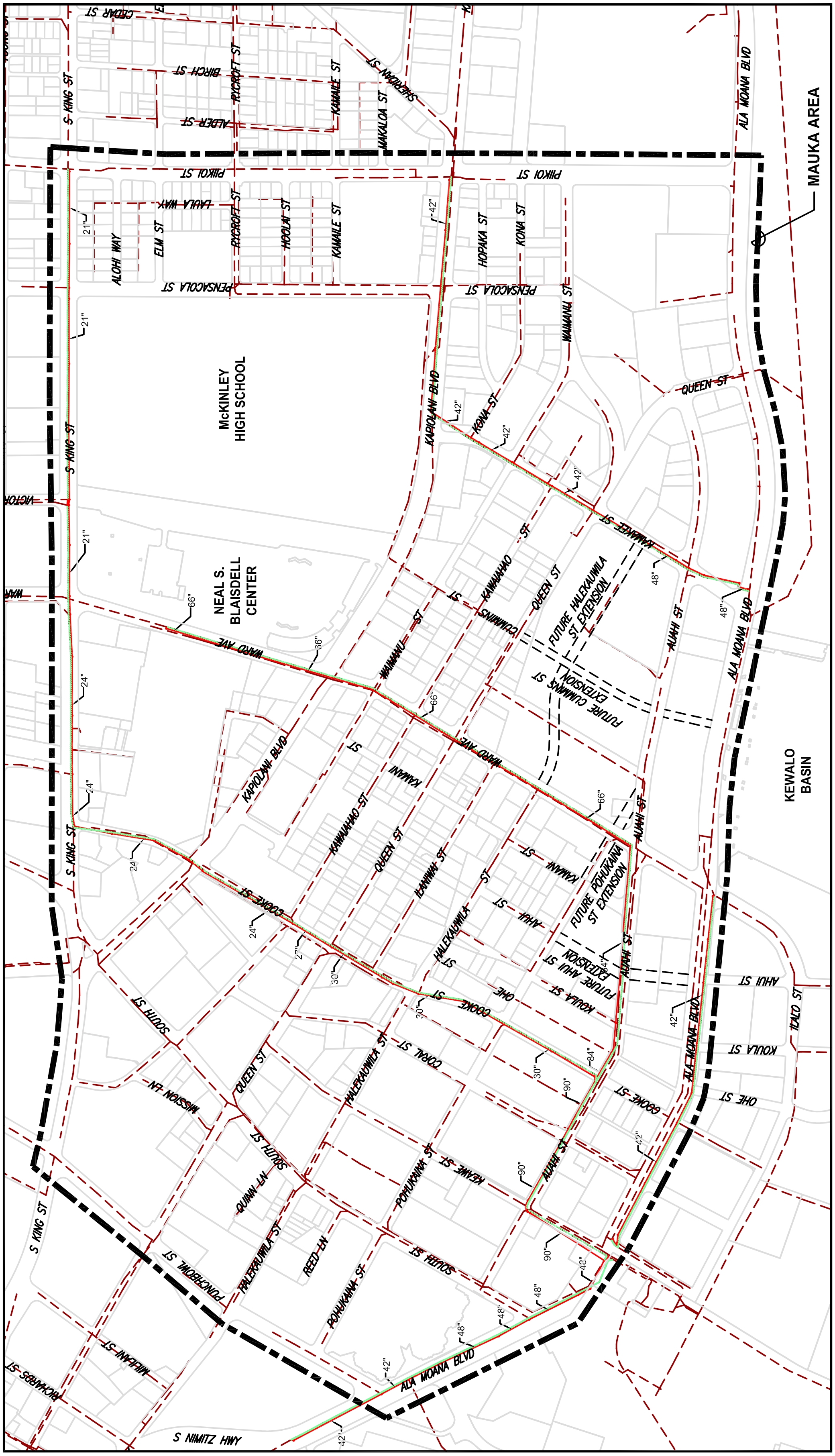

Figure 14 - Proposed Sanitary Sewer Systems

- Existing Sewerline to Remain
- Upsized Sewerline
- Mauka Area (Project Boundary)
- 42" Pipeline Size and Callout Tag Leader
- Existing Sewerline to be Replaced and Removed or Abandoned

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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7.0 SOLID WASTE DISPOSAL PROGRAM

7.1 Recommendations

Although increases in land use and population would generate more solid waste than the existing condition, specific improvements and modifications to the solid waste disposal program within the Mauka Area are not proposed. The existing mix of private and public collection services would expand to meet future collection demands as generated due to increases in land use and population.

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8.0 WATER SYSTEMS

8.1 Criteria

The Water System Standards of the BWS (2002) provides the basis and criteria for the master planning of the water system facilities. The HCDA will revise the water master plan as their Improvement Districts are determined, identified, and proposed for construction. Criteria and assumptions used in the water system facilities planning are described as follows.

8.1.1 Land Area

The Mauka Area encompasses approximately 450 acres. Using the projected 2030 population, the future use of the land area for each parcel is correlated with the Water System Standards where appropriate to compute the flow or demand.

8.1.2 Water Consumption Rate

The Water System Standards provides domestic consumption (in gallons per unit, gal/unit, and gallons per acre) guidelines and fire flow requirement (in gallons per minute, gpm) for various zoning and land use designation. The Domestic Consumption Guideline contained in the BWS standards include zoning for Residential, Commercial, Resort, Light Industry, Schools/Parks, Hospital and Agricultural; the Fire Flow Requirement, contained in the BWS standards include Agriculture, Rural, Single Family, Duplex, PUD Townhouse/Low Rise Apartments, Schools/Neighborhood Business/Small Shopping Centers/etc., Light Industry/Downtown Business/etc., and Heavy Industry/Hotels. However, Mauka Area land use classifications include: Mixed Use, Residential, Park at Grade, and Public.

Table 8-1 Domestic Consumption

Land Use Description	BWS Standards—Equivalent Category	Domestic Assumed Demand	Fire Flow Rate
Mixed Use – Residential	Commercial/Industrial Mix/Multi-Family High Rise	300 gal/unit	4,000 gpm
Residential – Commercial	Multi-Family High Rise/Commercial/ Industrial Mix	300 gal/unit	2,000 gpm
Park at Grade	Schools, Parks	4,000 gal/acre	2,000 gpm
Public	Schools, Parks	4,000 gal/acre	2,000 gpm

8.1.3 Maximum Flow Factor

The maximum flow factor based on the BWS Standards used for the Island of Oahu is 1.5. By multiplying the MFF to the projected average daily flow, the maximum daily demand can thus be obtained.

8.1.4 Peak Hour Flow

The projected peak hour flow in reference to the BWS Standards is determined by multiplying the projected average daily flow by a peak hour factor of 3.

8.2 Demand

The required minimum flow rate and fire flows are related to the land use or zoning and thus the type of development. The pipe sizes required must adhere to the following guidelines:

1. Maximum daily flow plus fire flow with a residual pressure of 20 pounds per square inch (psi) at critical hydrant.
2. Peak hour flow with a minimum residual pressure of 40 psi.
3. Maximum velocity in main (without fire flow) is 6 feet per second.
4. Maximum pressure, static or pumping, whichever is greater, shall not exceed 125 psi.

Water demand for the Mauka Area includes:

- Projected average flow of approximately 7.15 mgd; and,
- Projected maximum flow of approximately 10.73 mgd.

The peak hour flow is expected to be 21.45 mgd.

8.3 Proposed System

Refer to Figure 15—Proposed *Water Systems*, for the proposed water system improvements. Major sections in the water system are considered inadequate to meet the year 2030 water demand due to the small diameter size of the existing distribution lines.

The nearest three reservoirs supplying water to the Mauka Area are the Bella Vista 180 Reservoir, the Punchbowl 180 Reservoir, and the Makiki 180 Reservoir. Assuming one third of the future peak hour water demand is transmitted to the Mauka Area by each of the three, reservoirs, the transmission line from the Makiki 180 Reservoir needs to be upsized to at least 18-inch diameter. The waterlines running through the Mauka Area from each of the three reservoirs need to be upsized to at least 16-inch diameter.

Several segments of the existing waterlines should be replaced with larger waterlines to accommodate projected growth under either the current or revised plans. An undersized water supply system will result in low flow or no flow and low pressure at the faucet or fire hydrant. A significant portion of the existing water system will need to be up-sized to accommodate future projected growth (1.4 miles of 18-inch diameter waterlines and approximately 1.6 miles of 16-inch diameter waterlines). Future construction

area location and size would depend on the sequence or phasing of actual development and associated infrastructure improvements. The following recommended improvements would minimize the possibility of deteriorating water service:

- Replace approximately 900 LF of 12-inch water main with 18-inch water main from Punchbowl 180 Reservoir to South King Street.
- Replace the existing 16-, 12-, and eight-inch transmission lines from Makiki 180 Reservoir to South King Street with approximately 6,600 LF of 18-inch water main.
- Replace approximately 1,400 LF of 12-inch water main along Kapiolani Boulevard with 18-inch water main.
- Replace approximately 2,900 LF of eight-inch water main along South Street with 18-inch water main.
- Replace approximately 1,000 LF of 12-inch water main along Cooke Street with 18-inch water main.
- Replace approximately 1,800 LF of 12-inch water main along Kamakee Street with 18-inch water main.
- Replace approximately 2,700 LF of 12-inch water main along Ala Moana Boulevard with 18-inch water main.

Each individual development and redevelopment applicant for a City Building Permit shall be required to provide a water supply capable of supplying the required fire flow for fire protection to all premises, and shall be required to be in compliance with the prevailing applicable City Uniform Fire Code by submitting civil plans to the City Honolulu Fire Department (HFD) for review and approval.

8.4 Water Allocation and System Facilities Charges

The BWS has indicated that a water allocation is required for State-owned and Bishop Estate properties. The applicant will be assessed the BWS Water System Facilities Charges for resource development, transmission and daily storage in accordance with the BWS Schedule of Rates and Charges.

Each individual applicant for a City Building Permit shall be required to provide the BWS with project-specific water demands and infrastructure, and meet these criteria for specific projects. Specific projects within State lands requiring water service from the BWS will be required to pay a resource development charge, in addition to Water Facility Charges for transmission and daily storage. General overall water demands and calculations are contained in this infrastructure plan which will be included as part of the FSEIS. In addition, each individual applicant for a City Building Permit will be required to provide project-specific water demands and calculations to the City Engineering Division. The BWS will determine the availability of water on a case-by-case basis during their processing of specific City Building Permit applications.

8.5 Nonpotable Water

The BWS suggested that the applicant also investigate the availability and use of nonpotable water for the proposed parks. If nonpotable water is not available or unfeasible, a report of the investigation should be submitted to the BWS for the consideration of usage of potable water for irrigation.

8.6 Condition Assessment

Existing water mains consist of cast iron, ductile iron, and polyvinyl chloride (PVC). PVC mains range from 6-inch, 8 and 12-inch diameter and total approximately 6,450 LF. Cast iron mains range from 4-inch, 6, 8, 12 and 20-inch and total approximately 47,400 LF. Ductile iron mains range from 4-inch, 6, 8, 12 and 20-inch and total approximately 109,450 LF. Approximately 163,300 LF (31 miles) of water mains are installed: 4 % are PVC, 29 % are cast iron and 67 % are ductile iron.

Based on BWS geographic information updated as of October 2008, a review of water main break occurrences was conducted. The data included the location and date of the water main break, as well as, an indication if the entire segment of water main was replaced since the break. The following table summarizes possible water main segments, which may need replacement based on cluster of breaks and replacement history:

Table 8-2 Condition Assessment of Water Systems

Street	Crossing Thoroughfares (Street)	Possible Water Main Replacement Size/Length	Remark
Ala Moana Boulevard	Ward Avenue / Kamakee	12" / 300 LF	Seven 12" CIP breaks occurred from April 1969 to February 2007; no main was replaced since 1969.
Cooke	Kapiolani Boulevard / South King	8" / 400 LF	Five 8" ductile iron pipe (DIP) breaks occurred between November 1975 to August 2005; main was not replaced.
Kapiolani Boulevard	Ward Avenue / Kamakee	12" / 1,400 LF	Seventeen 12" DIP breaks occurred between June 1985 to May 2007; no main was replaced since 1985.
Keawe	Auahi / Pohukaina	6" / 560 LF	Fifteen 6"cast iron pipe (CIP) breaks occurred between November 1982 to August 2007; one segment replaced since 1982.
Ward Avenue	Kapiolani Boulevard / South King	12" / 200 LF	Nine 12" DIP breaks occurred between September 1974 to September 2008; three segments were replaced since 1983 and six segments were not replaced.

The frequency of break occurrences were sporadic enough to not warrant main replacement through the year 2030.

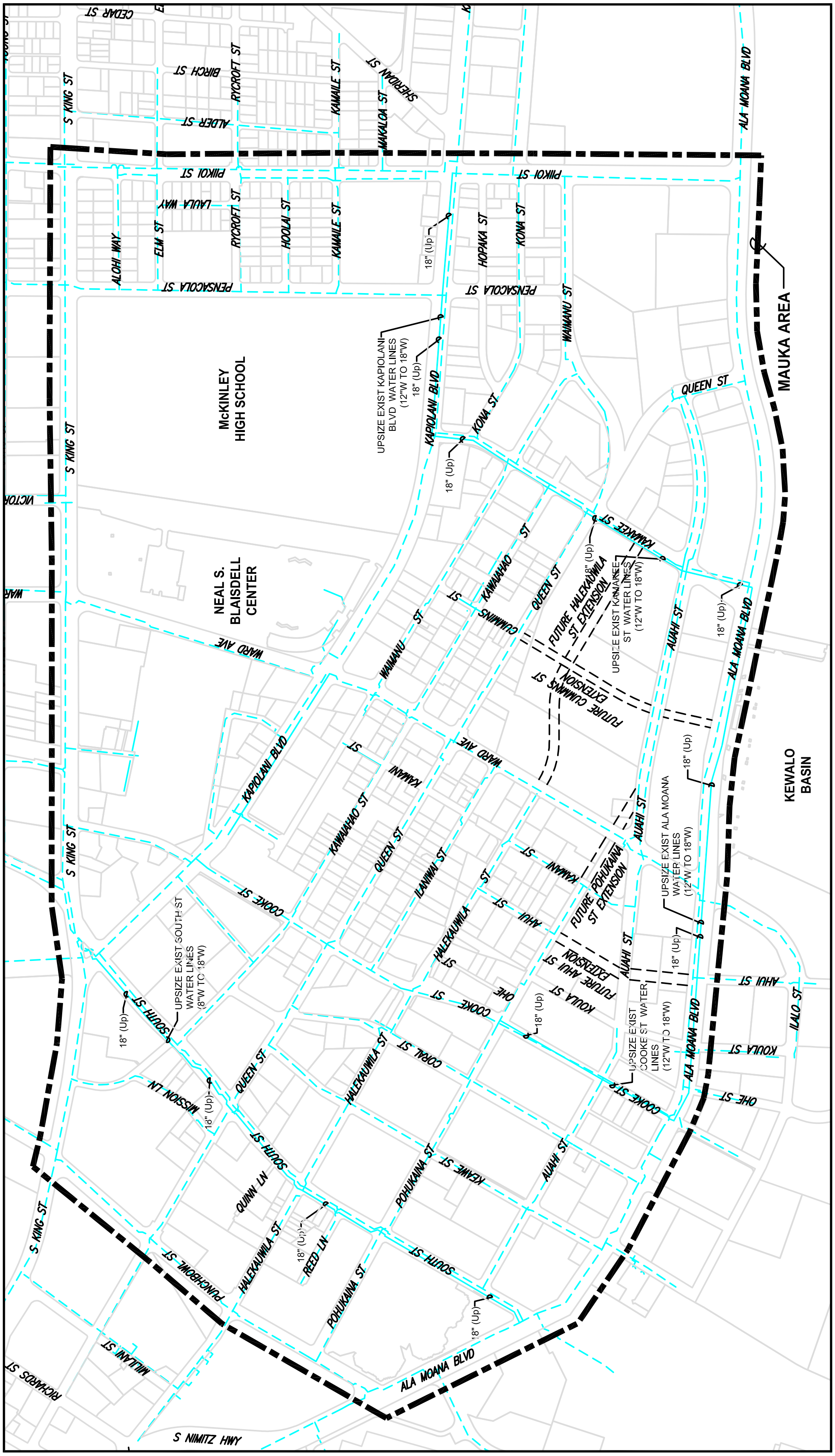

Figure 15 - Proposed Water Systems

Existing Waterline to Remain

Upsized Waterline

Mauka Area (Project Boundary)

18" Pipeline Size and Callout Tag Leader

0 800 1,600 Feet

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METCALF&EDDY | AECOM

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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9.0 SYNTHETIC NATURAL GAS SYSTEMS

9.1 Criteria

Engineers at GASCO did not provide any basis and or criteria for the master planning of their SNG system facilities within the Mauka Area.

9.2 Demand

The Gas Company indicated that they expand and upgrade their system to meet demand, and have the capability to comfortably meet 100 percent of the resident demand for the project area. Engineers at GASCO did not specify the current demand of SNG within the Mauka Area.

9.3 Proposed System

The Gas Company indicated that they expand and upgrade their system to meet demand. The Gas Company evaluates each request for new gas service on a case by case basis as required, and does not forecast demand to 2030.

According to a report done by the HCDA on the water and gas systems within Kakaako in 1979, the existing gas distribution system can be modified to accommodate future gas demands. This report also states that there are no restrictions or constraints on the capacity of the existing gas system due to future development of the study area. The Gas Company evaluates each request for new gas service on a case by case basis as required. The gas system will be upgraded as required. No site-specific recommendations are applicable.

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10.0 ELECTRICAL POWER SYSTEMS

10.1 Criteria

The Hawaiian Electric Company standard practices and policies areas, regulated by the Public Utilities Commission, provide the basis and criteria for the master planning of the electrical system facilities.

10.2 Demand

Based on the following estimated 2030 design scenario figures (roughly floor area ratio, FAR, of 2.5) of:

- Residential Use—11,000 additional units;
- Commercial Use—additional 7.6 Million square feet (Msf) of space; and,
- Industrial Use—additional 0.49 Msf of space,

the anticipated increased electrical demand will be 156 MVA, tabulated as follows:

- Increased residential loading 55 MVA or 35 percent of total load growth;
- Increased commercial loading, 95 MVA or 60 percent of total load growth; and,
- Increased industrial loading, 7 MVA or 5 percent of total load growth.

Averaging the build-out over the 23 year period, the average annual load growth will be approximately 6.8 MVA per year.

10.3 Proposed System

During the initial years of development, the spare capacity in the existing Kewalo, Kakaako and Honolulu Power Plant Substations will be adequate to serve the annualized load growth. However, within 4 years, HECo. would apparently need to construct and energize its proposed Cooke Street Substation site. As interim measures, HECo. could also consider adding fan cooling to their existing transformers which would increase their capacity by 25 percent or HECo. could shift load away from the existing substations presently serving this area onto Makaloa and Piikoi Substations which are the closest substations to the Mauka Area thereby creating additional capacity within substations serving the Mauka Area. Beyond 9 years development, HECo. may request an additional substation site. The need for this site would be evaluated based on actual load growth experienced during the 23-year design scenario.

It appears that, in general, the existing underground duct systems within the Mauka Area have sufficient space to accommodate the proposed load growth. However, development in areas served by existing overhead lines may be limited until these areas are converted to an underground duct system.

Refer to Figure 16—Proposed *Electrical Power Facilities* for the locations of the proposed electrical system facility upgrades for the Mauka Area.

10.4 System and Customer Charges

In general, under its Public Utilities Commission tariff, HECo. indicates that it bears the responsibility to develop and maintain sufficient generation, transmission and substation facilities to provide service to the Island of Oahu. It is HECo.'s current policy that improvements to their electrical system required to provide service on a regional basis, i.e. substations and high voltage transmission line, are considered "system" improvements and are paid for by the revenues derived from provision of electrical service to Oahu residents and businesses. In developed areas, such as the Mauka Area, where HECo. has facilities along most roadways, individual electric service applicants (referred to by HECo. as "Customers") whether large parcel developers or small building lessees will be required to coordinate their specific needs with HECo. and will be provided with a service proposal detailing the work HECo. must perform to provide electric service to the "Customer" and the charges for such work.

10.5 Condition Assessment

HECo.'s existing overhead electrical system consists of metal or wood poles of varying ages and uninsulated aluminum cables. HECo.'s underground electrical system consists of concrete encased polyvinyl chloride (PVC) conduits, reinforced concrete manholes and handholes and poly-ethylene rubber insulated aluminum cables. Except for the duct systems that were designed and constructed by HECo., most duct systems in the Mauka Area were constructed under Improvement District projects managed by HCDA and subsequently dedicated to HECo. Upon inspection and acceptance of these duct systems, HECo. assumes the responsibility to maintain and repair these systems. Further, HECo. maintains its cable facilities and, if subsequent development requires upgrading of these cable facilities, HECo. will replace the cable facilities to increase capacity. Apart from the Island-wide electrical outages experienced in recent years, a request for localized electrical outage data has been made by HCDA to HECo. and a reponse is anticipated.

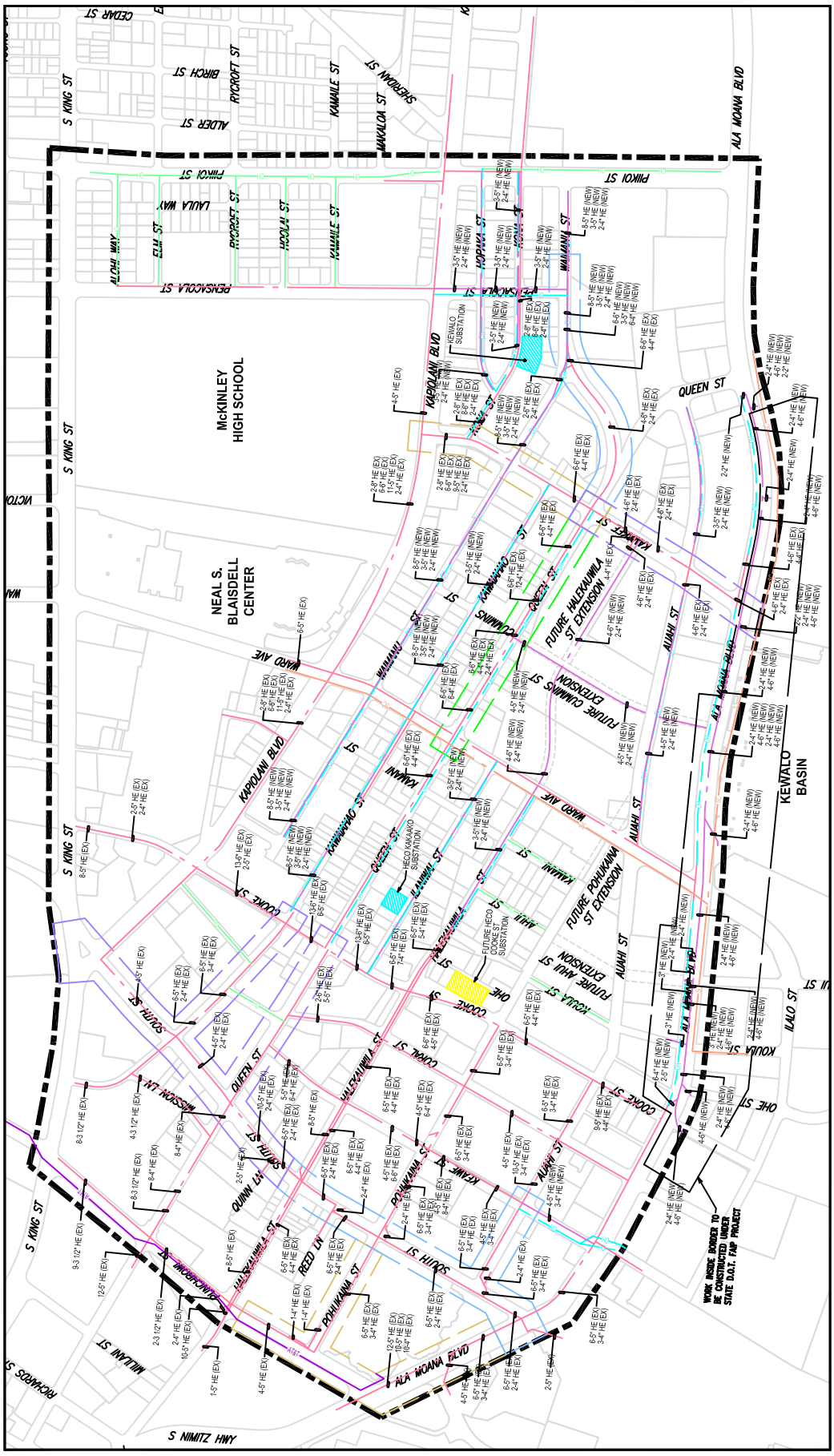

Figure 16 - Proposed Electrical Power Facilities

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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11.0 TELEPHONE AND COMMUNICATIONS SYSTEMS

11.1 Criteria

Hawaiian Telcom standard practices and policies are regulated by the Public Utilities Commission.

11.2 Demand

Based on the following estimated 2030 design scenario (roughly floor area ratio, FAR, of 2.5) of:

- Residential Use—11,000 additional units;
- Commercial Use—additional 7.6 Msf of space; and,
- Industrial Use—additional 0.49 Msf of space.

the anticipated increased telephone line requirements will be:

- Residential—16,500 lines;
- Commercial—34,000 lines; and,
- Industrial—1,000 lines.

It should be noted that these anticipated telephone line requirements reflect the in-building requirements and do not, necessarily, represent the actual quantity of lines that Hawaiian Telcom will be installing.

11.3 Proposed System

HTCo's existing Alakea and Kakaako Central Office facilities appear adequate to accommodate the projected residential, commercial and industrial developments without expansion. However, HTCo. may request easements within the Mauka Area or from building developers to allow multi-plexing "pair-gain" units to be deployed. These "pair-gain" units allow HTCo. to concentrate numerous customer lines onto high bandwidth, high capacity trunk lines. For example, a typical "pair-gain" unit module would concentrate approximately 100 customer lines onto 1 HTCo. trunk line. This line concentration would, in turn, lessen the quantity of cables HTCo. is required to install in their underground duct system or onto the joint utility pole system.

It appears that, in general, the existing underground duct systems within the Mauka Area have sufficient space to accommodate the proposed load growth. HTCo. may also accommodate development in areas served by overhead lines by adding cables onto the existing poles or through replacement of existing cables with larger capacity cables.

Refer to Figure 17—Proposed *Telephone and Communications Systems*, for the proposed telephone communications system for the Mauka Area.

11.4 Utility Charges

In general, under its Public Utilities Commission tariff, HTCo. indicates that it bears the responsibility to develop sufficient facilities to provide service to the Island of Oahu. It is HTCo.'s current policy that all normal improvements to their communications system required to provide service are considered "system" improvements and are paid for by the revenues derived from provision of telephone service to Oahu residents and businesses. In developed areas, such as the Mauka Area, where HTCo. has facilities along most roadways, individual telephone service applicants whether large parcel developers or small building lessees will be required to coordinate their specific needs with HTCo. and if special communications services are being requested that exceed those services that HTCo. would normally provide, HTCo. may elect to ask the requestee for a payment to establish such service. Similarly, if HTCo. considers a telephone service request to be speculative in nature, i.e. a request for multiple high-bandwidth circuits by a small property lessess, HTCo. may also elect to ask for an advance payment to establish telephone service.

11.5 Condition Assessment

HTCo.'s existing overhead communication system, in most areas, is jointly mounted to the wood poles used for HECo.'s overhead system and consists of insulated twisted-pair copper cables and fiber optic cables. HTCo.'s underground electrical system consists of concrete encased polyvinyl chloride (PVC) conduits, reinforced concrete manholes and handholes and the same types of cables used for the overhead systems. Except for the duct systems that were designed and constructed by HTCo., most duct systems in the Mauka Area were constructed under Improvement District projects managed by HCDA and subsequently dedicated to HTCo. Upon inspection and acceptance of these duct systems, HTCo. assumes the responsibility to maintain and repair these systems. Further, HTCo. maintains its cable facilities and, if subsequent development requires upgrading of these cable facilities, HTCo. will replace the cable facilities to increase capacity. HTCo.'s response letter to the HCDA (copy of HTCo. letter is in Appendix D) indicates that their existing facilities within the Mauka Area have not experienced any significant outages within the past 10 (ten) years. Further, HTCo. indicates that although the typical lifespan of their facilities is 46 years, maintenance and upgrades are done on a continuous basis.

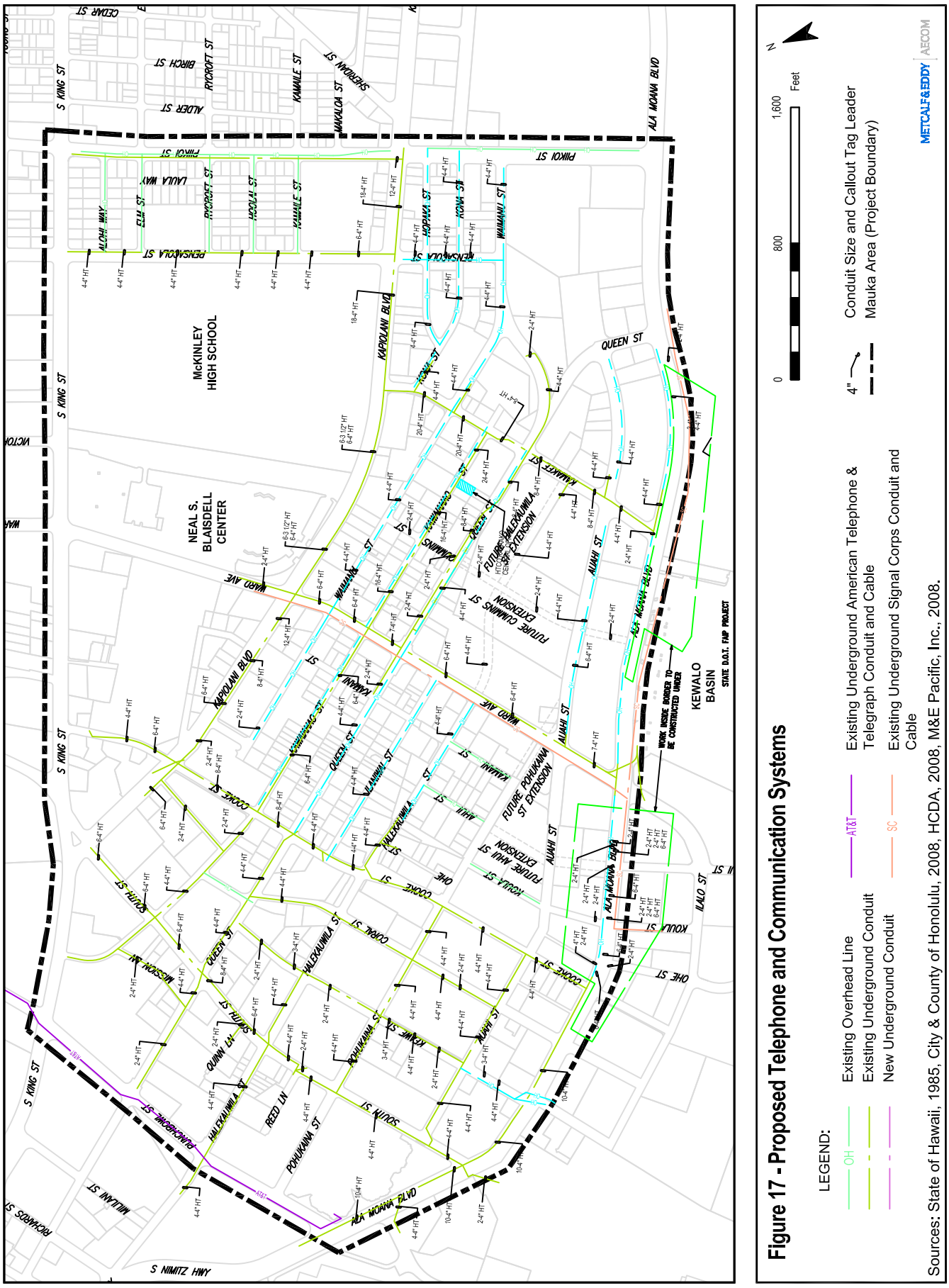

Figure 17 - Proposed Telephone and Communication Systems

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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12.0 CABLE TELEVISION SYSTEMS

12.1 Criteria

Oceanic Time Warner standard practices and policies are regulated by the State Department of Commerce and Consumer Affairs.

12.2 Demand

Due to the nature of Oceanic's system, it is not apparent that the increase in residential, commercial and industrial space would impact their existing cable infrastructure.

12.3 Proposed System

As additional development occurs, Oceanic may determine that reinforcement of their existing cable infrastructure may be needed, both to support the increase service demand and to provide enhanced capabilities. In the Mauka Area, where the various HCDA Improvement District projects constructed underground duct facilities, it appears that no provisions were made for Oceanic facilities. In these areas, however, Oceanic has negotiated with HTCo. for use of space with the HTCo. duct facilities. Similarly, in areas served by overhead facilities, Oceanic is not a member of the Joint Pole Committee, whose members include HECo., HTCo., the City and the State, and, therefore, cannot install cables onto existing overhead poles. However, Oceanic has negotiated with HTCo. to lease space on the joint poles from HTCo. Existing Oceanic cable facilities would either be added or upgraded to accommodate the additional development.

Refer to Figure 18—Proposed *Cable Television Systems*, for the proposed Oceanic system for the Mauka Area.

12.4 System and Customer Charges

In general, under its Department of Commerce and Consumer Affairs franchise, Oceanic indicates that it bears the responsibility to develop sufficient facilities to provide service to the Island of Oahu. It is Oceanic's current policy that all normal improvements to their communications system required to provide service are considered "system" improvements and are paid for by the revenues derived from provision of cable television and communications service to Oahu residents and businesses. In developed areas, such as the Mauka Area, where Oceanic has facilities along most roadways, individual communication service applicants whether large parcel developers or small building lessees will be required to coordinate their specific needs with Oceanic. Oceanic would then evaluate their system and advise the requestee on the availability of the type of service being requested. If special communications services are being requested that exceed those services that Oceanic is able to provide from its existing

facilities and the likelihood that similar requests would be forthcoming from nearby developments is minimal, Oceanic may elect to ask the requestee for a payment to establish such service.

12.5 Condition Assessment

Oceanic's existing overhead cable system, in most areas, is jointly mounted to the wood poles used for HECo.'s overhead system and consists of insulated coaxial copper cables and fiber optic cables. Oceanic's underground electrical system consists of concrete encased polyvinyl chloride (PVC) conduits, reinforced concrete manholes and handholes and the same types of cables used for the overhead systems. Except for the duct systems that were designed and constructed by Oceanic, most duct systems in the Mauka Area were constructed under Improvement District projects managed by HCDA and subsequently dedicated to Oceanic. Upon inspection and acceptance of these duct systems, Oceanic assumes the responsibility to maintain and repair these systems. Further, Oceanic maintains its cable facilities and, if subsequent development requires upgrading of these cable facilities, Oceanic will replace the cable facilities to increase capacity. A request for localized facility electrical outage data has been made by HCDA to Oceanic and a response is anticipated. It is noted that in the event of a HECo. outage, Oceanic's facilities may be intact but unable to deliver a television signal because of the power loss to one or more of their signal amplifiers.

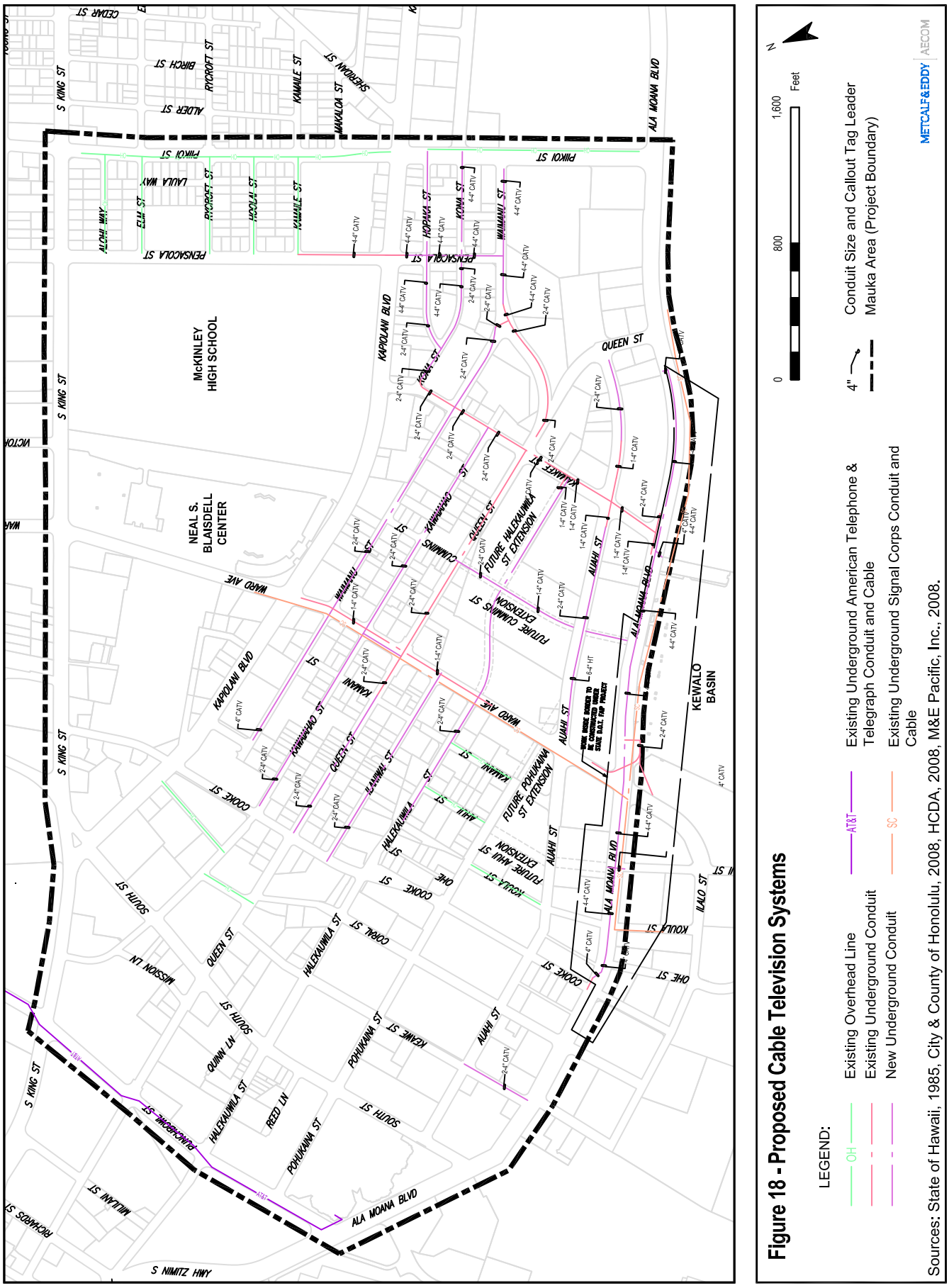

Figure 18 - Proposed Cable Television Systems

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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13.0 TRAFFIC SIGNAL SYSTEMS

13.1 Criteria

2003 Manual on Uniform Traffic Control Devices, and standard practices of the City DTS and standard practices of the State DOT are design references.

13.2 Demand

Based on the preliminary traffic study prepared for the supplementary environmental impact statement, three existing intersections, Pohukaina/Cooke Streets and Halekauwila/Cooke Streets , are currently controlled using four-way stop signs should be signalized. It should be noted that HCDA, under its Improvement District Project No. 11 completed a design for the signalization of the Queen/Kamakee Streets and, currently, a temporary traffic signal system is to be erected at this intersection to meet the existing traffic signal warrant. It should also be noted that the City has approved the installation of a traffic signal at the Queen/Auahi Street-Queen's Land intersection near the IBM Building.

13.3 Proposed System

The preliminary study also suggests changing the existing protective left turn signals off Ward Avenue into protective-permissive left turns. Another suggestion is the creation of a one-way couplet using Queen Street and Auahi Street. Both these changes will required modification to the existing traffic signal heads and standards as well as reprogramming of the traffic signal controllers.

The suggestion in the preliminary traffic study to maximize the timing and efficiency of the existing and proposed traffic signals should be done on a regional basis and should also consider the City's initiative to implement an intelligent transportation system on the Island of Oahu. Traffic signal controller that do not currently have a modem and telephone connector need to be upgraded. This will permit the signals to be controlled by the City through its Traffic Management Center. Also, as the traffic signal duct system is developed, fiber optic cables and closed circuit television cameras should be installed to facilitate the intelligent transportation system.

Subject to the implementation of the suggestions stated in the preliminary traffic study and to other studies prepared by HCDA or other concerned parties, the quantity and location of the existing and proposed traffic signals appears satisfactory. However, if conditions arise indicating that additional traffic signals are warranted, such signals should be funded and constructed. Further, as development of parcels within the Mauka Area occurs, the City Department of Planning and Permitting may mandate installation of mid-block signals to facilitate ingress and egress and for pedestrian safety. Refer to Figure 19—Proposed *Traffic Signal Systems*, for the proposed traffic signal systems for the Mauka Area.

13.4 System Development

In addition to the traffic signalization proposed by the Traffic Study prepared for Mauka Area Infrastructure Plan, individual parcel developers may be tasked, during their site improvement design process, to provide a traffic study of intersections adjacent to the property as well as major intersections on the arterials impacted by the developement. If traffic signal warrants are indicated by these traffic studies, the parcel developers will be required by the City to provide the necessary traffic signal improvements prior to occupancy of the project. Further, for City-owned roadways, if accumulated traffic incidents at any intersection meet the conditions of a traffic signal warrant or if development of public facilities triggers a traffic signal warrant, the City Department of Transportation Services would commission the design and construction of the new traffic signal. Likewise, for Ala Moana Boulevard, which is State-owned, the Department of Transportation would commission the design and construction a new traffic signal where conditions of a traffic signal warrant are met.

13.5 Condition Assessment

Once a traffic signal is inspected and accepted by the City Department of Transportation or the State Department of Transportation, DTS is responsible to maintain the traffic signal, including the replacement of signal heads, standards, cables, loop detectors and, where necessary, duct runs. Periodic projects are also issued by DTS to update the traffic signal technology. The most recent example of this type of project being the replacement of standard incandescent lamps with new Light Emitting Diode lamps which, although are significantly more expensive initially, provide a far longer life span and reduce electricity consumption dramatically.

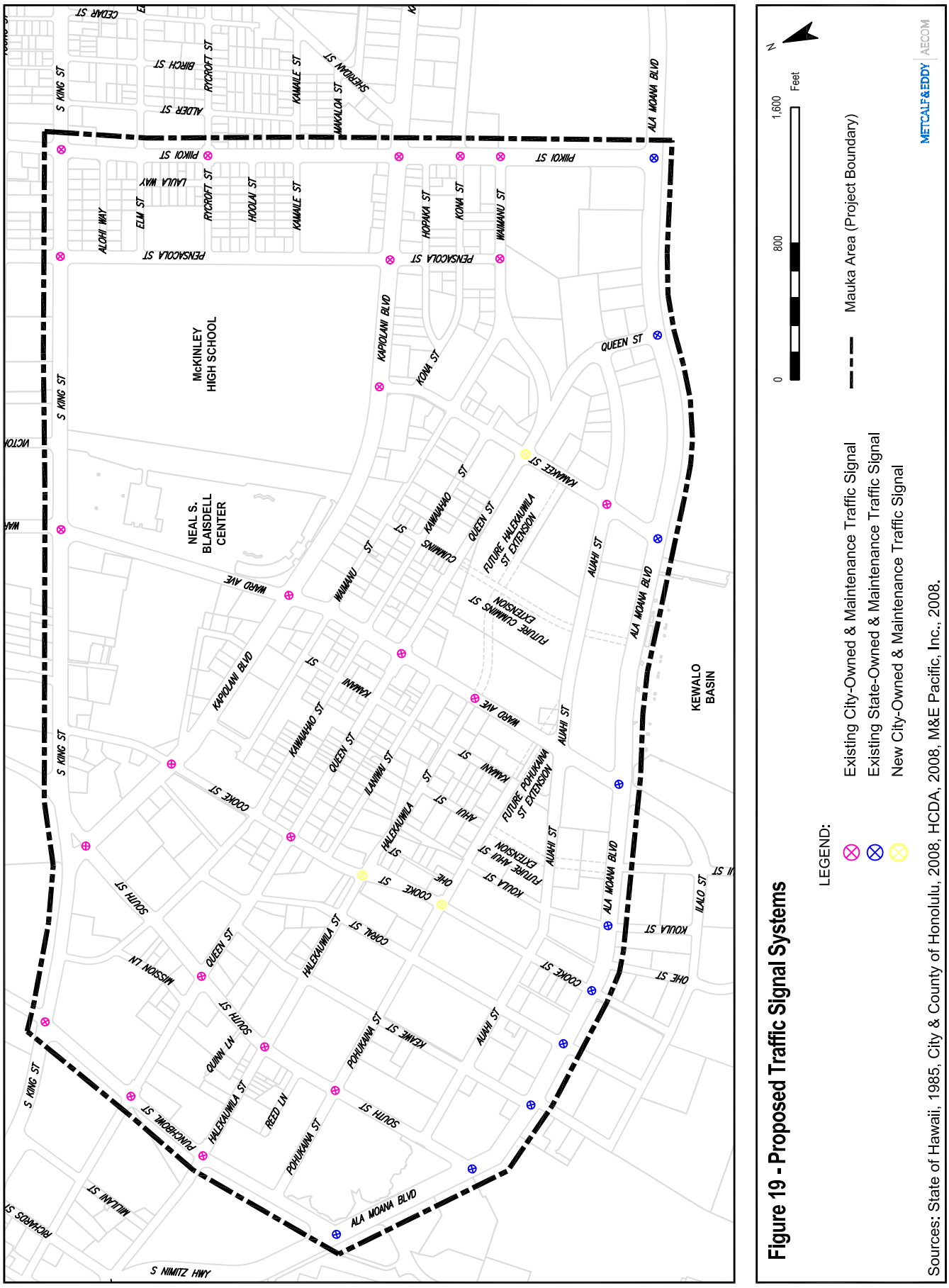

Figure 19 - Proposed Traffic Signal Systems

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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14.0 ROADWAY STREET LIGHT SYSTEMS

14.1 Criteria

Illuminating Engineering Society Lighting Handbook, current edition, standards and modifications adopted by the Department of Design and Construction, Mechanical/Electrical Division, AASHTO Informational Guide to Lighting and the standards of the State DOT are the design references.

14.2 Proposed System

The existing street light systems appear adequate subject to the review mentioned in the previous section. Refer to Figure 20—Proposed *Roadway Street Light Systems*, for the proposed roadway street light systems for the Mauka Area. With the increase of residential units and commercial properties within the Mauka Area, the illumination criteria on which the present street lighting system is based may need to be evaluated and, if necessary, the street lighting system may need to be upgraded to account for the higher pedestrian and automobile interaction. Also, should the City standardize around lighting technology differing from the current high pressure sodium lamp and ballast, consideration should be given to upgrading the street lights to the newer technology.

14.3 System Development

Except for the technology updates mentioned in the previous paragraph, street light systems along Mauka Area roadways constructed under the various HCDA Improvement District Projects will remain as constructed. Construction of new street lighting systems is likely to occur in three ways: 1) Improvement District Projects for those roadways currently unimproved; 2) Parcel developers required to improve roadways abutting the property will also be required to upgrade the street light system along those roadways; and 3) City initiated Street Rehabilitation projects. The last possibility contemplates a project(s) similar to the City street lighting projects for King Street/Downtown and Waikiki, where standard “cobra-head” type street light standards were replaced with decorative poles and luminaires.

14.4 Condition Assessment

Once street lights installed by a private developer are inspected and accepted by the City Department of Design and Construction, the Department of Facility Maintenance is responsible to maintain the street lights, including the replacement of luminaires, standards, cables and, where necessary, duct runs. Periodic projects are also issued by the Department of Design and Construction to repair or replace street light systems.

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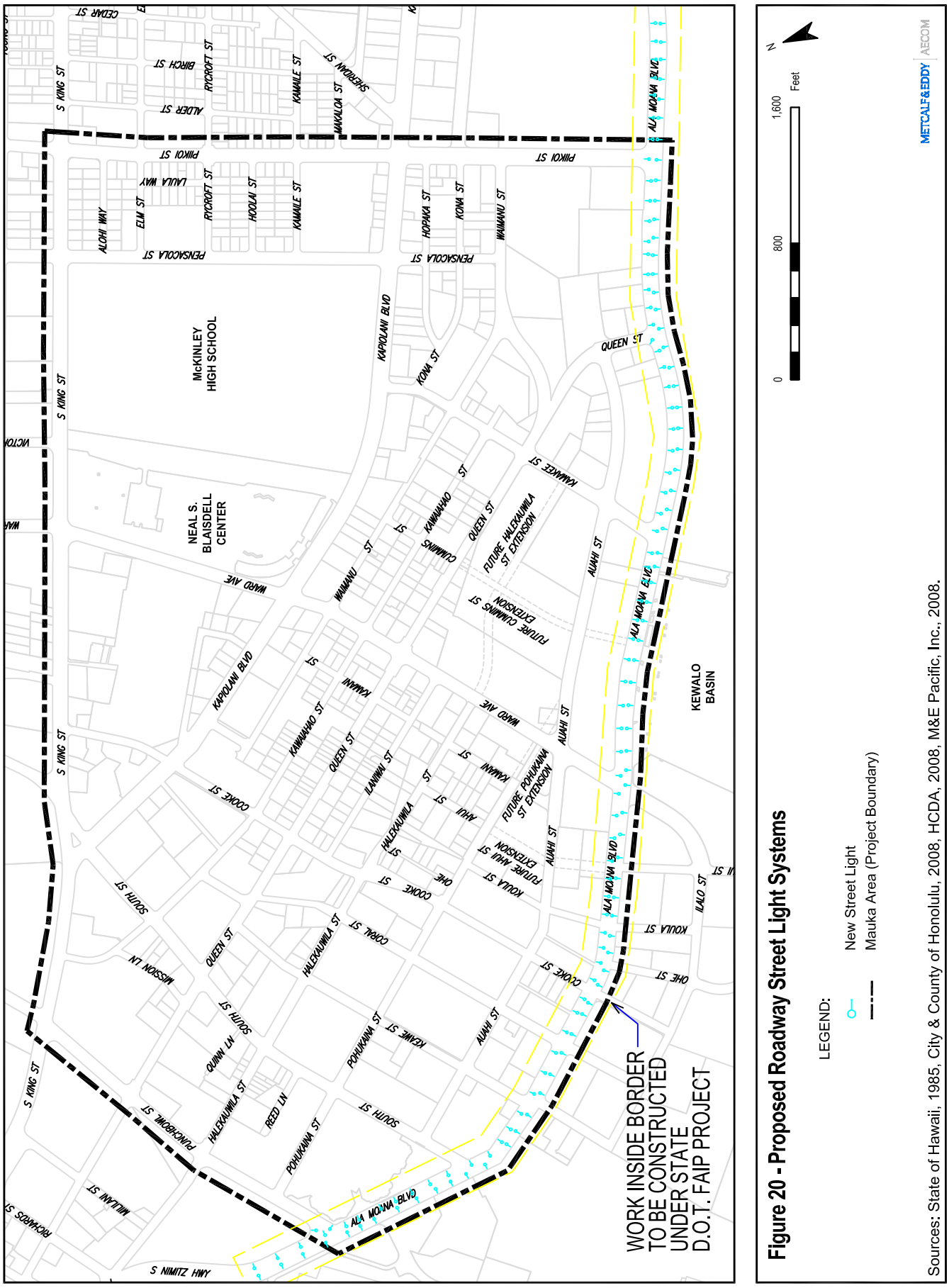

Figure 20 - Proposed Roadway Street Light Systems

Sources: State of Hawaii, 1985, City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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15.0 ROADWAYS

15.1 Requirements

Street and roadway improvements are designed to meet or exceed City design standards. Proposed street and roadway improvements include:

- AC pavement resurfacing;
- Widening and adjustment of ROW widths to conform with minimum City standards; and,
- Installation of concrete curbs, gutters, medians, planters and sidewalks, as applicable.

All roadways shall comply with the Subdivision Rules and Regulations of the City Department of Land Utilization and Traffic Standards Manual of the City Department of Transportation Services. Roadways are classified into three categories—major, secondary and minor. The minimum roadway ROW widths for major, secondary and minor streets are 70 feet, 56 feet and 40 feet, respectively. The following table summarizes existing and proposed roadway ROW widths for streets recommended to be improved within the Mauka Area. Although the minimum ROW widths are met; other minimum City standard improvements like sidewalks or concrete curb and gutters are lacking.

Table 15-1 Existing and Proposed Right-Of-Way Widths

Roadway	Roadway Classification	Existing Roadway Right-Of-Way Width	City Standard Width (Minimum)	Proposed Roadway Right-Of-Way Width
Ala Moana Boulevard	Major	100 Feet	76 Feet	100 Feet
Alohi Way	Minor	40 Feet	40 Feet	40 Feet
Cummins Street	Minor	40 Feet	40 Feet	40 Feet
Elm Street	Minor	40 Feet	40 Feet	40 Feet
Halekauwila Street	Secondary	60 Feet	56 feet	60 Feet
Hoolai Street	Minor	40 Feet	40 Feet	40 Feet
Hopaka Street	Minor	40 Feet	40 Feet	40 Feet
Ilaniwai Street	Minor	40 Feet	40 Feet	40 Feet
Kamaile Street	Minor	40 Feet	40 Feet	40 Feet
Kawaiahao Street	Minor	50 Feet	40 Feet	50 Feet
Kona Street	Minor	40 Feet	40 Feet	40 Feet
Laula Way	Minor	40 Feet	40 Feet	40 Feet
Pensacola Street	Major	76 Feet	76 Feet	76 Feet
Piikoi Street	Major	80 Feet	76 Feet	80 Feet
Queen Street	Secondary	60 Feet	56 Feet	60 Feet
Rycroft Street	Minor	40 Feet	40 Feet	40 Feet
Waimanu Street	Minor	50 Feet	40 Feet	50 Feet

Refer to Figure 21—Proposed *Roadways*, for the recommended roadway improvements within the Mauka Area. The separate document, *Kakaako Mauka Area Plan, Supplemental Environmental Impact*

Statement, Transportation Analysis, contains more detailed information about the traffic and roadway evaluation that relate to the recommended roadway improvements.

Existing streets are proposed to be brought up to City standards wherever possible and not limited by space. New streets, space permitting, are proposed to be designed to City codes and criteria governing pavement section, lane widths, sidewalks, bike lanes (in accordance with the State's *Bike Plan Hawaii*), curbs, gutters, planter areas, sight distance requirements, stopping distance requirements, radii, ADA curb ramps, accessible routes, signage, crosswalks, and pavement marking and striping. The width of sidewalks is proposed to be a minimum of four feet and comply with the provisions of Chapter 20 Revised Ordinances, 1969, as amended. The terrain or topography of the Mauka Area is relatively flat and special consideration needs to be made to ensure that the minimum longitudinal slope of new roadways shall not be less than 0.4 percent with minimum transverse cross slopes of two percent to allow for proper stormwater runoff drainage from the sidewalks.

The proposed improvements would enhance traffic and pedestrian/bicyclist circulation while simultaneously improving the drainage condition of roadways and minimizing localized ponding occurrences by directing surface runoff to the roadway gutters and curb catch basins and drain inlets.

Installations of new underground utilities within roadway rights-of-way involve digging trenches. In the Mauka Area, where the ground water table is near the ground surface, ground water would likely seep into open excavations. Removing ground water (dewatering) from the construction area shall be accomplished on a case-by-case basis for individual specific projects. Dewatering activities will be subject to water quality requirements by the State Department of Health (NPDES program) and the City. State and City permits will be necessary on a case-by-case basis with project-specific treatment requirements for the dewatered means and methods, and effluent type and quantity. A common practice of dewatering is to install a temporary barrier to divide the open trench into two sections—pump water from the work area section into the other or "back trench" section. A variation of this method would be to pump the ground water into a sedimentation tank and filter the water before the dewatering effluent is discharged into a nearby catch basin or drain inlet.

In addition to dewatering activities, utility installation, parcel development / redevelopment, and roadway improvements also require compaction of the underlying soil and placement of fill and backfill. Specific compaction requirements will be determined on a case-by-case basis through site-specific geotechnical explorations and analyses performed during the construction phases of infrastructure installations and improvements. Site-specific soils reports also provide recommendations for earthwork, cut / fill slopes, water content, percolation, pavement design, retaining wall design parameters, etc. that are typically required for the design and construction of projects.

15.2 Condition Assessment

The conditions of the existing roadways are generally good and anticipated to adequately support vehicular travel through the year 2030. Only a few potholes and cracking of asphalt pavement surfaces were observed during site visits on 7/1/08 through 7/6/08 and on 2/11/09. Potholes and the more severe pavement distresses tended to be on the outer portions of paved areas outside of the normal travelways, although not exclusively. Localized ponding also tended to occur in these outer-pavement areas, although

not exclusively. Cracking generally tends to allow infiltration of surface water into the pavement subgrade which could weaken and shorten the design life of the pavement.

Various common types of pavement distress include:

- Block cracking;
- Longitudinal cracking;
- Alligator cracking;
- Potholes;
- Rutting;
- Patch Deterioration; and
- Raveling

Block cracking is a pattern of cracks that divide the pavement into approximately rectangular pieces that range in size from 1 square foot (sf) to 100 sf. Longitudinal cracking is predominantly parallel to pavement centerline. Alligator cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt concrete surface under repeated traffic loading. Alligator cracking is often accompanied by potholes. Potholes are isolated, bowl shaped holes of varying sizes, generally a result of the loss of alligatored pavement. Rutting is a longitudinal surface depression in the wheel path. Patch deterioration is a portion of pavement surface, greater than one square foot in area that has been removed and replaced or additional material has been applied to the pavement after original construction, which is rutting. Raveling is a wearing away of the pavement surface caused by the dislodging of aggregate particles and loss of asphalt binder, ranging from loss of fines to loss of some coarse aggregate, and ultimately leading to a very rough and pitted surface with obvious loss of aggregate.

The three types of significant pavement distress observed in the Mauka Area were alligator cracking, rutting and potholes. The following table summarizes the field observations regarding areas of possible pavement patching repair:

Table 15-2 Condition Assessment of Roadway Pavement

Street	Crossing Street(s)	Alligator Cracking Possible Patching Repair	Rutting Possible Patching Repair	Potholes Possible Patching Repair
Alohi Way	Near Piikoi	50′x 100′		
Auahi	Kamani / Ward	50′x 200′		
Auahi	Kamakee	50′x 550′		6′x 12′
Cooke	Auahi / Ala Moana	50′x 500′		6′x 6′
Coral	Halekauwila		25′x 200′	
Emily	Queen / Kawaiahao	50′x 250′		
Halekauwila	Cooke	100′x 100′		
Halekauwila	Ward			6′x 6′
Hopaka	Piikoi	40′x 50′		6′x 6′
Kamani	Auahi / Pohukaina	50′x 200′		
Kawaiahao	South King / Mission	50′x 230′		
Kawaiahao	Emily / Curtis	50′x 250′		
Kawaiahao	Diamond Head of Cooke	50′x 200′	50′x 60′	
Kawaiahao	Ewa of Cummins	50′x 100′		
Keawe	Auahi	50′x 200′		
Keawe	Pohukaina	50′x 50′		
Kona	Pensacola / Piikoi	50′x 500′		

Street	Crossing Street(s)	Alligator Cracking Possible Patching Repair	Rutting Possible Patching Repair	Potholes Possible Patching Repair
Koula	Near Ala Moana	50′x 120′		6′x 12′
Ohe	Pohukaina / Halekauwila	30′x 400′		
Pensacola	Kona / Hoopaka	50′x 150′		
Pensacola	Kapiolani	50′x 100′		
Pensacola	Kamaile	70′x 100′		
Pensacola	Hoolai	70′x 100′		
Pensacola	Elm	70′x 100′		
Pensacola	Rycroft	70′x 100′		
Pensacola	Alohi Way	70′x 100′		
Reed Lane	Near South	50′x 50′		
Rycroft	Laula Way	50′x 50′		
South	Halekauwila	50′x 50′		
Waimanu	Cummins / Kamakee	50′x 650′		6′x 20′
Waimanu	Ward	50′x 100′		
Ward	Auahi	100′x 100′		
Ward	Queen	100′x 100′		

The recommended method of repair is made by constructing a deep patch that completely removes the affected area (top 4-inch pavement) and replaces it with new asphalt concrete (4-inch thick), as necessary. Hot-mix asphalt placed full-depth provides a strong patch and can be done expeditiously.

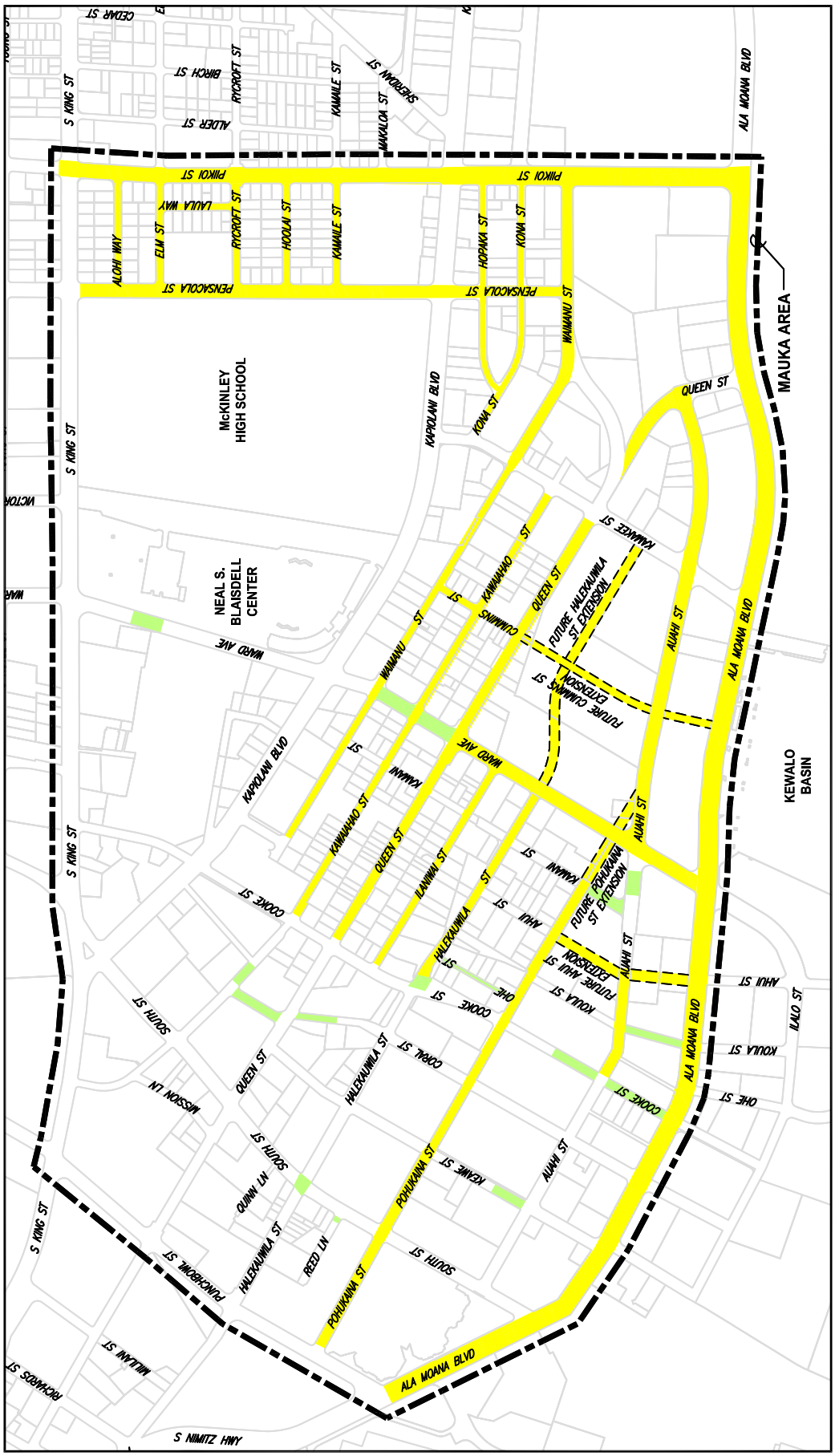

Figure 21 - Roadways

Roadway Improvements

Possible Repair of Potholes, Alligator Cracking and/or Rutting

Mauka Area (Project Boundary)

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

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16.0 COST ESTIMATES

The purpose of this cost estimate is to provide a breakdown of costs associated with different types of recommended infrastructure improvements for different locations within the Mauka Area. This cost estimate will assist the HCDA to formulate and identify Improvement Districts based on available funds for probable costs, in addition to need. In order to provide a consistent baseline for comparison between proposed infrastructure improvements and their associated costs, all estimates were determined in 2008 dollars. Due to the Consumer Price Index (CPI) at the time the construction work is performed, and the time value of money, different components and elements of projects will vary and increase in cost from the 2008-dollar basis depending on when the work is made part of and completed under the ID Program. Cost estimates will be developed on a project-by-project basis in the design phase of each ID that will provide estimates for construction in dollars closer to the time the work is done for more accurate project-funding purposes.

Depending on the extent of the improvement project and jurisdiction of the included areas, physical and financial responsibility for the installation and maintenance of infrastructure, traffic signs, signals, and street lighting rests with either the State, City and/or private developments and entities.

Historically, cost sharing has consisted of approximately 20% of construction costs paid by utility companies (HECO, HTCO/Hawaiian Telecom, The Gas Company, and Oceanic Time Warner) and from assessments to property owners within the ID who benefit from the improvements and 80% funded by government. This contributory level of legislative funding could possibly change due to currently-projected State budget adjustments. Public infrastructure improvements and installations are typically dedicated to the City after construction and all subsequent infrastructure maintenance and rehabilitation costs are under City jurisdiction. Part of the ID process involves public hearings and input, which will identify and address concerns (such as, construction-related provisions, parking, loading and unloading zones, taxes, legislative appropriations, construction timelines, financing options, public involvement / contributions / assessments, economic opportunities for lot owners, monetary support / assistance programs, and dislocation / property loss, as applicable) by the public (affected businesses, entities, individuals, etc.) specific to the particular subject ID being proposed.

A summary of the probable costs of construction based on this infrastructure master plan is as follows:

Storm Drain Systems
Increasing the capacity of the existing drainage system is limited by:

1. Existing thorough build out of the area.
2. General flatness of terrain.
3. Available funding and resources.

The existing onsite drainage system within the Mauka Area is sized to drain approximately 20 percent of the total 2,000-acre drainage basin. The system within the Mauka Area is a subset of the overall drainage

system of the basin. The Mauka Area and the existing offsite drainage basin area are thoroughly built-up. The forecasted development within the Mauka Area will not change substantially or generate considerably more storm runoff than the current condition. By City regulation, a proposed development or redevelopment cannot increase the existing storm runoff to a downstream parcel. Development and redevelopment will consist primarily of vertical build-up, which does not change the runoff character coefficient of the area.

The installation of new storm drain pipe or box mains would not be a cost-effective measure to alleviate runoff within the Mauka Area, and would be limited by space restrictions from existing structures, buildings, and infrastructure. Due to the general flat terrain and low-elevation of the entire area, new mains would be large with nearly flat slopes. Additionally, groundwater would require dewatering during construction and could pose concerns for infiltration and inflow into the system. The lower portions of new lines may be subject to tidal effects due to low elevation, and a new outlet to the ocean would require renewable permitting. Existing structures, buildings, and infrastructure would either need to be avoided, protected or reconstructed/restored/realigned after the installation of new storm drain mains.

The existing storm drain system is adequate to accommodate drainage contribution from the Mauka Area in accordance with City design requirements. Due to the flat terrain of the area however, catch basins and drain inlets with 18-inch pipe connections to the existing system and concrete gutter restorations are recommended in some locations to help alleviate localized ponding. These improvements are summarized in the table below:

Table 16-1 Costs for Proposed Storm Drain Systems Improvements

Street	Crossing Streets	Proposed Drainage Improvement	Cost
Ahui	Halekauwila / Pohukaina	3-CB, 440 LF×$450/LF	$ 200,000
Cooke	Kapiolani Boulevard / South King	3-CB, 600 LFx$450/LF	$ 270,000
Halekauwila	Cooke / Ward Avenue	2-CB, 1,100 LF×$450/LF	$ 495,000
Hopaka	Kona / Pensacola	4-CB, 500 LF×$450/LF	$ 225,000
Ilaniwai	Cooke / Ward Avenue	1-DI, 1,200 LF×$450/LF	$ 540,000
Kamani	Halekauwila / Pohukaina	1-DI, 440 LF×$450/LF	$ 200,000
Kawaiahao	South King / Kamakee	6-DI, 10-CB, 4,000 LF×$450/LF	$1,800,000
Koula	Auahi / Pohukaina	1-CB, 440 LF×$450/LF	$ 200,000
Kona	Kamakee / Pensacola	7-DI, 660 LF×$450/LF	$ 297,000
Mission Lane	Queen / Kawaiahao	3-CB, 500 LFx$450/LF	$ 225,000
Queen	Cooke / Kamakee	4-DI, 7-CB, 2,600 LF×$450/LF	$1,170,000
Waimanu	Drier / Kamakee	4-DI, 8-CB, 2,320 LF×$450/LF	$1,044,000
		Subtotal	**$6,666,000**

The estimated construction cost in 2008 dollars for the recommended drainage improvements is **$6.7 million**.

Sanitary Sewer Systems

The existing gravity sewer system within the Mauka Area is undersized to accommodate the projected wastewater flows to the year 2030. Approximately 18,000 feet of sewer trunk lines within the Mauka Area are recommended to be replaced with larger trunk lines. These improvements are summarized in the table below:

Table 16-2 Costs for Proposed Sanitary Sewer Systems Improvements

Street	Crossing Thoroughfares (Street)	Proposed Sewer Improvements	Cost
Ala Moana Boulevard	Punchbowl / Ward Avenue	3,100 LF (48")×$2,900/LF 150 LF (36")×$2,300/LF	$ 9,335,000
Auahi	Ward Avenue / Keawe	750 LF (90")×$5,600/LF 1,200 LF (84")×$5,100/LF	$10,320,000
Cooke	South King / Auahi	1,600 LF (30")×$1,700/LF 250 LF (27")×$1,600/LF 1,200 LF (24")×$1,400/LF	$ 4,800,000
Kamakee	Kapiolani Boulevard / Auahi	330 LF (48")×$2,900/LF 1,240 LF (42")×$2,600/LF	$ 4,181,000
Kapiolani	Piikoi / Kamakee	1,200 LF (42")×$2,600/LF	$ 3,120,000
Keawe	Auahi / Ala Moana Boulevard	450 LF (90")×$5,600/LF	$ 2,520,000
South King	Cooke / Piikoi	1,100 LF (24")×$1,400/LF 2,300 LF (21")×$1,200/LF	$ 4,300,000
Ward Avenue	South King / Auahi	2,660 LF (66")×$4,100/LF	$10,906,000
		Subtotal	**$49,482,000**

The estimated construction cost in 2008 dollars for the recommended sewer system improvements is **$49.5 million.**

Solid Waste Disposal Program

Although the quantity of solid waste would increase as the population increases, the existing mix of private and public collection services would expand to meet future collection demands as required. Specific improvements and modifications and associated costs to the solid waste disposal program within the Mauka Area are not applicable.

Water Systems

The existing water distribution system within the Mauka Area and waterlines connected to off-site reservoirs are undersized to accommodate the projected domestic water and fire flow supply demands to the year 2030. Approximately 1.4 mile of waterline to offsite reservoirs and approximately 1.9 mile of on-site waterline are recommended to be replaced with larger waterlines. The improvements are summarized in the table below:

Table 16-3 Costs for Proposed Water Systems Improvements

Location	Crossing Thoroughfares (Street)	Proposed Water Improvements	Cost
Punchbowl 180 Reservoir (off-site)	South King	900 LF (18")×$200/LF	$ 180,000
Makiki 180 Reservoir (off-site)	South King	6,600 LF (18")×$200/LF	$1,320,000
Ala Moana Boulevard	Cooke / Kamakee	2,700 LF (18")×$400/LF	$1,080,000
Cooke Street	Pohukaina / Ala Moana Boulevard	1,000 LF (18")×$400/LF	$ 400,000
Kamakee Street	Kapiolani Boulevard / Ala Moana Boulevard	1,800 LF×$400/LF	$ 720,000
Kapiolani Boulevard	Kamakee / Piikoi	1,400 LF (18")×$200/LF	$ 280,000
South Street	Kapiolani Boulevard / Ala Moana Boulevard	2,900 LF (18")×$400/LF	$1,160,000
		Subtotal	**$5,140,000**

The estimated construction cost in 2008 dollars for the previously identified water system improvements is **$5.2 million.**

Approximately 96% of the existing waterlines installed within the Mauka Area are metal and susceptible to corrosion leading to waterline leaks and breaks. Differential settlement along an installed waterline may cause pipe joints to shift and leak. Based on BWS geographic information updated as of October 2008, a review of break occurrences and segment replacement history was conducted. The following table summarizes possible waterline segments which may need replacement:

Table 16-4 Cost Estimates for Possible Water Main Replacement Based On Condition Assessment

Street	Crossing Thoroughfares (Street)	Possible Water Main Replacement Size/Length	Cost
Ala Moana Boulevard	Ward Avenue / Kamakee	12" / 300 LF ×$90/LF	$ 27,000
Cooke	Kapiolani Boulevard / South King	8" / 400 LF ×$85/LF	$ 34,000
Kapiolani Boulevard	Ward Avenue / Kamakee	12" / 1,400 LF ×$90/LF	$126,000
Keawe	Auahi / Pohukaina	6" / 560 LF ×$80/LF	$ 44,800
Ward Avenue	Kapiolani Boulevard / South King	12" / 200 LF ×$90/LF	$ 18,000
		Subtotal	**$249,800**

The estimated construction cost in 2008 dollars for the recommended water main replacements based on condition assessment is **$0.3 million**.

Synthetic Natural Gas

The Gas Company evaluates each request for new gas service on a case by case basis as required. The gas system will upgraded as required. No site-specific recommendations and associated costs are applicable.

Electrical Power Systems

Based on the available existing plans of the Mauka Area electrical infrastructure, HECo. appears to have sufficient conduits to extend their 46-kV transmission cables underground from Archer Substation on the HECo. Ward Avenue compound to the proposed Cooke Street Substation. The 12.47-kV feeders emanating from the Cooke Street Substation would be connected to existing and new underground feeders to support the proposed development. The following table summarizes the proposed electrical power facilities improvements:

Table 16-5 Costs for Proposed Electrical Power Facilities Improvements

Street	Electrical Improvement	Cost
Ahui	12.47 kV Distribution	$ 260,000
Auahi	12.47 kV Distribution	$ 950,000.
Cummins	12.47 kV Distribution	$ 280,000
Halekauwila	12.47 kV Distribution	$ 420,000
Hopaka	12.47 kV Distribution	$ 580,000
Ilaniwai	46 kV and 12.47 kV Distribution	$ 1,610,000
Kamani	12.47 kV Distribution	$ 760,000
Kawaiahao	46 kV and 12.47 kV Distribution	$ 3,140,000
Keawe	12.47 kV Distribution	$ 240,000
Kona	12.47 kV Distribution	$ 440,000
Koula	12.47 kV Distribution	$ 440,000
Pensacola	12.47 kV Distribution	$ 360,000
Piikoi	46 kV and 12.47 kV Distribution	$ 1,000,000
Pohukaina	12.47 kV Distribution	$ 420,000
Queen *(Extension)*	46 kV and 12.47 kV Distribution	$ 1,340,000
Waimanu	46 kV and 12.47 kV Distribution	$ 3,530,000
	Subtotal	**$15,770,000**

The estimated construction cost in 2008 dollars for the proposed electrical power systems improvements is **$15.8 million**.

Telephone and Communications Systems

Similar to the electrical system, areas presently served by existing overhead facilities, consideration should be given to constructing underground duct systems and relocating the existing overhead conductors. This would have aesthetic benefits as well as continuing the streetscape improvements begun under the HCDA Improvement District projects. The proposed duct system for most areas presently served by overhead systems would consist of a minimum of four 4″ conduits and 5′×10.5′ manholes. Provision of separate underground facilities would lessen the possible congestion of HTCo. facilities by routing Oceanic cables separately from HTCo. cables. HTCo. would install a combination of fiber optic and copper cables. The fiber optic lines, in most cases, would be used by HTCo. as trunk facilities, while the copper cables provide telephone service to the buildings located along the route of the telephone ductlines. As mentioned in the previous section, HTCo. would place dedicated "pair-gain" units to serve large developments or would request easements on the large developments so that the "pair-gain" unit(s) could provide service to the large development as well as neighboring developments.

Based on the available existing plans of the Mauka Area telephone infrastructure, HTCo. appears to have sufficient conduits to extend additional service from their Alakea and Kakaako Central Offices to the Mauka Area. The following table summarizes the proposed telephone and communication systems improvements:

Table 16-6 Costs for Proposed Telephone and Communication Systems Improvements

Street	Cost
Ahui	$ 190,000
Auahi	$ 720,000
Cummins	$ 210,000
Halekauwila	$ 310,000
Hopaka	$ 440,000
Ilaniwai	$ 580,000
Kamani	$ 580,000
Kawaiahao	$1,200,000
Keawe	$ 175,000
Kona	$ 330,000
Koula	$ 330,000
Pensacola	$ 270,000
Piikoi	$ 340,000
Pohukaina	$ 310,000
Queen *(Extension)*	$ 460,000
Waimanu	$1,260,000
Subtotal	**$7,705,000**

The estimated construction cost in 2008 dollars for the proposed telephone and communication systems improvements is **$7.7 million**.

Cable Television Systems

Similar to the electrical and telephone systems, areas presently served by existing overhead facilities, consideration should be given to constructing underground duct systems and relocating the existing overhead conductors. This would have aesthetic benefits, as well as, continuing the streetscape improvements begun under the HCDA Improvement District projects. The proposed duct system for most areas presently served by overhead systems would consist of a minimum of two 4″ conduits and 3′×5′ or 2′×6′ handholes. Oceanic would install a combination of fiber optic and coaxial cables. The fiber optic lines, in most cases, would be used by Oceanic as trunk facilities, while the coaxial cables provide service to the buildings located along the route of the ductlines.

After the construction of the Oceanic ductline along Ala Moana Boulevard, Oceanic may be able to reconfigure its system to lessen the impact on the existing telephone ductlines constructed under the HCDA Kakaako Improvement District Nos. 1, 2 and 3. The following table summarizes the proposed cable television systems improvements:

Table 16-7 Costs for Proposed Cable Television Systems Improvements

Street	Cost
Ahui	$ 65,000
Auahi	$ 240,000
Cummins	$ 70,000
Halekauwila	$ 110,000
Hopaka	$ 150,000
Ilaniwai	$ 200,000
Kamani	$ 190,000
Kawaiahao	$ 380,000
Keawe	$ 60,000
Kona	$ 110,000
Koula	$ 110,000
Pensacola	$ 90,000
Piikoi	$ 120,000
Pohukaina	$ 110,000
Queen *(Extension)*	$ 160,000
Waimanu	$ 420,000
Subtotal	**$2,585,000**

The estimated construction cost in 2008 dollars for the proposed cable television systems improvements is **$2.6 million**.

Traffic Signal Systems

A regional study of the existing and project traffic flows should be performed to determine feasible traffic signal timing and coordination changes. These changes should then be implemented as a single construction package rather than installed piecemeal. The City DTS, which would review the proposed changes, should also be consulted as to the timetable for deployment of their intelligent transportation systems. The following table summarizes the proposed traffic signal systems improvements:

Table 16-8 Costs for Proposed Traffic Signal Systems Improvements

Street	Cost
Halekauwila / Cooke	$300,000
Pohukaina / Cooke	$300,000
Subtotal	**$600,000**

The estimated construction cost in 2008 dollars for the proposed traffic signal systems improvements is **$0.6 million**.

Roadway Street Light Systems

As the existing overhead utility lines are placed underground, the joint pole mounted street lights would be converted to conventional street lights on concrete foundations. Additional electrical metering locations may need to be sited in order to provide power to the street light systems. The following table summarizes the proposed roadway street light systems improvements:

Table 16-9 Costs for Proposed Roadway Street Light Systems Improvements

Street	Cost
Ahui	$ 130,000
Auahi	$ 480,000
Cummins	$ 140,000
Halekauwila	$ 210,000
Hopaka	$ 300,000
Ilaniwai	$ 390,000
Kamani	$ 380,000
Kawaiahao	$ 750,000
Keawe	$ 120,000
Kona	$ 220,000
Koula	$ 220,000
Pensacola	$ 180,000
Piikoi	$ 240,000
Pohukaina	$ 220,000
Queen *(Extension)*	$ 320,000
Waimanu	$ 840,000
Subtotal	**$5,140,000**

The estimated construction cost in 2008 dollars for the proposed roadway street light systems improvements is **$0.6 million**.

Roadways
Street and roadway improvements are designed to meet or exceed City design standards. Proposed street and roadway improvements include:

- AC pavement resurfacing;
- Widening and adjustment of ROW widths to conform with minimum City standards; and,
- Installation of concrete curbs, gutters, medians, planters and sidewalks, as applicable.

These improvements are summarized in the table below:

Table 16-10 Costs for Proposed Roadways Improvements

Roadway Improvement (Street)	Cost
Ala Moana Boulevard (widen 12′; planted median)	$ 3,760,000
Alohi Way	$ 450,000
Cummins	$ 1,300,000
Elm	$ 450,000
Halekauwila	$ 2,930,000
Hoolai	$ 450,000
Hopaka	$ 460,000
Ilaniwai	$ 640,000
Kamaile	$ 450,000
Kawaiahao	$ 1,490,000
Kona	$ 790,000
Laula Way	$ 270,000
Pensacola	$ 1,080,000
Piikoi	$ 1,240,000
Queen	$ 2,750,000
Rycroft	$ 450,000
Waimanu	$ 1,820,000
Subtotal	**$20,780,000**

The estimated construction cost in 2008 dollars for the proposed roadway improvements is **$20.8 million**.

Based upon field observations of existing cracking of the asphalt pavement within the Mauka Area, areas of possible pavement repair are recommended to extend the life of the pavement and mitigate formation of potholes. The estimated asphalt pavement patching repair costs based on the condition assessment of the pavement from visual observation are summarized in the table below:

Table 16-11 Cost Estimates for Possible Pavement Patching Repair Based On Condition Assessment

Street	Crossing Thoroughfares (Street)	Possible Pavement Patching Repair	Cost
Alohi Way	Near Piikoi	50′×100′ ×$8/SF	$ 40,000
Auahi	Kamani / Ward Avenue	50′x200′ x$8/SF	$ 80,000
Auahi	Kamakee	(50′x550′) + (6′x12′) x$8/SF	$ 220,580
Cooke	Auahi / Ala Moana Boulevard	(50′x500′) + (6′x6′) x$8/SF	$ 200,290
Coral	Halekauwila	25′x200′ x$8/SF	$ 40,000
Emily	Queen / Kawaiahao	50′×250′ ×$8/SF	$ 100,000
Halekauwila	Cooke	100′×100′ ×$8/SF	$ 80,000
Halekauwila	Ward Avenue	6′x6′ x$8/SF	$ 290
Hopaka	Piikoi	(40′x50′) + (6′x6′) x$8/SF	$ 16,290
Kamani	Auahi / Pohukaina	50′x200′ $8/SF	$ 80,000

Street	Crossing Thoroughfares (Street)	Possible Pavement Patching Repair	Cost
Kawaiahao	Emily / Curtis	50′×250′ ×$8/SF	$ 100,000
Kawaiahao	South King / Mission	50′×230′ ×$8/SF	$ 92,000
Kawaiahao	Diamond Head of Cooke	(50′x200′) + (50′x60′) x$8/SF	$ 104,000
Kawaiahao	*Ewa* of Cummins	50′×100′ ×$8/SF	$ 40,000
Keawe	Auahi	50′×200′ ×$8/SF	$ 80,000
Keawe	Pohukaina	50′×50′ ×$8/SF	$ 20,000
Kona	Pensacola / Piikoi	50′x500′ $8/SF	$ 200,000
Koula	Near Ala Moana Boulevard	(50′×120′) + (6′x12′) ×$8/SF	$ 48,580
Ohe	Pohukaina / Halekauwila	30′×400′ ×$8/SF	$ 96,000
Pensacola	Kona / Hoopaka	50′×150′ ×$8/SF	$ 60,000
Pensacola	Kapiolani Boulevard	50′×100′ ×$8/SF	$ 40,000
Pensacola	Kamaile	70′×100′ ×$8/SF	$ 56,000
Pensacola	Hoolai	70′×100′ ×$8/SF	$ 56,000
Pensacola	Elm	70′×100′ ×$8/SF	$ 56,000
Pensacola	Rycroft	70′×100′ ×$8/SF	$ 56,000
Pensacola	Alohi Way	70′×100′ ×$8/SF	$ 56,000
Reed Lane	Near South	50′×50′ ×$8/SF	$ 20,000
Rycroft	Laula Way	50′×50′ ×$8/SF	$ 20,000
South	Halekauwila	50′×50′ ×$8/SF	$ 20,000
Waimanu	Cummins / Kamakee	(50′×650′) + (6′x20′) ×$8/DF	$ 260,960
Waimanu	Ward Avenue	50′x100′ $8/SF	$ 40,000
Ward Avenue	Auahi	100′×100′ ×$8/SF	$ 80,000
Ward Avenue	Queen	100′×100′ ×$8/SF	$ 80,000
		Subtotal	**$2,538,990**

The estimated construction cost in 2008 dollars for the possible pavement patching repair is **$2.6 million**.

The overall total cost of improvements in 2008 dollars is **$112.4 million**.

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24. Hawaiian Telcom Co. system maps and comments received on 25 January 2008.

25. Oceanic Time Warner Cable system map received on 27 December 2007.

26. Email from Oceanic Time Warner Cable dated 14 January 2008.

27. Email from Hawaiian Electric Co. dated 27 February 2008.

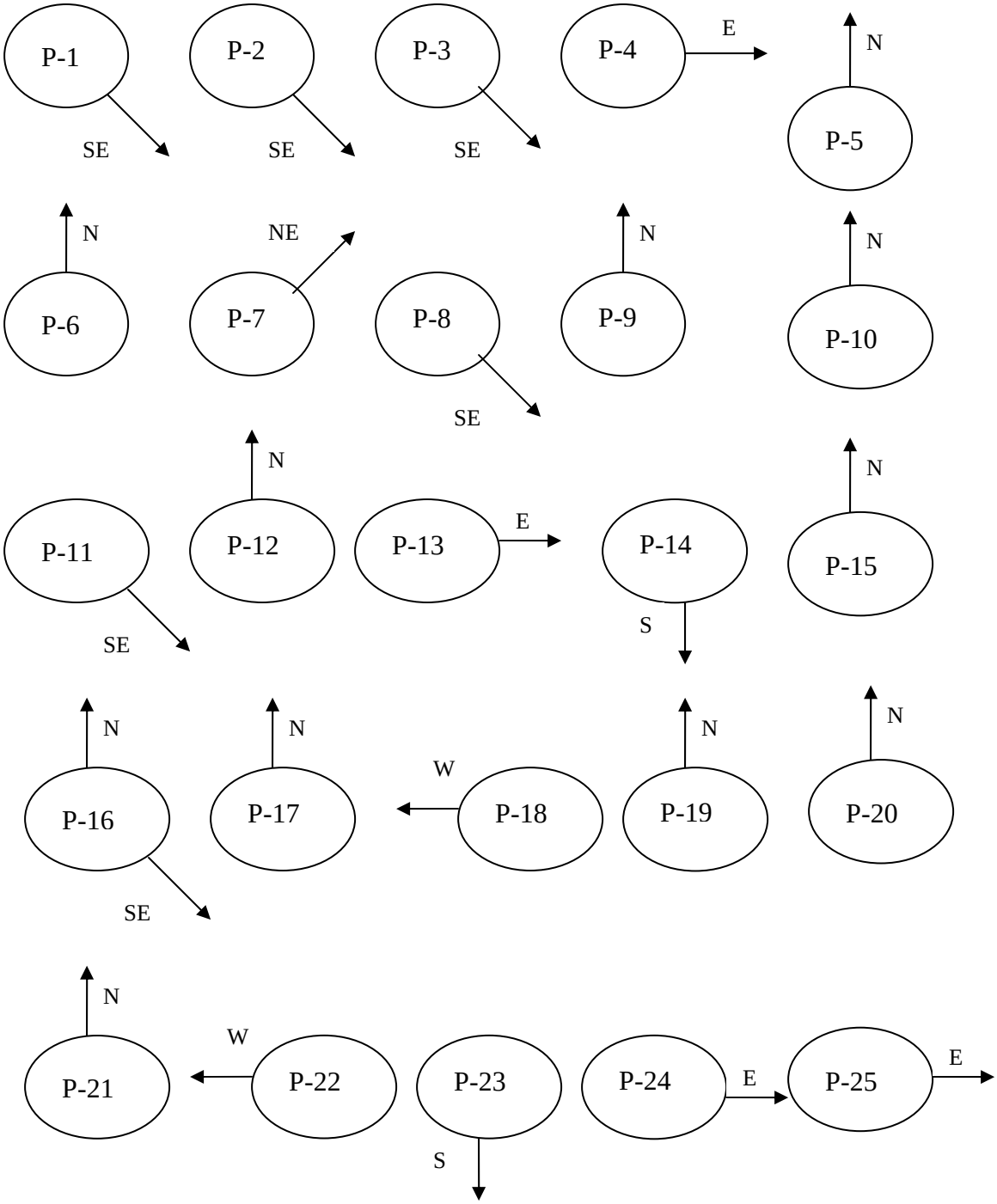
28. Hawaiian Electric Co. Adequacy of Supply Letter dated 16 January 2008.

APPENDIX A

PHOTOGRAPHS

APPENDIX A

PHOTO KEY MAP



APPENDIX A

PHOTOS

Photo P-1: Intersection of Keawe St. and Ala Moana Blvd. (1/7/08)

Photo P-2: Intersection of Keawe St. and Auahi St. (1/7/08)

Photo P-3: Intersection of Keawe St. and Pohukaina St. (1/7/08)

Photo P-4: Intersection of South St. and Halekauwila St. (1/7/08)

Photo P-5: Intersection of Ward Ave. and Kapiolani Blvd. (1/8/08)

Photo P-6: Intersection of Kamakee St. and Queen St. (1/8/08)

Photo P-7: Intersection of Pensacola St. and Hopaka St. (1/8/08)

Photo P-8: Intersection of Piikoi St. and Kapiolani Blvd. (1/9/08)

Photo P-9: Intersection of South St. and Ala Moana Blvd. (2/19/08)

Photo P-10: Intersection of Punchbowl St. and Ala Moana Blvd. (2/19/08)

Photo P-11: Intersection of Cooke St. and Ala Moana Blvd. (2/19/08)


Photo P-12: Intersection of Ward Ave. and Ala Moana Blvd. (2/19/08)

Photo P-13: Intersection of Kamakee St. and Auahi St. (2/19/08)


Photo P-14: Intersection of Ward Ave. and Auahi St. (2/19/08)

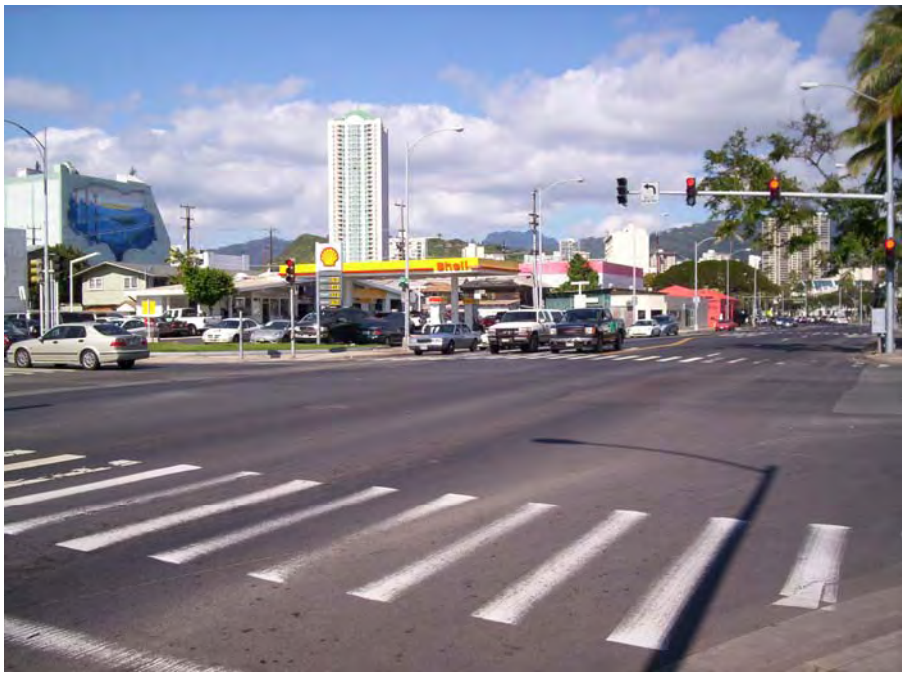


Photo P-15: Intersection of Ward Ave. and Queen St. (2/19/08)


Photo P-16: Intersection of Kamakee St. and Kapiolani Blvd. (2/19/08)

Photo P-17: Intersection of Pensacola St. and Kapiolani Blvd. (2/19/08)

Photo P-18: Intersection of Piikoi St. and Ala Moana Blvd. (2/19/08)

Photo P-19: Intersection of Piikoi St. and King St. (2/19/08)

Photo P-20: Intersection of Pensacola St. and King St. (2/19/08)

Photo P-21: Intersection of Ward Ave. and King St. (2/19/08)


Photo P-22: Intersection of Punchbowl St. and King St. (2/19/08)

Photo P-23: Intersection of South St., Kapiolani Blvd., and King St. (2/19/08)

Photo P-24: Intersection of Cooke St. and Kapiolani Blvd. (2/22/08)

Photo P-25: Intersection of Cooke St. and Queen St. (2/22/08)

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APPENDIX B

CALCULATIONS

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Water Demand Calculations

Year 2008 Population:

6,000 capita x 100gal / capita = 0.6 mgd

7.4 msf x 100gal / 1000SF = 0.74 mgd
1.34 mgd ave.

2.71ac x 4000gal / ac = 0.011mgd (Park)
1.351 mgd ave.

45.35ac x 4,000gal / ac = 0.181mgd (McKinley)
1.532 mgd ave.

Max daily demand = 1.5 x 1.532 = 2.298 mgd

Fire Flow = 4,000gpm x 24(60)min / day = 5.76 mgd

Max daily demand + Fire Flow = **8.058 mgd** (min. 20psi) ← **governs**

Peak Hour = 3.0 x 1.532 = 4.596 mgd (min. 40psi)

Year 2030 Population Projection:

20,000 units x 300gal / Unit = 6.0 mgd

9.6 msf x 100gal / 1000SF = 0.96 mgd
6.96 mgd ave.

2.71ac x 4000gal / ac = 0.011mgd (Park)
6.97 mgd ave.

45.35ac x 4,000gal / ac = 0.181mgd (McKinley)
7.15 mgd ave.

Max daily demand = 1.5 x 7.15 = 10.73mgd

Fire Flow = 4,000gpm x 24(60)min / day = 5.76 mgd

Max daily demand + Fire Flow = 16.49 mgd (min. 20psi)

Peak Hour = 3.0 x 7.15 = **21.45mgd** (min. 40psi) ← **governs**

KAKAAKO COMMUNITY DEVELOPMENT DISTRICT
MAUKA AREA INFRASTRUCTURE PLAN
EXISTING SEWER

DOWN_MH	UP_MH	DES_Q_PEAK	SIZE	SLOPE	VELOCITY	CAPACITY	PCT_CAP	BASE_RATE	DWI_RATE	WWI_RATE	LINE_BASE	LINE_DWI	LINE_WWI	BASINNAME
SI21AC0000	SI21AC3036	110.6298	78	0.0005	3.445	73.8798	149.7	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0018	01A01
SI21AC3001	SI21AC3004	89.7567	78	0.0005	3.634	77.9236	115.2	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0029	01A01
SI21AC3004	SI21AC3010	89.6973	78	0.0005	3.639	78.0375	114.9	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0032	01A01
SI21AC3010	SI21AC3015	83.9522	78	0.0005	3.663	78.5556	106.9	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0017	01A01
SI21AC3015	SI21AC3019	83.9504	78	0.0005	3.700	79.3461	105.8	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0039	01A01
SI21AC3019	SI21AC3038	83.9466	78	0.0006	3.769	80.8300	103.9	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0010	01A01
SI21AC3036	SI21AC3000	92.9140	78	0.0005	3.499	75.0265	123.8	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0042	01A01
SI21AC3038	SI21AC3039	83.9455	78	0.0005	3.652	78.3233	107.2	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0038	01A01
SI21AC4120	SI21AC0109	38.3148	69	0.0002	2.233	37.4699	102.3	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0040	01A01
SI21AC0184	SI21AC0263	83.3466	60	0.0016	5.299	67.2416	124.0	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0042	01A01
SI21AC0263	SI21AC0330	83.3424	60	0.0016	5.298	67.2264	124.0	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0036	01A01
SI21AC0330	SI21AC0333	83.3388	60	0.0016	5.322	67.5280	123.4	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0045	01A01
SI21AC0333	SI21AC0338	83.3343	60	0.0016	5.299	67.2410	123.9	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0048	01A01
SI21AC0541	SI21AC0184	83.3503	60	0.0016	5.328	67.6130	123.3	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0037	01A01
SI21AD0700	SI21AD0701	63.1557	60	0.0011	4.382	55.6044	113.6	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0011	01B02A
SI21AD0701	SI21AD0702	63.1546	60	0.0011	4.396	55.7819	113.2	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0015	01B02A
SI21AD0702	SI21AD0703	63.1531	60	0.0011	4.387	55.6638	113.5	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0009	01B02A
SI21AD0703	SI21AD0711	63.1523	60	0.0011	4.309	54.6818	115.5	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0016	01B02A
SI21AD0711	SI21AD0712	62.6943	60	0.0011	4.411	55.9762	112.0	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0017	01B02A
SI21AD0712	SI21AF0600	62.6578	60	0.0011	4.394	55.7576	112.4	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0020	01B02A
SI21AF0600	SI21AF0602	62.6235	60	0.0011	4.394	55.7560	112.3	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0015	01B02A
SI21AJ0915	SI21AD0700	63.5053	60	0.0011	4.395	55.7645	113.9	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0013	01B02A
SI21AJ0916	SI21AJ0915	69.4473	60	0.0011	4.409	55.9511	124.1	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0013	01B02A
SI21AJ0917	SI21AJ0916	69.4480	60	0.0011	4.398	55.8134	124.4	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0007	01B02A
SI21AJ0920	SI21AJ0921	71.4581	60	0.0012	4.590	58.2464	122.7	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0009	01B02A
SI21AJ0921	SI21AJ0922	71.4572	60	0.0018	5.601	71.0715	100.5	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0009	01B02A
SI21AJ0922	SI21AJ0924	71.4390	60	0.0017	5.423	68.8183	103.8	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0006	01B02A
SI21AJ0924	SI21AJ0925	69.4812	60	0.0014	4.946	62.7644	110.7	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0010	01B02A
SI21AJ0925	SI21AJ0926	69.4509	60	0.0014	4.983	63.2378	109.8	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0004	01B02A
SI21AJ0926	SI21AJ0927	69.4506	60	0.0011	4.489	56.9600	121.9	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0010	01B02A
SI21AJ0927	SI21AJ0918	69.4495	60	0.0010	4.222	53.5775	129.6	31.7750	36.9000	1225.4660	0.0000	0.0000	0.0010	01B02A
SI21AC0108	SI21AC0110	12.6929	36	0.0005	2.124	9.7044	130.8	29.4746	56.7200	6613.1476	0.0064	0.0123	0.0133	01A01
SI21AC0110	SI21AC0120	12.1931	36	0.0005	2.176	9.9383	122.7	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0014	01A01
SI21AC0120	SI21AC0121	12.1917	36	0.0005	2.090	9.5476	127.7	29.4746	56.7200	6613.1476	0.0022	0.0043	0.0093	01A01
SI21AC0121	SI21AC0122	12.1743	36	0.0005	2.064	9.4268	129.1	29.4746	56.7200	6613.1476	0.0026	0.0050	0.0078	01A01
SI21AC0122	SI21AC0123	12.1571	36	0.0005	2.158	9.8588	123.3	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0020	01A01
SI21AC0123	SI21AC9123	11.3899	36	0.0005	2.061	9.4145	121.0	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0020	01A01
SI21AC3037	SI21AQ0002	19.7595	36	0.0014	3.538	16.1645	122.2	103.1796	56.1252	31652.9925	0.0000	0.0000	0.0052	01A02
SI21AC9123	SI21AJ0002	11.3879	36	0.0004	1.974	9.0156	126.3	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0019	01A01
SI21AF0604	SI21AF0009	21.0881	36	0.0015	3.655	16.6946	126.3	34.1047	11.6455	17757.1734	0.0095	0.0032	0.0661	01B03A
SI21AJ0002	SI21AJ1002	11.3860	36	0.0002	1.460	6.6712	170.7	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0007	01A01
SI21AJ0004	SI21AJ0005	13.3450	36	0.0008	2.584	11.8049	113.0	29.4746	56.7200	6613.1476	0.0011	0.0021	0.0034	01A01
SI21AJ0005	SI21AJ0006	13.3376	36	0.0005	2.106	9.6202	138.6	29.4746	56.7200	6613.1476	0.0043	0.0083	0.0091	01A01
SI21AJ0006	SI21AJ0007	13.3128	36	0.0005	2.165	9.8890	134.6	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0016	01A01

KAKAAKO COMMUNITY DEVELOPMENT DISTRICT
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DOWN_MH	UP_MH	DES_Q_PEAK	SIZE	SLOPE	VELOCITY	CAPACITY	PCT_CAP	BASE_RATE	DWI_RATE	WWI_RATE	LINE_BASE	LINE_DWI	LINE_WWI	BASINNAME
SI21AJ0007	SI21AJ0008	13.3112	36	0.0005	2.110	9.6386	138.1	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0017	01A01
SI21AJ0008	SI21AJ0009	13.3095	36	0.0005	2.110	9.6386	138.1	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0017	01A01
SI21AJ0009	SI21AJ0010	13.3078	36	0.0005	2.152	9.8306	135.4	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0018	01A01
SI21AJ0010	SI21AJ0012	12.9410	36	0.0005	2.086	9.5290	135.8	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0017	01A01
SI21AJ0012	SI21AJ0013	12.9392	36	0.0005	2.078	9.4915	136.3	29.4746	56.7200	6613.1476	0.0000	0.0000	0.0014	01A01
SI21AJ0013	SI21AJ0014	12.5991	36	0.0005	2.190	10.0049	125.9	39.4401	113.9916	17682.4500	0.0031	0.0090	0.0117	01D01
SI21AJ0014	SI21AJ0015	12.5731	36	0.0005	2.089	9.5408	131.8	39.4401	113.9916	17682.4500	0.0125	0.0360	0.0455	01D01
SI21AJ0019	SI21AJ0020	11.9548	36	0.0005	2.110	9.6386	124.0	39.4401	113.9916	17682.4500	0.0006	0.0017	0.0033	01D01
SI21AJ0020	SI21AJ0021	11.8286	36	0.0005	2.127	9.7183	121.7	39.4401	113.9916	17682.4500	0.0026	0.0074	0.0136	01D01
SI21AJ0021	SI21AJ0950	11.6969	36	0.0003	1.509	6.8926	169.7	39.4401	113.9916	17682.4500	0.0036	0.0104	0.0195	01D01
SI21AJ0100	SI21AJ0102	13.0817	36	0.0005	2.072	9.4666	138.2	39.4401	113.9916	17682.4500	0.0032	0.0091	0.0172	01D01
SI21AJ0102	SI21AJ1166	12.6064	36	0.0005	2.101	9.5959	131.4	39.4401	113.9916	17682.4500	0.0050	0.0145	0.0385	01D01
SI21AJ0166	SI21AJ0232	11.9836	36	0.0005	2.054	9.3816	127.7	39.4401	113.9916	17682.4500	0.0108	0.0311	0.0204	01D01
SI21AJ0232	SI21AJ0233	11.3971	36	0.0005	2.122	9.6916	117.6	39.4401	113.9916	17682.4500	0.0000	0.0000	0.0081	01D01
SI21AJ0233	SI21AJ0234	11.3890	36	0.0005	2.103	9.6087	118.5	39.4401	113.9916	17682.4500	0.0195	0.0563	0.0579	01D01
SI21AJ0234	SI21AJ0235	11.2416	36	0.0005	2.118	9.6765	116.2	39.4401	113.9916	17682.4500	0.0019	0.0055	0.0133	01D01
SI21AJ0235	SI21AJ9500	11.0385	36	0.0004	1.827	8.3473	132.2	39.4401	113.9916	17682.4500	0.0026	0.0076	0.0102	01D01
SI21AJ0241	SI21AJ0242	11.0006	36	0.0006	2.311	10.5586	104.2	39.4401	113.9916	17682.4500	0.0000	0.0000	0.0011	01D01
SI21AJ0242	SI21AJ0262	9.6540	36	0.0005	2.073	9.4702	101.9	39.4401	113.9916	17682.4500	0.0025	0.0072	0.0187	01D01
SI21AJ0263	SI21AJ0264	9.2902	36	0.0004	1.971	9.0021	103.2	39.4401	113.9916	17682.4500	0.0007	0.0022	0.0097	01D01
SI21AJ1166	SI21AJ0166	11.9839	36	0.0007	2.449	11.1896	107.1	39.4401	113.9916	17682.4500	0.0000	0.0000	0.0003	01D01
SI21AJ9500	SI21AJ0241	11.0162	36	0.0005	2.110	9.6386	114.3	39.4401	113.9916	17682.4500	0.0013	0.0038	0.0096	01D01
SI21AQ0002	SI21AQ0003	19.7543	36	0.0006	2.359	10.7763	183.3	103.1796	56.1252	31652.9925	0.0000	0.0000	0.0052	01A02
SI21AQ0003	SI21AQ0004	19.6588	36	0.0006	2.294	10.4800	187.6	103.1796	56.1252	31652.9925	0.0770	0.0419	0.0940	01A02
SI21AQ0004	SI21AQ0005	19.3958	34	0.0006	2.280	9.2916	208.7	103.1796	56.1252	31652.9925	0.0185	0.0101	0.0267	01A02
SI21AQ0005	SI21AQ0006	19.3284	34	0.0007	2.316	9.4372	204.8	103.1796	56.1252	31652.9925	0.0652	0.0354	0.1345	01A02
SI21AQ0006	SI21AQ0007	19.0505	34	0.0006	2.221	9.0494	210.5	103.1796	56.1252	31652.9925	0.0144	0.0078	0.0511	01A02
SI21AQ0007	SI21AQ0011	18.3767	34	0.0006	2.152	8.7698	209.5	103.1796	56.1252	31652.9925	0.0144	0.0078	0.0501	01A02
SI21AQ0011	SI21AQ0017	17.9123	32	0.0008	2.426	8.7577	204.5	103.1796	56.1252	31652.9925	0.0565	0.0308	0.2590	01A02
SI21AQ0017	SI21AQ0018	17.5278	32	0.0006	2.173	7.8443	223.4	103.1796	56.1252	31652.9925	0.0069	0.0037	0.0750	01A02
SI21AQ0018	SI21AQ0019	17.4375	32	0.0007	2.337	8.4367	206.7	103.1796	56.1252	31652.9925	0.0051	0.0028	0.0314	01A02
SI21AQ0019	SI21AQ0049	15.2619	32	0.0007	2.252	8.1298	187.7	103.1796	56.1252	31652.9925	0.0129	0.0070	0.0482	01A02
SI21AQ0049	SI21AQ0050	13.6728	32	0.0006	2.116	7.6366	179.0	103.1796	56.1252	31652.9925	0.0000	0.0000	0.0007	01A02
SI21AC0157	SI21AC0160	6.2112	24	0.0012	2.502	5.0791	122.3	41.9855	51.0146	21973.8905	0.0000	0.0000	0.0082	01A03
SI21AC0160	SI21AC0195	6.0637	24	0.0012	2.503	5.0821	119.3	41.9855	51.0146	21973.8905	0.0012	0.0014	0.0112	01A03
SI21AC0192	SI21AC0247	6.0033	24	0.0012	2.507	5.0908	117.9	41.9855	51.0146	21973.8905	0.0043	0.0052	0.0316	01A03
SI21AC0194	SI21AC0192	6.0132	24	0.0012	2.470	5.0147	119.9	41.9855	51.0146	21973.8905	0.0000	0.0000	0.0099	01A03
SI21AC0195	SI21AC0194	6.0485	24	0.0012	2.493	5.0607	119.5	41.9855	51.0146	21973.8905	0.0041	0.0050	0.0215	01A03
SI21AC0247	SI21AC0269	5.7408	24	0.0012	2.505	5.0854	112.9	41.9855	51.0146	21973.8905	0.0010	0.0012	0.0106	01A03
SI21AC1157	SI21AC0157	6.2185	24	0.0012	2.491	5.0581	122.9	41.9855	51.0146	21973.8905	0.0000	0.0000	0.0073	01A03

KAKAAKO COMMUNITY DEVELOPMENT DISTRICT
MAUKA AREA INFRASTRUCTURE PLAN
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DOWN_MH	UP_MH	DES_Q_PEAK	SIZE	SLOPE	VELOCITY	CAPACITY	PCT_CAP	BASE_RATE	DWI_RATE	WWI_RATE	LINE_BASE	LINE_DWI	LINE_WWI	BASINNAME	RECOMMEND
SI21AC0000	SI21AC3036	113.0056	78	0.0005	3.445	73.8798	153.0	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0018	01A01	96
SI21AC3001	SI21AC3004	94.0789	78	0.0005	3.634	77.9236	120.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0029	01A01	90
SI21AC3004	SI21AC3010	94.0174	78	0.0005	3.639	78.0375	120.5	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0032	01A01	90
SI21AC3010	SI21AC3015	87.8842	78	0.0005	3.663	78.5556	111.9	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0017	01A01	84
SI21AC3015	SI21AC3019	87.8825	78	0.0005	3.700	79.3461	110.8	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0039	01A01	84
SI21AC3019	SI21AC3038	87.8786	78	0.0006	3.769	80.8300	108.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0010	01A01	84
SI21AC3036	SI21AC3000	96.5771	78	0.0005	3.499	75.0265	128.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0042	01A01	90
SI21AC3038	SI21AC3039	87.8776	78	0.0005	3.652	78.3233	112.2	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0038	01A01	84
SI21AC4120	SI21AC0109	41.6111	69	0.0002	2.233	37.4699	111.1	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0040	01A01	72
SI21AC0184	SI21AC0263	87.2365	60	0.0016	5.299	67.2416	129.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0042	01A01	66
SI21AC0263	SI21AC0330	87.2323	60	0.0016	5.298	67.2264	129.8	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0036	01A01	66
SI21AC0330	SI21AC0333	87.2288	60	0.0016	5.322	67.5280	129.2	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0045	01A01	66
SI21AC0333	SI21AC0338	87.2242	60	0.0016	5.299	67.2410	129.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0048	01A01	66
SI21AC0541	SI21AC0184	87.2403	60	0.0016	5.328	67.6130	129.0	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0037	01A01	66
SI21AD0700	SI21AD0701	65.7333	60	0.0011	4.382	55.6044	118.2	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0011	01B02A	66
SI21AD0701	SI21AD0702	65.7323	60	0.0011	4.396	55.7819	117.8	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0015	01B02A	66
SI21AD0702	SI21AD0703	65.7308	60	0.0011	4.387	55.6638	118.1	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0009	01B02A	66
SI21AD0703	SI21AD0711	65.7299	60	0.0011	4.309	54.6818	120.2	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0016	01B02A	66
SI21AD0711	SI21AD0712	65.2948	60	0.0011	4.411	55.9762	116.6	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0017	01B02A	66
SI21AD0712	SI21AF0600	65.2603	60	0.0011	4.394	55.7576	117.0	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0020	01B02A	66
SI21AF0600	SI21AF0602	65.2310	60	0.0011	4.394	55.7560	117.0	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0015	01B02A	66
SI21AJ0915	SI21AD0700	66.1558	60	0.0011	4.395	55.7645	118.6	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0013	01B02A	66
SI21AJ0916	SI21AJ0915	72.9209	60	0.0011	4.409	55.9511	130.3	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0013	01B02A	66
SI21AJ0917	SI21AJ0916	72.9216	60	0.0011	4.398	55.8134	130.7	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0007	01B02A	66
SI21AJ0920	SI21AJ0921	75.1006	60	0.0012	4.590	58.2464	128.9	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0009	01B02A	66
SI21AJ0921	SI21AJ0922	75.0997	60	0.0018	5.601	71.0715	105.7	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0009	01B02A	66
SI21AJ0922	SI21AJ0924	75.0832	60	0.0017	5.423	68.8183	109.1	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0006	01B02A	66
SI21AJ0924	SI21AJ0925	72.9707	60	0.0014	4.946	62.7644	116.3	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0010	01B02A	66
SI21AJ0925	SI21AJ0926	72.9245	60	0.0014	4.983	63.2378	115.3	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0004	01B02A	66
SI21AJ0926	SI21AJ0927	72.9242	60	0.0011	4.489	56.9600	128.0	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0010	01B02A	66
SI21AJ0927	SI21AJ0918	72.9231	60	0.0010	4.222	53.5775	136.1	29.1604	32.8054	1225.4660	0.0000	0.0000	0.0010	01B02A	66
SI21AC0108	SI21AC0110	13.7043	36	0.0005	2.124	9.7044	141.2	18.1869	23.3977	6604.0547	0.0085	0.0109	0.0133	01A01	42
SI21AC0110	SI21AC0120	13.1352	36	0.0005	2.176	9.9383	132.2	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0014	01A01	42
SI21AC0120	SI21AC0121	13.1338	36	0.0005	2.090	9.5476	137.6	18.1869	23.3977	6604.0547	0.0014	0.0018	0.0093	01A01	42
SI21AC0121	SI21AC0122	13.1204	36	0.0005	2.064	9.4268	139.2	18.1869	23.3977	6604.0547	0.0146	0.0187	0.0078	01A01	42
SI21AC0122	SI21AC0123	13.0697	36	0.0005	2.158	9.8588	132.6	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0019	01A01	42
SI21AC0123	SI21AC9123	12.4620	36	0.0005	2.061	9.4145	132.4	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0020	01A01	42
SI21AC3037	SI21AQ0002	18.2295	36	0.0014	3.538	16.1645	112.8	46.2234	33.5247	31652.9925	0.0000	0.0000	0.0052	01A02	42
SI21AC9123	SI21AJ0002	12.4600	36	0.0004	1.974	9.0156	138.2	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0019	01A01	42
SI21AF0604	SI21AF0009	21.3427	36	0.0015	3.655	16.6946	127.8	36.7169	12.7711	17757.1734	0.0102	0.0036	0.0661	01B03A	42
SI21AJ0002	SI21AJ1002	12.4581	36	0.0002	1.460	6.6712	186.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0007	01A01	48
SI21AJ0004	SI21AJ0005	15.0464	36	0.0008	2.584	11.8049	127.5	18.1869	23.3977	6604.0547	0.0014	0.0018	0.0034	01A01	42
SI21AJ0005	SI21AJ0006	15.0388	36	0.0005	2.106	9.6202	156.3	18.1869	23.3977	6604.0547	0.0057	0.0074	0.0091	01A01	48
SI21AJ0006	SI21AJ0007	15.0130	36	0.0005	2.165	9.8890	151.8	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0016	01A01	48
SI21AJ0007	SI21AJ0008	15.0114	36	0.0005	2.110	9.6386	155.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0017	01A01	48
SI21AJ0008	SI21AJ0009	15.0097	36	0.0005	2.110	9.6386	155.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0017	01A01	48
SI21AJ0009	SI21AJ0010	15.0080	36	0.0005	2.152	9.8306	152.7	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0018	01A01	48
SI21AJ0010	SI21AJ0012	14.6632	36	0.0005	2.086	9.5290	153.9	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0017	01A01	48

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DOWN_MH	UP_MH	DES_Q_PEAK	SIZE	SLOPE	VELOCITY	CAPACITY	PCT_CAP	BASE_RATE	DWI_RATE	WWI_RATE	LINE_BASE	LINE_DWI	LINE_WWI	BASINNAME	RECOMMEND
SI21AJ0012	SI21AJ0013	14.6615	36	0.0005	2.078	9.4915	154.5	18.1869	23.3977	6604.0547	0.0000	0.0000	0.0014	01A01	48
SI21AJ0013	SI21AJ0014	14.2940	36	0.0005	2.190	10.0049	142.9	32.2828	65.3934	17682.4500	0.0055	0.0111	0.0117	01D01	48
SI21AJ0014	SI21AJ0015	14.2623	36	0.0005	2.089	9.5408	149.5	32.2828	65.3934	17682.4500	0.0219	0.0443	0.0455	01D01	48
SI21AJ0019	SI21AJ0020	12.7543	36	0.0005	2.110	9.6386	132.3	32.2828	65.3934	17682.4500	0.0010	0.0021	0.0033	01D01	42
SI21AJ0020	SI21AJ0021	12.5788	36	0.0005	2.127	9.7183	129.4	32.2828	65.3934	17682.4500	0.0045	0.0091	0.0136	01D01	42
SI21AJ0021	SI21AJ0950	12.4224	36	0.0003	1.509	6.8926	180.2	32.2828	65.3934	17682.4500	0.0063	0.0128	0.0195	01D01	48
SI21AJ0100	SI21AJ0102	13.8229	36	0.0005	2.072	9.4666	146.0	32.2828	65.3934	17682.4500	0.0026	0.0052	0.0172	01D01	42
SI21AJ0102	SI21AJ1166	13.3312	36	0.0005	2.101	9.5959	138.9	32.2828	65.3934	17682.4500	0.0140	0.0284	0.0385	01D01	42
SI21AJ0166	SI21AJ0232	12.4973	36	0.0005	2.054	9.3816	133.2	32.2828	65.3934	17682.4500	0.0088	0.0178	0.0204	01D01	42
SI21AJ0232	SI21AJ0233	11.8326	36	0.0005	2.122	9.6916	122.1	32.2828	65.3934	17682.4500	0.0008	0.0016	0.0081	01D01	42
SI21AJ0233	SI21AJ0234	11.8215	36	0.0005	2.103	9.6087	123.0	32.2828	65.3934	17682.4500	0.0165	0.0334	0.0579	01D01	42
SI21AJ0234	SI21AJ0235	11.7030	36	0.0005	2.118	9.6765	120.9	32.2828	65.3934	17682.4500	0.0016	0.0032	0.0133	01D01	42
SI21AJ0235	SI21AJ9500	11.5360	36	0.0004	1.827	8.3473	138.2	32.2828	65.3934	17682.4500	0.0022	0.0044	0.0102	01D01	42
SI21AJ0241	SI21AJ0242	11.5043	36	0.0006	2.311	10.5586	109.0	32.2828	65.3934	17682.4500	0.0000	0.0000	0.0011	01D01	42
SI21AJ0242	SI21AJ0262	10.3125	36	0.0005	2.073	9.4702	108.9	32.2828	65.3934	17682.4500	0.0040	0.0081	0.0187	01D01	42
SI21AJ0262	SI21AJ0263	10.0587	36	0.0005	2.110	9.6386	104.4	32.2828	65.3934	17682.4500	0.0057	0.0115	0.0294	01D01	42
SI21AJ0263	SI21AJ0264	10.0084	36	0.0004	1.971	9.0021	111.2	32.2828	65.3934	17682.4500	0.0006	0.0012	0.0097	01D01	42
SI21AJ1166	SI21AJ0166	12.4977	36	0.0007	2.449	11.1896	111.7	32.2828	65.3934	17682.4500	0.0000	0.0000	0.0003	01D01	42
SI21AJ9500	SI21AJ0241	11.5179	36	0.0005	2.110	9.6386	119.5	32.2828	65.3934	17682.4500	0.0011	0.0022	0.0096	01D01	42
SI21AQ0002	SI21AQ0003	18.2243	36	0.0006	2.359	10.7763	169.1	46.2234	33.5247	31652.9925	0.0000	0.0000	0.0052	01A02	48
SI21AQ0003	SI21AQ0004	18.1038	36	0.0006	2.294	10.4800	172.7	46.2234	33.5247	31652.9925	0.1533	0.1112	0.0940	01A02	48
SI21AQ0004	SI21AQ0005	17.6333	34	0.0006	2.280	9.2916	189.8	46.2234	33.5247	31652.9925	0.1094	0.0793	0.0267	01A02	48
SI21AQ0005	SI21AQ0006	17.3366	34	0.0007	2.316	9.4372	183.7	46.2234	33.5247	31652.9925	0.1303	0.0945	0.1345	01A02	42
SI21AQ0006	SI21AQ0007	16.8788	34	0.0006	2.221	9.0494	186.5	46.2234	33.5247	31652.9925	0.0065	0.0047	0.0511	01A02	48
SI21AQ0007	SI21AQ0011	16.2874	34	0.0006	2.152	8.7698	185.7	46.2234	33.5247	31652.9925	0.0065	0.0047	0.0501	01A02	42
SI21AQ0011	SI21AQ0017	15.9956	32	0.0008	2.426	8.7577	182.6	46.2234	33.5247	31652.9925	0.0184	0.0133	0.2590	01A02	42
SI21AQ0017	SI21AQ0018	15.6907	32	0.0006	2.173	7.8443	200.0	46.2234	33.5247	31652.9925	0.0048	0.0035	0.0750	01A02	42
SI21AQ0018	SI21AQ0019	15.6037	32	0.0007	2.337	8.4367	185.0	46.2234	33.5247	31652.9925	0.0422	0.0306	0.0314	01A02	42
SI21AQ0019	SI21AQ0049	13.8114	32	0.0007	2.252	8.1298	169.9	46.2234	33.5247	31652.9925	0.0871	0.0631	0.0482	01A02	42
SI21AQ0049	SI21AQ0050	12.0327	32	0.0006	2.116	7.6366	157.6	46.2234	33.5247	31652.9925	0.0000	0.0000	0.0007	01A02	42
SI21AC0157	SI21AC0160	6.7707	24	0.0012	2.502	5.0791	133.3	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0082	01A03	30
SI21AC0160	SI21AC0195	6.5520	24	0.0012	2.503	5.0821	128.9	45.7268	39.7472	21973.8905	0.0028	0.0024	0.0112	01A03	30
SI21AC0192	SI21AC0247	6.4651	24	0.0012	2.507	5.0908	127.0	45.7268	39.7472	21973.8905	0.0133	0.0116	0.0316	01A03	30
SI21AC0194	SI21AC0192	6.4833	24	0.0012	2.470	5.0147	129.3	45.7268	39.7472	21973.8905	0.0029	0.0025	0.0099	01A03	30
SI21AC0195	SI21AC0194	6.5327	24	0.0012	2.493	5.0607	129.1	45.7268	39.7472	21973.8905	0.0096	0.0084	0.0215	01A03	30
SI21AC0247	SI21AC0269	6.0860	24	0.0012	2.505	5.0854	119.7	45.7268	39.7472	21973.8905	0.0022	0.0019	0.0106	01A03	27
SI21AC1157	SI21AC0157	6.7780	24	0.0012	2.491	5.0581	134.0	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0073	01A03	30
SI21AC0269	SI21AC0310	5.6882	21	0.0020	2.929	4.5523	125.0	45.7268	39.7472	21973.8905	0.0027	0.0024	0.0115	01A03	24
SI21AC0295	SI21AC0350	5.5751	18	0.0018	2.172	2.4807	224.7	45.7268	39.7472	21973.8905	0.0076	0.0066	0.0199	01A03	24
SI21AC0297	SI21AC0295	5.5813	18	0.0056	3.861	4.4098	126.6	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0062	01A03	21
SI21AC0299	SI21AC0297	5.5875	18	0.0056	3.852	4.3992	127.0	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0062	01A03	21
SI21AC0300	SI21AC0299	5.5945	18	0.0045	3.462	3.9538	141.5	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0070	01A03	21
SI21AC0341	SI21AJ0368	4.5748	18	0.0018	2.184	2.4946	183.4	45.7268	39.7472	21973.8905	0.0325	0.0283	0.2539	01A03	21
SI21AC0344	SI21AC0341	4.5776	18	0.0018	2.183	2.4937	183.6	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0028	01A03	21
SI21AC0346	SI21AC0344	4.8419	18	0.0006	1.225	1.3988	346.2	45.7268	39.7472	21973.8905	0.0108	0.0093	0.0270	01A03	27
SI21AC0347	SI21AC0346	5.0244	18	0.0020	2.312	2.6409	190.3	45.7268	39.7472	21973.8905	0.0310	0.0269	0.0892	01A03	24
SI21AC0350	SI21AC1347	5.2631	18	0.0020	2.282	2.6063	201.9	45.7268	39.7472	21973.8905	0.0154	0.0134	0.0404	01A03	24
SI21AJ0367	SI21AJ0366	3.8430	18	0.0016	2.061	2.3534	163.3	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0007	01A03	21

KAKAAKO COMMUNITY DEVELOPMENT DISTRICT
MAUKA AREA INFRASTRUCTURE PLAN
FUTURE SEWER

DOWN_MH	UP_MH	DES_Q_PEAK	SIZE	SLOPE	VELOCITY	CAPACITY	PCT_CAP	BASE_RATE	DWI_RATE	WWI_RATE	LINE_BASE	LINE_DWI	LINE_WWI	BASINNAME	RECOMMEND
SI21AJ0368	SI21AJ0367	4.2217	18	0.0018	2.213	2.5271	167.1	45.7268	39.7472	21973.8905	0.0205	0.0178	0.0762	01A03	21
SI21AJ0360	SI21AJ0359	2.8297	16	0.0018	2.002	1.8061	156.7	45.7268	39.7472	21973.8905	0.0077	0.0067	0.0261	01A03	21
SI21AJ0361	SI21AJ0360	2.8681	16	0.0018	2.029	1.8306	156.7	45.7268	39.7472	21973.8905	0.0056	0.0049	0.0206	01A03	21
SI21AJ0363	SI21AJ0361	2.9438	16	0.0017	1.990	1.7958	163.9	45.7268	39.7472	21973.8905	0.0000	0.0000	0.0018	01A03	21
SI21AJ0364	SI21AJ0363	3.0163	16	0.0018	2.025	1.8270	165.1	45.7268	39.7472	21973.8905	0.0109	0.0095	0.0381	01A03	21
SI21AJ0365	SI21AJ0364	3.1917	16	0.0018	2.025	1.8270	174.7	45.7268	39.7472	21973.8905	0.0112	0.0097	0.1403	01A03	21
SI21AJ0366	SI21AJ0365	3.6879	16	0.0018	2.025	1.8275	201.8	45.7268	39.7472	21973.8905	0.0242	0.0210	0.4208	01A03	21

APPENDIX C

COST ESTIMATES

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Kakaako Mauka Area Master Plan
Drainage Cost Estimate

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
1	**Waimanu Street between Ward Ave. and Kamakee St.**				
	Resurface Pavement	3830	SY	$ 100.00	$ 383,000.00
2	**Cummins Street between Waimanu St. and Queen St.**				
	Resurface Pavement	1560	SY	$ 100.00	$ 156,000.00
3	**Hopaka Street between Kona St. and Pensacola St.**				
	Resurface Pavement	1710	SY	$ 100.00	$ 171,000.00
4	**Kona Street between Kamakee St. and Piikoi St.**				
	Resurface Pavement	4360	SY	$ 100.00	$ 436,000.00
	Total Drainage System				**$ 1,146,000.00**

Kakaako Mauka Area Master Plan
Sewer Cost Estimate

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE		COST
1	**Ala Moana Trunk Sewer**					
	48-in RCP	3100	LF	$ 2,900.00	$	8,990,000.00
	36-in RCP	150	LF	$ 2,300.00	$	345,000.00
	Subtotal				**$**	**9,335,000.00**
2	**King Street Trunk Sewer**					
	24-in VCP	1100	LF	$ 1,400.00	$	1,540,000.00
	21-in VCP	2300	LF	$ 1,200.00	$	2,760,000.00
	Subtotal				**$**	**4,300,000.00**
3	**Cooke Street Relief Sewer**					
	30-in VCP	1600	LF	$ 1,700.00	$	2,720,000.00
	27-in VCP	250	LF	$ 1,600.00	$	400,000.00
	24-in VCP	1200	LF	$ 1,400.00	$	1,680,000.00
	Subtotal				**$**	**4,800,000.00**
4	**Ward Street Relief Sewer**					
	66-in RCP	2660	LF	$ 4,100.00	**$**	**10,906,000.00**
5	**Kapiolani Boulevard to Kamakee Street Sewer**					
	48-in RCP	330	LF	$ 2,900.00	$	957,000.00
	42-in RCP	2440	LF	$ 2,600.00	$	6,344,000.00
	Subtotal				**$**	**7,301,000.00**
6	**Auahi Street Trunk Sewer**					
	90-in RCP	1200	LF	$ 5,600.00	$	6,720,000.00
	84-in RCP	1200	LF	$ 5,100.00	$	6,120,000.00
	Subtotal				**$**	**12,840,000.00**
	Total Sewer System				**$**	**49,482,000.00**

Kakaako Mauka Area Master Plan
Water Cost Estimate

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE		COST
1	**Punchbowl 180 Reservoir**					
	18-in PVC	900	LF	$ 200.00	**$**	**180,000.00**
2	**Makiki 180 Reservoir**					
	18-in PVC	6600	LF	$ 200.00	**$**	**1,320,000.00**
3	**Kapiolani Boulevard**					
	18-in PVC	1400	LF	$ 200.00	**$**	**280,000.00**
4	**South Street**					
	18-in PVC	2900	LF	$ 400.00	**$**	**1,160,000.00**
5	**Cooke Street**					
	18-in PVC	1000	LF	$ 400.00	**$**	**400,000.00**
6	**Kamakee Street**					
	18-in PVC	1800	LF	$ 400.00	**$**	**720,000.00**
7	**Ala Moana Boulevard**					
	18-in PVC	1600	LF	$ 400.00	**$**	**640,000.00**
	Total Water System				**$**	**4,700,000.00**

Project: Kakaako Mauka Area Master Plan

For: M & E Pacific Date: 1/28/2008

Description	Quantity	Unit	Unit Price	Extension
Elec./Comm. Infrastructure Budget				
Summary				
Keawe Street				$583,250
Waimanu Street				$6,028,700
Kawaiahao Street				$5,379,000
Ilaniwai Street				$2,754,000
Halekauwila Street				$1,032,250
Auahi Street				$2,375,000
Hopaka Street				$1,437,000
Kona Street				$1,076,500
Queen Street Extension				$2,250,000
Pensacola Street				$899,500
Piikoi Street				$1,662,000
Cummins Street				$677,500
Kamani Street				$943,750
Total Elec./Comm. Infrastructure Budget				$27,098,450
			say	$27,100,000
Contingent Work*				
Kamani Street				$943,750
Koula Street				$1,076,500
Ahui Street				$628,250
Pohukaina Street				$1,032,250
Contingent Work Total				$3,680,750
			say	$3,700,000
* - Based on proposed consolidation, these roads				
may dissappear				

Project: Kakaako Mauka Area Master Plan

For: M & E Pacific Date: 1/28/2008

Description	Quantity	Unit	Unit Price	Extension
Breakdown by Road				
Keawe Street				
Ductline	450	lf	$550.00	$247,500
Handhole/Manhole Group	3	ea	$45,000.00	$135,000
Secondary Conversion		ls		$50,000
HECo. Charges		ls		$67,500
HTCo. Charges		ls		$67,500
Oceanic Charges		ls		$15,750
Keawe Street Total				$583,250
Waimanu Street				
HECo. 46 kV Ductline	2850	lf	$527.00	$1,501,950
HECo. 46 kV Manhole	7	ea	$50,000.00	$350,000
Ductline	2850	lf	$550.00	$1,567,500
Handhole/Manhole Group	13	ea	$45,000.00	$585,000
Secondary Conversion		ls		$300,000
HECo. Charges		ls		$1,197,000
HTCo. Charges		ls		$427,500
Oceanic Charges		ls		$99,750
Waimanu Street Total				$6,028,700
Kawaiahao Street				
HECo. 46 kV Ductline	2550	lf	$525.00	$1,338,750
HECo. 46 kV Manhole	6	ea	$50,000.00	$300,000
Ductline	2550	lf	$550.00	$1,402,500
Handhole/Manhole Group	11	ea	$45,000.00	$495,000
Secondary Conversion		ls		$300,000
HECo. Charges		ls		$1,071,000
HTCo. Charges		ls		$382,500
Oceanic Charges		ls		$89,250
Kawaiahao Street Total				$5,379,000

Project: Kakaako Mauka Area Master Plan

For: M & E Pacific Date: 1/28/2008

Description	Quantity	Unit	Unit Price	Extension
Ilaniwai Street				
HECo. 46 kV Ductline	1300	lf	$525.00	$682,500
HECo. 46 kV Manhole	3	ea	$50,000.00	$150,000
Ductline	1300	lf	$550.00	$715,000
Handhole/Manhole Group	6	ea	$45,000.00	$270,000
Secondary Conversion		ls		$150,000
HECo. Charges		ls		$546,000
HTCo. Charges		ls		$195,000
Oceanic Charges		ls		$45,500
Ilaniwai Street Total				$2,754,000
Halekauwila Street				
Ductline	850	lf	$550.00	$467,500
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$127,500
HTCo. Charges		ls		$127,500
Oceanic Charges		ls		$29,750
Halewkauwila Street Total				$1,032,250
Auahi Street				
Ductline	2000	lf	$550.00	$1,100,000
Handhole/Manhole Group	9	ea	$45,000.00	$405,000
Secondary Conversion		ls		$200,000
HECo. Charges		ls		$300,000
HTCo. Charges		ls		$300,000
Oceanic Charges		ls		$70,000
Auahi Street Total				$2,375,000
Hopaka Street				
Ductline	1200	lf	$550.00	$660,000
Handhole/Manhole Group	5	ea	$45,000.00	$225,000
Secondary Conversion		ls		$150,000
HECo. Charges		ls		$180,000
HTCo. Charges		ls		$180,000
Oceanic Charges		ls		$42,000
Hopaka Street Total				$1,437,000

Project: Kakaako Mauka Area Master Plan

For: M & E Pacific Date: 1/28/2008

Description	Quantity	Unit	Unit Price	Extension
Kona Street				
Ductline	900	lf	$550.00	$495,000
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$135,000
HTCo. Charges		ls		$135,000
Oceanic Charges		ls		$31,500
Kona Street Total				$1,076,500
Queen Street Extension				
HECo. 46 kV Ductline	1000	lf	$525.00	$525,000
HECo. 46 kV Manhole	4	ea	$50,000.00	$200,000
Ductline	1000	lf	$550.00	$550,000
Handhole/Manhole Group	6	ea	$45,000.00	$270,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$420,000
HTCo. Charges		ls		$150,000
Oceanic Charges		ls		$35,000
Queen Street Extension Total				$2,250,000
Pensacola Street				
Ductline	700	lf	$550.00	$385,000
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$105,000
HTCo. Charges		ls		$105,000
Oceanic Charges		ls		$24,500
Pensacola Street Total				$899,500

Project: Kakaako Mauka Area Master Plan

For: M & E Pacific Date: 1/28/2008

Description	Quantity	Unit	Unit Price	Extension
Piikoi Street				
HECo. 46 kV Ductline	650	lf	$525.00	$341,250
HECo. 46 kV Manhole	4	ea	$50,000.00	$200,000
Ductline	650	lf	$550.00	$357,500
Handhole/Manhole Group	6	ea	$45,000.00	$270,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$273,000
HTCo. Charges		ls		$97,500
Oceanic Charges		ls		$22,750
Piikoi Street Total				$1,662,000
Cummins Street				
Ductline	500	lf	$550.00	$275,000
Handhole/Manhole Group	3	ea	$45,000.00	$135,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$75,000
HTCo. Charges		ls		$75,000
Oceanic Charges		ls		$17,500
Cummins Street Total				$677,500
Kamani Street				
Ductline	750	lf	$550.00	$412,500
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$112,500
HTCo. Charges		ls		$112,500
Oceanic Charges		ls		$26,250
Kamani Street Total				$943,750
Contingent Work				
Kamani Street				
Ductline	750	lf	$550.00	$412,500
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$112,500
HTCo. Charges		ls		$112,500
Oceanic Charges		ls		$26,250
Kamani Street Total				$943,750

Project: Kakaako Mauka Area Master Plan

For: M & E Pacific Date: 1/28/2008

Description	Quantity	Unit	Unit Price	Extension
Koula Street				
Ductline	900	lf	$550.00	$495,000
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$135,000
HTCo. Charges		ls		$135,000
Oceanic Charges		ls		$31,500
Koula Street Total				$1,076,500
Ahui Street				
Ductline	450	lf	$550.00	$247,500
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$50,000
HECo. Charges		ls		$67,500
HTCo. Charges		ls		$67,500
Oceanic Charges		ls		$15,750
Ahui Street Total				$628,250
Pohukaina Street				
Ductline	850	lf	$550.00	$467,500
Handhole/Manhole Group	4	ea	$45,000.00	$180,000
Secondary Conversion		ls		$100,000
HECo. Charges		ls		$127,500
HTCo. Charges		ls		$127,500
Oceanic Charges		ls		$29,750
Pohukaina Street Total				$1,032,250

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APPENDIX D

RECORDS OF DISCUSSION

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 6, 2008

Mr. Paul Inouye
M&E Pacific, Incorporated
Davies Pacific Center
841 Bishop Street, Suite 1900
Honolulu, Hawaii 96813

Dear Mr. Inouye:

Subject: Your Letter Dater February 1, 2008 on the Kakaako Mauka Supplemental EIS and Infrastructure Study

We concur with your methodology to determine the preliminary water system improvements necessary for the development of the Kakaako Mauka area.

A revised water master plan should be submitted.

The adequacy of the water system to accommodate the individual projects will be confirmed when the building permit application is submitted for approval.

When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development, transmission and daily storage.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

KEITH S. SHIDA
Program Administrator
Customer Care Division

Inouye, Paul

From: Butler, Shawn

Sent: Friday, January 25, 2008 2:18 PM

To: Inouye, Paul; Nishimura, Michael

Cc: Privett, Justin

Subject: 60028310 EDAW HCDA Kakaako Mauka SEIS, Telecon 1-25-08, Gas Supply

RECORD OF TELEPHONE CONVERSATION
1/25/08- 1:40pm
Keith Yamamoto, KY- The Gas Company, 594-5574
60028310- Gas Supply for Kakaako Mauka

KY mentioned that they base their pipe sizing on the loads of the appliances their customers use and the length of pipe used. If a load is greater than what the main supply lines can supply, they upgrade the supply line as needed. And once again, they don't have an overall load of our study area. There is one Pressure Regulator Station within the study area where a 4" distribution line connects with a 8" supply line located at the intersection of Ward and Kapiolani. KY also mentioned that the existing infrastructure is in good condition and they can upgrade the system, for example install new Pressure Regulator Stations, as needed to meet future gas demands.
Sincerely,

Shawn Butler

M&E Pacific, Inc.

METCALF&EDDY | AECOM
Davies Pacific Center
841 Bishop Street, Suite 1900
Honolulu, Hawai'i 96813
Telephone: 808.521.3051, Ext. 230
Facsimile: 808.524.0246
Electronic Mail: Shawn.Butler@M-E.AECOM.Com

Inouye, Paul

From: Butler, Shawn

Sent: Thursday, January 24, 2008 2:26 PM

To: Inouye, Paul; Nishimura, Michael

Cc: Privett, Justin

Subject: 60028310 EDAW HCDA Kakaako Mauka SEIS, Telecon 1-24-08, Gas Supply

RECORD OF TELEPHONE CONVERSATION
1/24/08- 2:10pm
Keith Yamamoto, KY- The Gas Company, 594-5574
60028310- Gas Supply for Kakaako Mauka

KY mentioned that at The Gas Company, they have no data on how much synthesized natural gas is being supplied to Kakaako Mauka. There are gas meters for individual customers. The minimum pressure for gas mains is 10 lbs and a minimum pipe size is 1". The typical gas main materials are steel and polyethylene, and there is warning tape above the gas mains.

Sincerely,
Shawn Butler

M&E Pacific, Inc.

METCALF&EDDY | AECOM
Davies Pacific Center
841 Bishop Street, Suite 1900
Honolulu, Hawai'i 96813
Telephone: 808.521.3051, Ext. 230
Facsimile: 808.524.0246
Electronic Mail: Shawn.Butler@M-E.AECOM.Com

M & E Pacific, Inc.
Davies Pacific Center, Suite 1900, 841 Bishop Street, Honolulu, Hawai'i 96813
T 808.521.3051 F 808.524.0246 www.m-e.aecom.com

METCALF & EDDY | AECOM

RECORD OF DISCUSSION

ORIGINAL TO FILE: 60028310
COPY TO FILE(S):

PROJECT NUMBER	PROJECT DESCRIPTION
60028310.00300	Kakaako Mauka Supplemental Environmental Impact Statement & Infrastructure Study Honolulu, Hawaii

BY	DATE	TIME
Paul Inouye	Thursday, January 31, 2008	2:55 pm

WITH	ORGANIZATION
Robert Chun (RC), Chief Capital Projects Division	Honolulu Board of Water Supply

OUTGOING CALL	INCOMING CALL	TELEPHONE NUMBER	FAX NUMBER
☒	☐	748-5443	550-5056

VISIT	SITE/LOCATION
☐	

TOPIC

Water Supply Evaluation Methodology

DISCUSSION

We are involved in updating the working draft of the Mauka Area Plan, Kakaako Community Development District, May 2007, which projects the population and development requirements to the year 2030 under the jurisdiction of the Hawaii Community Development Authority. Our tasks involve preparing an infrastructure study for planning purposes which includes evaluating the water distribution system.

The Kakaako Mauka area is bounded by Punchbowl Street to Piikoi Street and South King Street to Ala Moana Boulevard. Our scope of work excludes detailed loop modeling analysis of the distribution network. We have tried to simplify the methodology by assuming the three nearest low service reservoirs (Bella Vista 180, Punchbowl 180, and Makiki 180) each supply approximately 1/3 of the projected water demand for the year 2030. We estimate the projected 2030 average water demand to be approximately 7.15 mgd.

From the Water System Standards, the water distribution system shall be sized to provide:

1. The Maximum Daily Demand plus Fire Flow with a residual pressure of 20 psi at a critical fire hydrant; and
2. The Peak Hour Flow with a minimum residual pressure of 40 psi

The Maximum Daily Demand plus Fire Flow is 16.49 mgd. The Peak Hour Flow is 21.45 mgd. The Peak Hour Flow criteria governs in our case to evaluate the water main sizes. Refer to the attached figure with the three 180 reservoirs highlighted. Point 1 is the location where both water supplies from Buena Vista Res. and Punchbowl Res. appear to contact the perimeter of the study area. Point 2 is the location where the water supply from the Makiki Res. appears to contact the perimeter of the study area. Point 3 is the estimated "most remote location" from Point 1 and Point 2. The Hazen-Williams formula is used to estimate the pressures at Points 1, 2, and 3 from the assumed water flows. We have attached the calculation sheets which show what is needed at minimum: 18-inch water mains from each of the three reservoirs to South King Street perimeter and 16-inch water mains branching from the South King Street mains throughout the study area.

Please review our simplified methodology to evaluate adequacy of the existing water system. We believe this analysis approximates the required pipe sizing for estimating infrastructure costs for planning purposes. Your concurrence or recommendations will be greatly appreciated.

ACTION REQUIRED	ACTION TAKEN
BWS review and comments	None.

M & E Pacific, Inc.
Davies Pacific Center, Suite 1900, 841 Bishop Street, Honolulu, Hawai'i 96813
T 808.521.3051 F 808.524.0246 www.m-e.aecom.com

METCALF & EDDY | AECOM

RECORD OF DISCUSSION

ORIGINAL TO FILE: **60028310**
COPY TO FILE(S): **200**

PROJECT NUMBER	PROJECT DESCRIPTION
60028310.00300	Kakaako Mauka SEIS & Infrastructure Study Honolulu, Oahu Hawaii

BY	DATE	TIME
Paul Inouye (PI)	Wednesday, January 23, 2008	9:00 am

WITH	ORGANIZATION
Dennis Nishimura (DN), WWB	Wastewater Branch, Dept. of Planning & Permitting (WWB) M&E Pacific, Inc. (ME)

OUTGOING CALL	INCOMING CALL	TELEPHONE NUMBER	FAX NUMBER
☐	☐		

VISIT	SITE/LOCATION
☒	One Stop Customer Service Counter

TOPIC
Sewer System

DISCUSSION
I explained that we are involved in the subject project which involves evaluating the existing sewer system for adequacy in servicing the future year 2030 scenario. I presented DN with a draft figure highlighting our draft proposed increase in sewer interceptors needed to service the future scenario. DN requested the figure to review and he estimated his review for the present condition only would be complete by Friday, 1/25/08 at the earliest.

The following summarizes our methodology in evaluating the City's sewer system:

Sewer System—The existing sewer system was evaluated using the City's INFIX 3.0 computer software. In the mid 1990's to early 2000, the City was required to prepare a Sewer Rehabilitation and Infiltration & Inflow (I/I) Minimization Plan in accordance with an USEPA consent decree. Based on this study, the average sewage flow per capita, dry weather I/I and the wet weather I/I were adjusted to accurately reflect existing conditions for wastewater pump station basins on Oahu. The INFIX software contains these adjusted parameters. The proposed development standards were evaluated for large and small parcels and we determined that the maximum 3.5 FAR applied to the vast majority of the study area parcels with the exception of public, park, and public parking structures. We estimated a corresponding demand (gallons per acre) associated with the maximum 3.5 FAR and created a new development plan code for the Kakaako Mauka parcels. Executing the INFIX software for the maximum 3.5 FAR scenario (full build-out) did not alter the original INFIX future scenario output to 2020. We found that the original City sewer model accurately depicts the Kakaako Mauka area full build-out population. Using the State's population project estimate until 2030, we evaluated the effect of population on the design peak hourly sewage flow. We found that the 7% increase in population from 2030 to full build-out only increased the design peak hourly sewage flow by approximately 3%. The wet weather infiltration/inflow (I/I) is not dependent on the tributary population, but the wet weather I/I is approximately 60% of the design peak hourly sewage flow. This 3% design peak flow increase does not significantly affect the selection of the required sewer pipe size for planning purposes.

ACTION REQUIRED	ACTION TAKEN
Prepare record of discussion for Dennis Nishimura, City DPP Wastewater Branch and request his review for accuracy	In progress.

M & E Pacific, Inc.
Davies Pacific Center, Suite 1900, 841 Bishop Street, Honolulu, Hawai'i 96813
T 808.521.3051 F 808.524.0246 www.m-e.aecom.com

Memorandum

Date: July 14, 2008

To:

From: Shawn Butler, M&E Pacific, Inc. (521-3051)

Subject: Kakaako Infrastructure Field Investigation Notes

Distribution: M&E Pacific, Inc.: Paul Inouye, Mike Nishimura, Project File

Field Notes:

1/7/08 (Mike Nishimura, Paul Inouye, Shawn Butler)

- Streets visited were South St. and Keawe St. between Ala Moana Blvd. and Halekauwila St.
- A lot of debris/litter accumulation in storm drain along Keawe St between Auahi St. and Ala Moana Blvd.
- Thru gutters cracked at intersection along Keawe St.
- Storm drain walls in satisfactory condition.
- Alligator cracks at Keawe at Auahi and Keawe at Pohukaina and South at Halekauwila.

1/8/08 (Paul Inouye, Shawn Butler)

- Streets visited were Kawaihao St. between South St. and Cooke St., and interior streets bordered by Kamakee St., Kapiolani Blvd., Piikoi St., and Waimanu Street. Also, Kamakee St. between Ala Moana Blvd. and Kapiolani Blvd., and Piikoi St. between Ala Moana Blvd. and Kapiolani Blvd.
- Could not field verify storm drainline near Emily Street between Kawaiahao Street and Queen Street. A new high rise was being constructed at the time, preventing access to the drainline.
- Alligator cracks along Emily between Queen and Kawaiahao, and along Pensacola between Kona and Hoopaka.

1/9/08 (Paul Inouye, Shawn Butler)

- Streets visited were Ward Ave. and Pensacola St. between King St. and Kapiolani Blvd.
- No major concerns were found for these streets.

7/1/08 (Mike Nishimura, Paul Inouye, Shawn Butler)

- Streets visited were sections of Kawaiahao St., Queen St., Cooke St., Pensacola St., Piikoi St. and local roads between Piikoi and Pensacola.

- AC pavement cracking, ponding, and sediment build-up at edge of pavement along Kawaiahao St.

- Ponding and sediment build-up at edge of pavement along Kawaiahao St. and Emily St., and along Curtis St. between Kawaiahao St. and Kapiolani St.

- Damaged catch basin at intersection of Cooke St. and Kawaiahao St.

- Ponding at edge of pavement at intersection of Queen St. and Kamakee St.

- Sediment build-up along Waimanu St. near intersection with Pensacola St.

- Ponding at edge of pavement near the middle of Kamaile St.

- Sediment build-up at edge of pavement along Piikoi St. at intersection with Elm St.

- Damaged pedestrian sidewalk fronting a property that is under going construction/renovation in the middle of Alohi Way.

- Ponding and sediment build-up at edge of pavement along King St. between Pensacola St. and Piikoi St.

- Alligator cracking at various locations along Kawaiahao and Pensacola.

7/2/08 (Paul Inouye, Shawn Butler)

- Ponding at edge of pavement along Punchbowl St. at intersection with Pohukaina St.

- Ponding and sediment build-up at edge of pavement along Ala Moana Blvd. at intersection with South St.

- Ponding and sediment build-up at edge of pavement along South St. at intersection with Ala Moana Blvd.

- Sediment build-up at edge of pavement along Auahi St. at intersection with South St.

- Sediment build-up at edge of pavement along Keawe St. at intersection with Ala Moana Blvd.

- No AC pavement around graded drain inlet in the middle of Coral St. between Queen St. and Halekauwila St.

- Break in Coral St. between Halekauwila St. and Pohukaina St.

- Sediment build-up at edge of pavement along Coral St. near intersection with Pohukaina St.

- Clogged graded drain inlet along Ala Moana Blvd. between Keawe St. and Coral St.

- Alligator cracking at Auahi and Keawe.

7/3/08 (Paul Inouye, Shawn Butler)

- Alligator cracking and pothole along Ohe St.

- Damaged catch basin along Kamani St. at intersection with Pohukaina St.

- Ponding and sediment build-up at edge of pavement along Auahi St. at intersection with Ward Ave.
- Ponding at edge of pavement along Ward Ave. at intersection with Auahi St.
- Ponding and sediment build-up at edge of pavement along Ward Ave. at intersection with Ala Moana Blvd.
- Inlet to graded drain inlet, along Kamani St. between Waimanu St. and Kawaiahao St., is blocked by root of a tree and sediment build-up.
- Ponding at edge of pavement along Ward Ave. between Kawaiahao St. and Waimanu St.
- Sediment build-up along Queen St. near intersection with Cooke St.
- Alligator cracking at Koula near Ala Moana and along Waimanu and along Kawaiahao.

7/6/08 (Shawn Butler)

- Sediment build-up in gutter at the intersection of Queen St. and Ala Moana Blvd.
- Clogged graded drain inlet along Ala Moana Blvd. near intersection with Queen St.
- Damaged catch basin at intersection of Piikoi St. and Ala Moana Blvd.
- Ponding in gutter along Ala Moana Blvd. between Queen St. and Piikoi St.
- Ponding in gutter along Auahi St. near Kamakee St.
- Ponding along Kona St.
- Ponding along Piikoi St. between Kona St. and Hopaka St.
- Ponding at edge of pavement along Hopaka St. underneath parked cars.

Hawaiian Telcom

February 11, 2009

HCDA
Attn: Neil Imada
677 Alamoana Blvd Suite 1001
Honolulu, HI 96813

Dear Mr. Imada,

This is a confirmation that we have received your letter concerning the information on the maintenance of our facilities and outage.

Hawaiian Telcom provides telecommunication service for the Kakaako Mauka Area from its Alakea, Kakaako and Punahou Central Offices.

Hawaiian Telcom's facilities are located both underground and overhead in the Kakaako Mauka area. Beginning with the Kakaako Improvement District 5 project in 1999, approximately 19,200 feet of underground conduits were installed to relocate existing Hawaiian Telcom overhead facilities within the area. The most recent improvement project, Kakaako ID 12, was completed in 2007. The undergrounding of Hawaiian Telcom facilities along Ala Moana Boulevard is currently in the design stage of this proposed improvement project.

Hawaiian Telcom's telecommunication facilities and equipment have an average useful life of 46 years. Hawaiian Telcom will maintain and repair the facilities and support structures which it owns and furnishes to its customers.

At present, no significant outages have occurred within the past ten years impacting any of Hawaiian Telcom's facilities serving the Kakaako Mauka Area.

Sincerely,

Kip Woodrum
Hawaiian Telcom
Director-Field Operations

lst

Kakaako Mauka Distress Pavement Identification
(photos located in P:\Projects\Oahu\60028310 Kakaako SEIS\400 Photographs\Kakaako Site Visit (Distressed Pav't ID) 2-11-09)

Cooke Street
Photos 1-23
Block cracking, longitudinal cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Koula Street
Photos 24-28, 53-56
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Pohukaina Street
Photos 29, 146-159
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Kamani Street
Photos 30, 57-61
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Auahi Street
Photos 62, 63, 127-140
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Ward Avenue
Photos 34, 64-74
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Keawe Street
Photos 35-41
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, and raveling.

Coral Street
Photos 42-52
Longitudinal and transverse cracking, alligator (fatigue) cracking, deteriorating patches, potholes, shoving and raveling.

Pensacola Street
Photos 75-91
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Rycroft Street
Photos 92-102
Longitudinal and transverse cracking, alligator (fatigue) cracking, and rutting.

Hoolai Street
Photos 103-106
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Hopaka Street
Photos 107-111
Longitudinal and transverse cracking, deteriorating patches, potholes and raveling.

Kona Street
Photos 112-119
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Waimanu Street
Photos 120-122, 181-189
Longitudinal and transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Kamakee Street
Photos 123-126
Longitudinal and slight raveling.

Ilaniwai Street
Photos 31-33, 141-145
Transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches and potholes.

Kawaiahao Street
Photos 160-180
Transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches, potholes and raveling.

Mission Lane
Photos 190-193
Transverse cracking, alligator (fatigue) cracking, rutting, deteriorating patches and potholes.

PHOTOS

Photo P-5: Cooke Street Alligator & Block Cracking

Photo P-10: Cooke Street at Halekauwila Street Raveling & Block Cracking

Photo P-13: Cooke Street Rutting

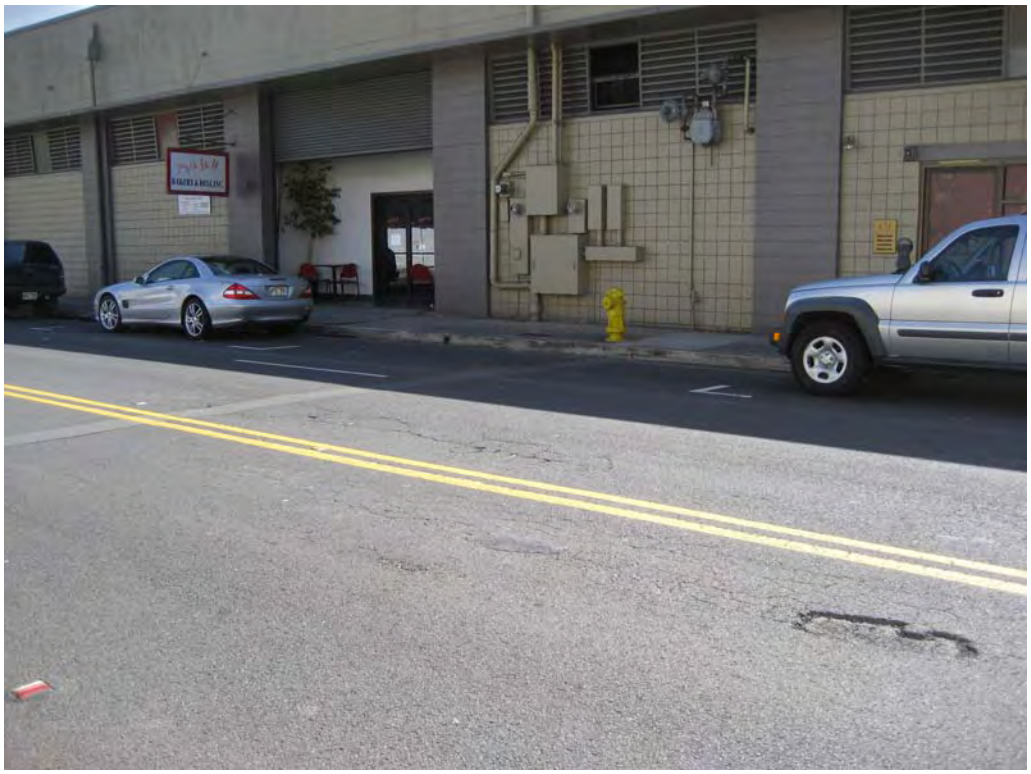


Photo P-17: Cooke Street Pothole

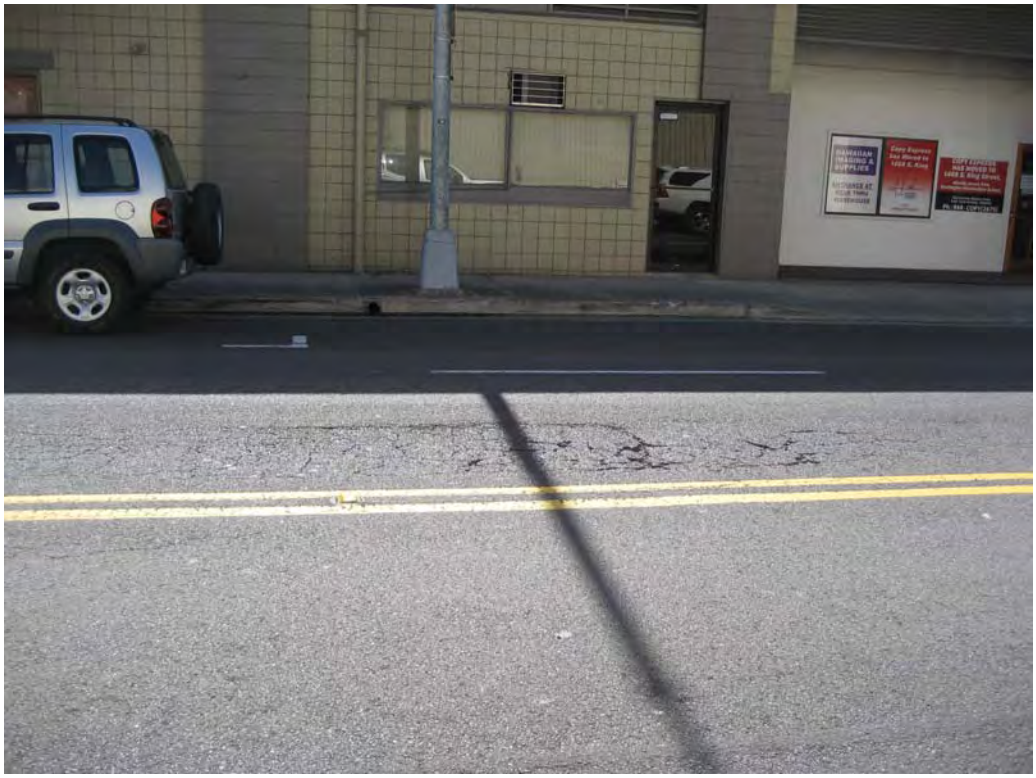


Photo P-18: Cooke Street Rutting & Alligator Cracking

Photo P-25: Koula Street Pothole & Alligator Cracking

Photo P-26: Koula Street Alligator Cracking

Photo P-37: Keawe Street Block Cracking

Photo P-42: Coral Street Deteriorating Patching

Photo P-49: Coral Street at Halekauwila Street Raveling

Photo P-58: Kamani Street Alligator & Block Cracking

Photo P-67: Ward Avenue Pothole & Deteriorating Patching

Photo P-81: Pensacola Street Pothole

Photo P-104: Hoolai Street at Piikoi Street Block Cracking

Photo P-111: Hopaka Street at Piikoi Street Raveling & Deteriorating Patching

Photo P-113: Kona Street Alligator & Block Cracking & Raveling

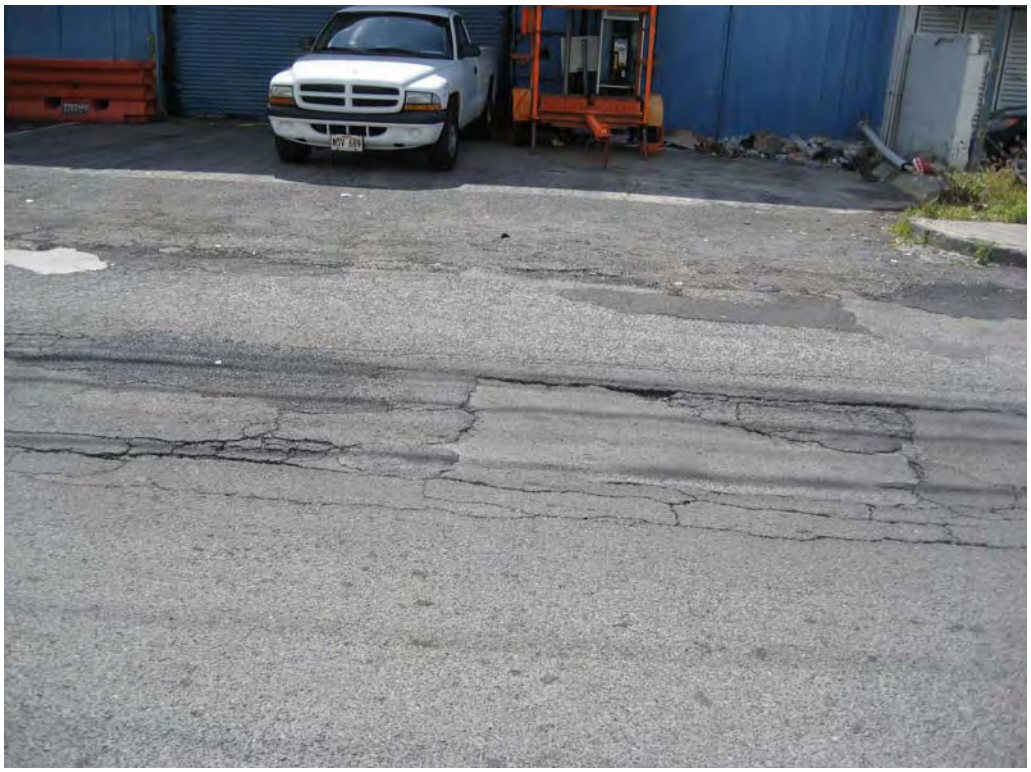


Photo P-117: Kona Street Block & Longitudinal Cracking

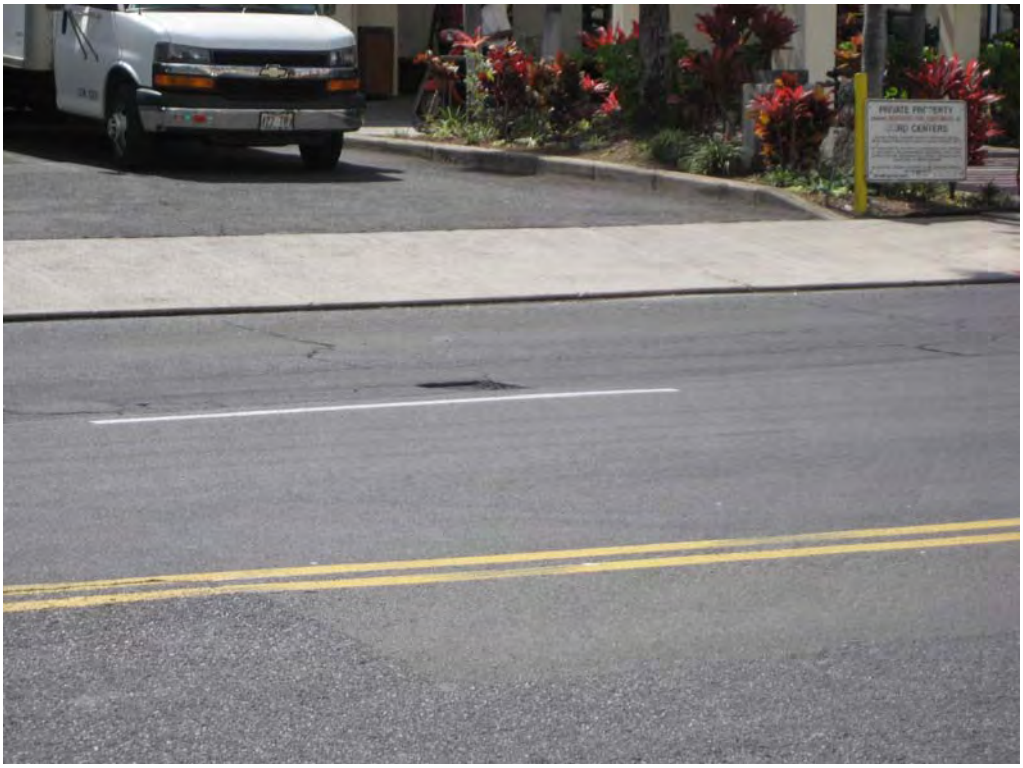


Photo P-129: Auahi Street Pothole

Photo P-132: Auahi Street Pothole

Photo P-147: Pohukaina Street Longitudinal Cracking

Photo P-163: Kawaiahao Street Rutting & Deteriorating Patching

Photo P-181: Waimanu Street Potholes, Deteriorating Patching & Longitudinal Cracking

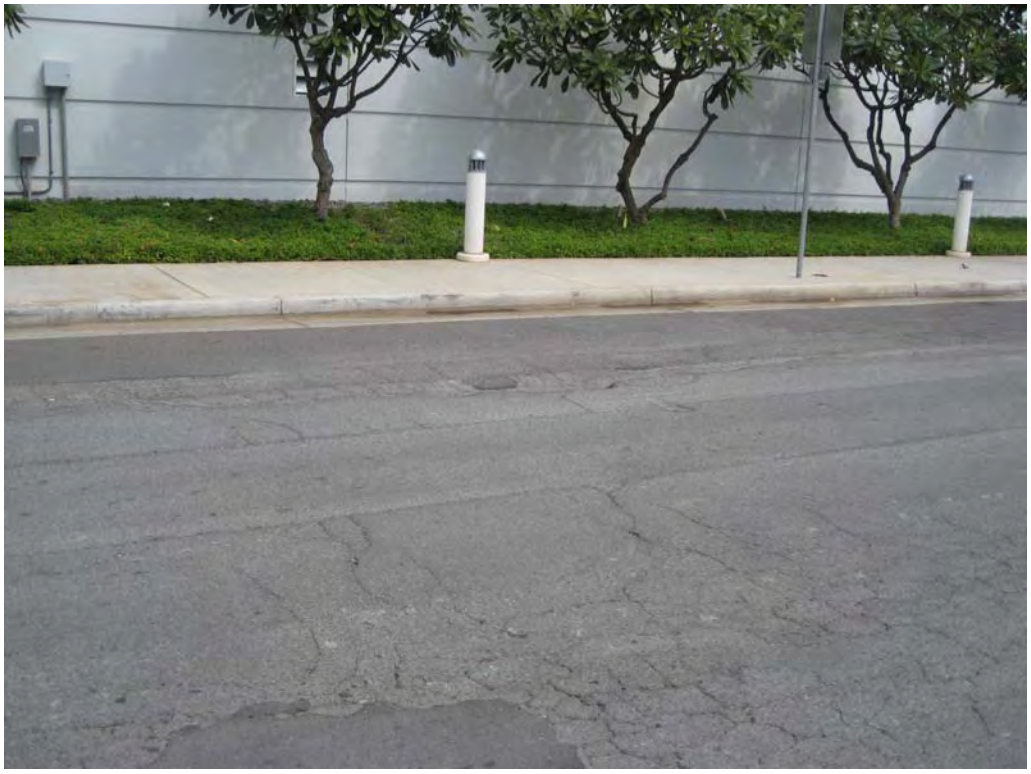
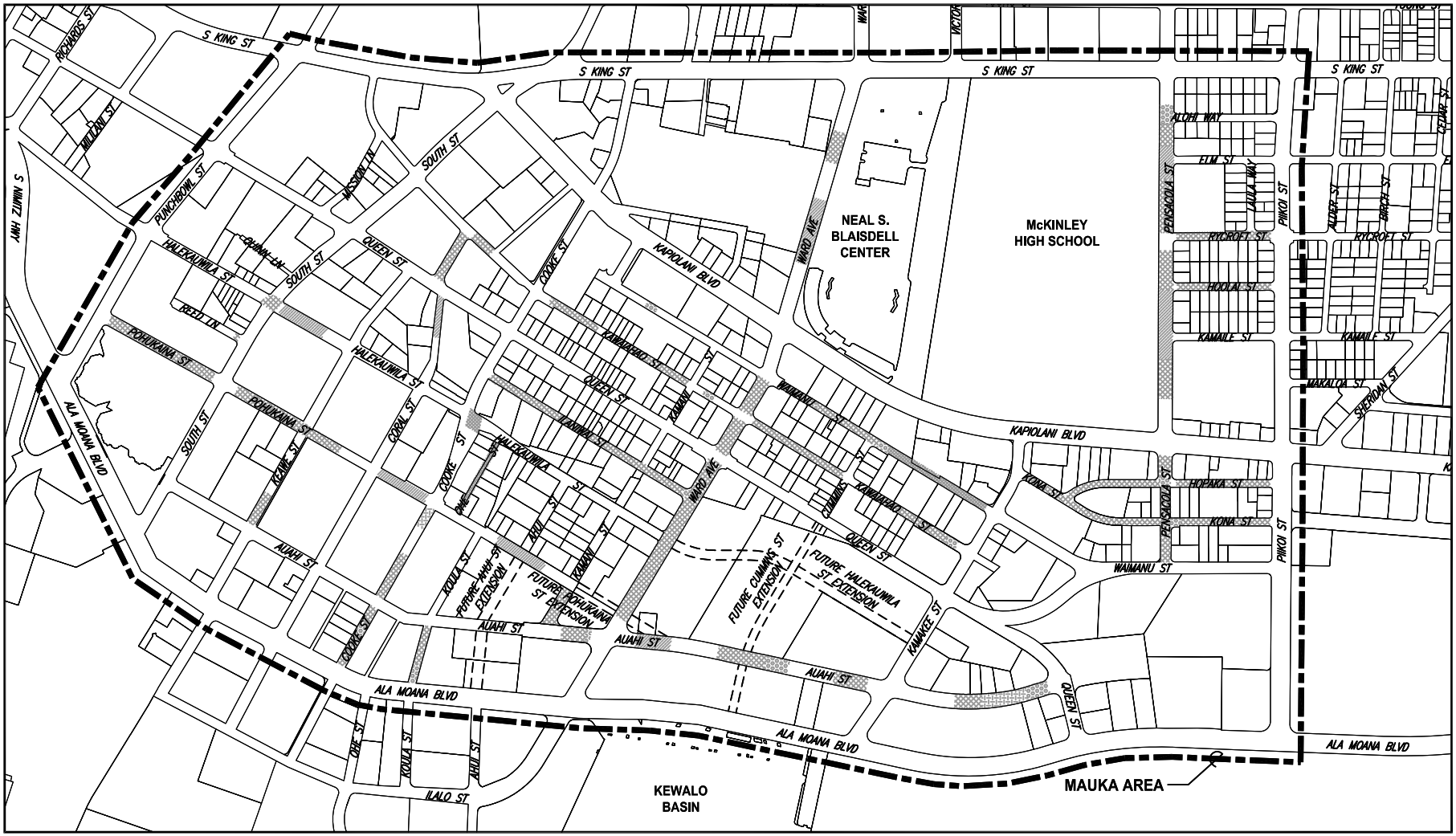


Photo P-187: Waimanu Street Alligator & Block Cracking & Rutting

Photo P-192: Mission Lane Block Cracking



Pothole (Approximate location); Possible Repair

Alligator Cracking; Possible Repair

Block Cracking

Rutting, Possible Repair

Mauka Area (Project Boundary)

0 800 1,600 Feet

N

Sources: City & County of Honolulu, 2008, HCDA, 2008, M&E Pacific, Inc., 2008.

01/31/09 METCALF&EDDY | AECOM

APPENDIX E

CITY SEWER CCTV INSPECTION SCOPE OF WORK

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Kakaako Master Plan, SEIS Infra ture Assesment CCTV Status

Street	US Manhole	DS Manhole	Sewer ID	Diameter	Material	Plan Length	CCTV Length	Direction	CCTV Date	Operator	Comments	DVD DISK
South	341052	341119	344351	30	VCP	161	160	DS	1/12/2009	Rudy		Kakaako 01
South	341119	3010716	3010717	30	VCP	0	170.1	DS	1/16/2009	Jeremy		Kakaako 01
South	683866	683904	685401	30	VCP	275	266.9	DS	1/16/2009	Jeremy		Kakaako 01
South	3010716	685353	3010718	30	VCP	0	245.5	DS	1/16/2009	Jeremy	Couldn't reach downstream manhole 683760.	Kakaako 02
South	4025660	341052	344302	30	VCP	127	128.8	DS	1/12/2009	Rudy		Kakaako 02
South	4025661	4025660	4025662	36	CIPP	78.32	79	DS	1/12/2009	Rudy		Kakaako 02
South	4025663	4025661	4025664	36	CIPP	286.62	281.1	DS	1/12/2009	Rudy		Kakaako 02
Ward	342321	379737	345149	12	TCP	258.7	167.9	DS	1/22/2009	Rudy	Unable to continue due to camera being underwater.	Kakaako 03
South	683801	683866	685365	30	VCP	253	250.6	DS	1/16/2009	Jeremy		Kakaako 03
South	683904	683933	685428	30	VCP	295	296.1	DS	1/26/2009	Rudy		Kakaako 03
South	683933	4025642	4025644	36	CIPP	39.2	38.8	DS	1/26/2009	Rudy		Kakaako 04
South	4025642	4025640	4025643	36	CIPP	261	246	DS	1/26/2009	Rudy	Ended ~10' from the ending manhole.	Kakaako 04
Ward	342231	342244	345085	12	TCP	41	4.1	DS	2/19/2009	Jeremy		Kakaako 05
Ward	342244	342321	345095	12	TCP	239.76	228	DS	2/19/2009	Jeremy		Kakaako 05
Ward	342321	379737	345149	12	TCP		8.1	US	2/19/2009	Jeremy	Unable to continue due to camera being underwater.	Kakaako 05
Ward	342321	379737	345149	12	TCP		174.7	DS	2/19/2009	Jeremy	Unable to pass settled deposits.	Kakaako 05
Ward	379737	379790	380425	12	TCP	250	49.5	US	2/20/2009	Jeremy	Unable to continue due to heavy grease.	Kakaako 05

Street	US Manhole	DS Manhole	Sewer ID	Diameter	Material	Plan Length	CCTV Length	Direction	CCTV Date	Operator	Comments	DVD DISK
Ward	379737	379790	380425	12	TCP		5.9	DS	2/20/2009	Jeremy	Unable to continue due to camera being underwater.	Kakaako 05
Ward	379790	379855	380462	14	TCP	250	247	DS	2/20/2009	Jeremy		Kakaako 06
Ward	379855	379874	380508	14	TCP	70	67.5	DS	2/20/2009	Jeremy		Kakaako 06
Ward	342078	342088	344981	10	TCP	13	11.2	US	3/5/2009	Jeremy		Kakaako 07
Ward	342088	342157	345259	10	TCP	250	4.1	DS	3/5/2009	Jeremy	Unable to pass heavy grease.	Kakaako 07
Ward	342157	342231	345110	10	TCP	244	238.8	DS	3/5/2009	Jeremy	Unable to pass a piece of broken pipe that settled in the line.	Kakaako 07
Ward	342321	379737	345149	12	TCP		249.8	DS	3/5/2009	Jeremy	Unable to pass deposits.	Kakaako 07
Ward	379737	379790	380425	12	TCP		24.6	DS	3/5/2009	Jeremy	Deposits.	Kakaako 07

INSPECTION AND RELATED WORK ON SEWER LINES ON OAHU, AREA A - CORE AREAS

WORK ORDER: KAKAAKO

SUMMARY OF INSPECTION WORK

1. CCTV all sewer mains.
2. Clean as needed.

NOTES

Frictional Factors (n): VCP = 0.015 RCP = 0.015 TCP = 0.015 HDPE = 0.015 CIP = 0.015

Length/Depth has been estimated and may not reflect the actual length/depth.

UNK = Unknown

Definition of Flow Factors:

- Q_{AVG} Design Average Flow = Average Wastewater Flow + Applicable Dry Weather Infiltration/Inflow rate
- Q_{MAX} Design Maximum Flow = Maximum Flow + Dry Weather Infiltration/Inflow rate.
- Q_{PEAK} Design Peak Flow = Design Maximum Flow + Wet Weather Infiltration/Inflow
- $Q_{Capacity}$ Flow at Capacity
- $V_{Capacity}$ Velocity at Capacity

?" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
344164	UNK	510.69	---	---	---	340741	340456	---	---	---	---	---	17.00			---	---	---	---	---
384227	UNK	165.00	---	---	---	382586	382619	SI21AJ0047	SI21AJ0046	---	---	---	0.00		X	---	---	---	---	---
3006115	UNK	6.27	---	---	---	381771	381768	SI21AJ0162	SI21AJ1166	---	9.00	11.60	0.00			0.16760	0.27400	0.61510	1.27340	2.50900
3011128	UNK	7.79	---	---	---	340456	340444	---	SI21AC2222	---	---	8.30	0.00			---	---	---	---	---
3013570	UNK	260.00	---	---	---	3013569	339480	---	SI21AQ0042	---	---	4.70	6.00			---	---	---	---	---
3013635	UNK	85.27	---	---	---	3013634	379754	---	SI21AC0557	---	---	3.60	0.00			---	---	---	---	---
3014998	UNK	88.13	---	---	---	353032	3014997	SI21AJ1194	---	---	2.60	---	0.00			---	---	---	---	---
3014999	UNK	153.98	---	---	---	3014997	381328	---	SI21AJ0196	---	---	3.50	3.00			---	---	---	---	---
TOTALS		**1,277.13**											**26**	**0**	**1**					

6" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
305901	TCP	241.00	0.00846	2.260	0.220	302603	302466	SI21AQ0302	SI21AQ0246	6.0	4.00	6.70	14.00		X	0.02220	0.05090	0.09210	0.28910	2.27900
314202	TCP	119.60	0.02592	13.770	10.670	310485	310590	SI21AQ0296	SI21AQ0295	6.0	2.80	3.60	3.00		X	0.00120	0.00280	0.04720	0.50600	3.98700
314268	TCP	92.00	0.02880	10.670	8.020	310590	310633	SI21AQ0295	SI21AQ0292	6.0	3.60	3.80	0.00		X	0.00210	0.00470	0.07910	0.53340	4.20300
315221	TCP	235.00	0.10200	69.770	45.800	312278	312377	SI21AC0449	SI21AC0445	6.0	8.20	4.60	5.00			0.00340	0.00880	0.02180	1.00370	7.91000
315417	TCP	181.71	0.09268	45.900	29.060	312411	312478	SI21AC0444	SI21AC0443	6.0	6.10	4.70	7.00			0.01940	0.03270	0.04030	0.95670	7.54000
315418	TCP	155.00	0.02516	22.600	18.700	312414	312501	SI21AC0439	SI21AC0436	6.0	3.00	4.60	5.00		X	---	---	---	0.49850	3.92900
315457	TCP	14.00	0.17286	28.420	26.000	312482	312488	SI21AC0442	SI21AC1441	6.0	4.50	7.50	0.00			0.01940	0.03270	0.04060	1.30660	10.29700
315463	TCP	54.00	0.02185	26.000	24.820	312488	312503	SI21AC1441	SI21AC0441	6.0	7.50	7.80	0.00			0.01940	0.03270	0.04110	0.46460	3.66100
315473	TCP	120.00	0.05300	24.820	18.460	312503	312540	SI21AC0441	SI21AC0440	6.0	7.80	9.30	0.00			0.01940	0.03270	0.04210	0.72350	5.70200
315489	TCP	130.00	0.12400	80.220	64.100	312533	312578	SI21AC0448	SI21AC1448	6.0	7.80	3.00	1.00		X	0.00190	0.00480	0.01110	1.10670	8.72100
315575	TCP	293.51	0.12572	84.500	47.600	312664	312750	SI21AC0478	SI21AC0447	6.0	5.40	7.10	5.00			0.00180	0.00470	0.01530	1.11430	8.78200
315613	TCP	67.27	0.05857	47.600	43.660	312750	337969	SI21AC0447	SI21AC0431	6.0	7.10	7.60	0.00			0.00180	0.00470	0.01640	0.76060	5.99400
342432	TCP	215.00	0.00358	-0.170	-0.940	683865	341331	SI21AC0219	SI21AC0218	6.0	5.00	5.90	12.00		X	---	---	---	0.18810	1.48200
342506	TCP	167.13	0.03985	48.220	41.560	338080	337969	SI21AC0479	SI21AC0431	6.0	7.00	7.60	2.00			0.02120	0.05460	0.16060	0.62740	4.94400
342577	TCP	162.57	0.06200	58.220	48.220	4034461	338080	---	SI21AC0479	6.0	4.80	7.00	1.00			0.01530	0.03950	0.13770	0.77870	6.13700
342649	TCP	185.92	0.05600	69.610	59.200	338333	338207	SI21AC0481	SI21AC0480	6.0	7.00	4.10	1.00			0.00110	0.00290	0.01120	0.78800	6.21000

6" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
342937	TCP	134.45	0.08174	39.700	28.710	338769	338816	SI21AC0392	SI21AC0391	6.0	4.00	4.00	6.00			0.00490	0.00820	0.01040	0.89850	7.08100
342966	TCP	150.55	0.05805	28.710	19.970	338816	338867	SI21AC0391	SI21AC0390	6.0	4.00	4.00	5.00			0.00840	0.01410	0.01850	0.75720	5.96700
343021	TCP	179.79	0.06997	56.840	44.260	339016	339132	SI21AC0420	SI21AC0419	6.0	7.00	7.10	0.00			0.01220	0.02060	0.02680	0.83130	6.55100
343061	TCP	108.00	0.03648	12.510	8.570	338980	339039	SI21AC0379	SI21AC0380	6.0	4.00	4.50	5.00			0.03620	0.06100	0.07980	0.60030	4.73000
343088	TCP	248.14	0.10397	42.800	17.000	339029	339187	SI21AC0388	SI21AC0387	6.0	3.20	6.30	6.00			0.03170	0.05340	0.07280	1.01340	7.98600
343096	TCP	200.00	0.01400	8.570	5.770	339039	339146	SI21AC0380	SI21AC0381	6.0	4.50	4.70	7.00			0.04920	0.08280	0.10670	0.37190	2.93000
343181	TCP	166.23	0.04091	17.000	10.200	339187	339303	SI21AC0387	SI21AC0386	6.0	6.30	4.00	0.00			0.03910	0.06580	0.09080	0.63560	5.00900
343183	TCP	120.00	0.02000	47.640	45.240	339189	339230	SI21AC0417	SI21AC0418	6.0	8.70	7.00	1.00			0.02130	0.03580	0.04020	0.44450	3.50300
343252	TCP	167.01	0.00916	10.200	8.670	339303	339438	SI21AC0386	SI21AC0383	6.0	4.00	6.30	4.00			0.04370	0.07350	0.10250	0.30080	2.37100
343398	VCP	52.00	0.08615	39.000	34.520	339507	339570	SI21AC0415	SI21AC0401	6.0	5.00	8.90	0.00		X	0.00250	0.00410	0.00970	0.92250	7.27000
344232	TCP	21.00	0.01667	3.270	2.920	340845	4039005	SI21AC0348	---	6.0	6.60	---	0.00			0.00860	0.01630	0.06540	0.40570	3.19700
344394	TCP	299.40	0.00448	4.610	3.270	341125	340845	SI21AC0349	SI21AC0348	6.0	1.40	6.60	2.00			0.00860	0.01630	0.06480	0.21030	1.65700
344415	TCP	41.20	0.00388	1.700	1.540	341161	341127	SI21AC0305	SI21AC0306	6.0	3.80	4.20	0.00			0.00550	0.00920	0.01100	0.19590	1.54300
344514	TCP	200.00	0.00510	-0.940	-1.960	341331	341199	SI21AC0218	SI21AC0221	6.0	5.90	7.10	6.00			0.01340	0.02250	0.05460	0.22440	1.76900
344518	TCP	225.00	0.00498	-1.940	-3.060	341339	341252	SI21AC0213	SI21AC0243	6.0	6.90	8.10	4.00			0.01820	0.03060	0.05720	0.22170	1.74700
344556	TCP	153.00	0.00484	-1.200	-1.940	341402	341339	SI21AC0214	SI21AC0213	6.0	6.20	6.90	0.00			0.01580	0.02660	0.04930	0.21860	1.72200
344573	TCP	193.30	0.00398	3.830	3.060	341428	341490	SI21AC0321	SI21AC0319	6.0	3.20	4.20	3.00		X	0.01540	0.02860	0.05000	0.19840	1.56300
344594	TCP	143.00	0.00400	-0.600	-1.200	4026570	341402	---	SI21AC0214	6.0	---	6.20	1.00			---	---	---	---	---
344609	TCP	196.82	0.00091	3.060	2.880	341490	341556	SI21AC0319	SI21AC0318	6.0	4.20	4.00	3.00		X	0.03080	0.05710	0.10000	0.09500	0.74900
344680	TCP	116.00	0.01241	4.510	3.070	341601	341660	SI21AC0650	SI21AC0324	6.0	1.10	2.20	2.00			0.00590	0.01100	0.02010	0.35020	2.75900
344717	TCP	259.70	0.00570	3.070	1.590	341660	341814	SI21AC0324	SI21AC0325	6.0	2.20	4.10	2.00			0.01580	0.02920	0.05230	0.23730	1.87000
344793	TCP	288.00	0.00497	2.660	1.230	341794	341935	SI21AC0207	SI21AC0208	6.0	3.00	3.50	5.00		X	0.00040	0.00070	0.02710	0.22150	1.74500
344798	TCP	134.00	0.00410	0.330	-0.220	341803	341729	SI21AC0190	SI21AC0191	6.0	4.30	5.20	0.00			0.02160	0.04110	0.09340	0.20130	1.58700
344806	TCP	17.50	0.01086	1.590	1.400	341814	341826	SI21AC0325	SI21AC0326	6.0	4.10	4.40	0.00			0.01580	0.02920	0.05270	0.32750	2.58100
344816	TCP	250.00	0.00532	1.400	0.070	341826	341967	SI21AC0326	SI21AC0327	6.0	4.40	4.90	1.00			0.02520	0.04670	0.08270	0.22920	1.80600
344830	TCP	225.50	0.00399	1.270	0.370	341852	341976	SI21AC1266	SI21AC0266	6.0	4.10	5.40	10.00			0.01990	0.03350	0.04910	0.19850	1.56500
344882	TCP	238.00	---	---	---	341934	342049	SI21AC0249	SI21AC0250	6.0	4.10	4.90	6.00			---	---	---	---	---
344889	TCP	236.00	---	---	---	341945	341803	SI21AC0189	SI21AC0190	6.0	3.30	4.30	5.00			---	---	---	---	---
344890	TCP	134.00	0.00396	1.310	0.780	341945	342026	SI21AC0189	SI21AC0188	6.0	3.30	4.10	4.00			0.00940	0.01580	0.02240	0.19770	1.55800
344904	TCP	244.00	0.00570	0.070	-1.320	341967	342078	SI21AC0327	SI21AC0328	6.0	4.90	6.00	2.00			0.05020	0.09320	0.15170	0.23720	1.86900
344913	TCP	233.00	0.00313	0.370	-0.360	341976	342081	SI21AC0266	SI21AC0265	6.0	5.40	6.10	4.00			0.02460	0.04140	0.06230	0.17590	1.38600
344943	TCP	266.00	0.00188	0.780	0.280	342026	342111	SI21AC0188	SI21AC0187	6.0	4.10	4.90	4.00			0.01720	0.02890	0.04310	0.13630	1.07400
344961	TCP	234.00	0.00402	0.070	-0.870	342049	342145	SI21AC0250	SI21AC0260	6.0	4.90	5.50	2.00			0.01830	0.03080	0.04500	0.19920	1.57000
344967	TCP	235.00	0.00498	1.870	0.700	342056	342154	SI21AC0198	SI21AC0199	6.0	3.10	4.30	5.00		X	0.01130	0.01900	0.03030	0.22180	1.74800
344984	TCP	197.00	0.00701	-0.360	-1.740	342081	342157	SI21AC0265	SI21AC0264	6.0	6.10	6.40	4.00			0.03300	0.05550	0.08330	0.26300	2.07300
344991	TCP	180.00	0.00500	2.220	1.320	342093	342161	SI21AC0196	SI21AC0156	6.0	4.00	3.30	0.00		X	---	---	---	0.22220	1.75100
345002	TCP	217.00	0.00659	0.280	-1.150	342111	342208	SI21AC0187	SI21AC0186	6.0	4.90	6.30	4.00			0.02190	0.03700	0.05580	0.25510	2.01100
345005	TCP	174.00	0.00500	2.740	1.870	342114	4044866	SI21AC0197	---	6.0	3.00	6.40	2.00		X	0.00430	0.00720	0.01170	0.22220	1.75100
345025	TCP	233.00	0.00399	-0.870	-1.800	342145	342231	SI21AC0260	SI21AC0262	6.0	5.50	6.80	1.00			0.02720	0.04590	0.06760	0.19860	1.56500
345028	TCP	175.00	0.00497	2.040	1.170	342150	342202	SI21AC0172	SI21AC0171	6.0	3.20	3.80	1.00		X	0.00330	0.00550	0.00900	0.22160	1.74600
345031	TCP	150.00	0.00507	0.700	-0.060	342154	342210	SI21AC0199	SI21AC0200	6.0	4.30	4.60	1.00		X	0.01320	0.02230	0.03600	0.22370	1.76300
345036	TCP	265.50	0.00493	1.320	0.010	342161	342253	SI21AC0156	SI21AC0155	6.0	3.30	5.30	12.00		X	0.01500	0.02520	0.04060	0.22080	1.74000
345038	TCP	200.00	0.00200	-0.600	-1.000	342162	342078	SI21AC0565	SI21AC0328	6.0	4.50	6.00	3.00			0.03140	0.05840	0.08840	0.14050	1.10800
345065	TCP	232.00	0.00500	1.170	0.010	342202	342308	SI21AC0171	SI21AC0173	6.0	3.80	5.00	4.00		X	0.02450	0.04120	0.05970	0.22220	1.75100
345068	TCP	107.00	0.00495	1.410	0.880	342207	342248	SI21AC0206	SI21AC0205	6.0	3.70	4.10	0.00		X	0.00640	0.01080	0.01580	0.22120	1.74300
345069	TCP	250.00	0.00596	-1.150	-2.640	342208	342321	SI21AC0186	SI21AC0185	6.0	6.30	7.40	4.00			0.03200	0.05380	0.08160	0.24260	1.91200
345071	TCP	150.00	0.00500	-0.060	-0.810	342210	342283	SI21AC0200	SI21AC0201	6.0	4.60	5.10	1.00		X	0.01820	0.03070	0.04960	0.22220	1.75100
345078	TCP	260.00	0.00500	1.440	0.140	342221	342320	SI21AC0154	SI21AC0153	6.0	2.00	3.20	5.00			0.00390	0.00660	0.01120	0.22220	1.75100
345101	TCP	170.00	0.00512	0.880	0.010	342248	342308	SI21AC0205	SI21AC0173	6.0	4.10	5.00	0.00		X	0.01120	0.01880	0.02800	0.22480	1.77200

6" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
345103	TCP	265.50	0.00569	0.010	-1.500	342253	342356	SI21AC0155	SI21AC0151	6.0	5.30	5.90	8.00		X	0.02500	0.04200	0.06740	0.23700	1.86800
345107	TCP	233.00	0.00571	0.730	-0.600	342258	342162	SI21AC0566	SI21AC0565	6.0	1.30	4.50	2.00			0.02090	0.03890	0.05650	0.23740	1.87100
345111	TCP	233.00	0.00562	-0.430	-1.740	342261	342157	SI21AC0560	SI21AC0264	6.0	4.10	6.40	1.00			0.03380	0.05690	0.08380	0.23570	1.85700
345124	TCP	150.00	0.00600	-0.810	-1.710	342283	342357	SI21AC0201	SI21AC0202	6.0	5.10	5.90	2.00		X	0.03260	0.05490	0.08670	0.24340	1.91800
345140	TCP	150.00	0.00500	0.010	-0.740	342308	342385	SI21AC0173	SI21AC0174	6.0	5.00	5.20	2.00		X	0.05580	0.09390	0.13430	0.22220	1.75100
345148	TCP	195.00	0.00497	0.140	-0.830	342320	342402	SI21AC0153	SI21AC0152	6.0	3.20	4.80	3.00			0.00590	0.00990	0.01730	0.22170	1.74700
345171	TCP	178.00	0.00601	0.260	-0.810	342353	342283	SI21AC0203	SI21AC0201	6.0	3.80	5.10	0.00		X	0.00930	0.01570	0.02410	0.24370	1.92000
345174	TCP	150.00	0.00600	-1.710	-2.610	342357	379737	SI21AC0202	SI21AC0183	6.0	5.90	7.50	2.00		X	0.04000	0.06740	0.10530	0.24340	1.91800
345182	TCP	234.00	0.00402	0.510	-0.430	342367	342261	SI21AC0559	SI21AC0560	6.0	3.20	4.10	4.00			0.03130	0.05270	0.07560	0.19920	1.57000
345197	TCP	150.00	0.00500	-0.740	-1.490	342385	379756	SI21AC0174	SI21AC0175	6.0	5.20	5.50	2.00		X	0.05890	0.09920	0.14330	0.22220	1.75100
345205	TCP	104.00	0.00596	0.880	0.260	342394	342353	SI21AC0204	SI21AC0203	6.0	3.30	3.80	1.00		X	0.00370	0.00620	0.00910	0.24270	1.91200
345226	TCP	178.00	0.00399	1.220	0.510	379754	342367	SI21AC0557	SI21AC0559	6.0	3.60	3.20	2.00			0.02370	0.03990	0.05600	0.19850	1.56400
345229	TCP	233.00	0.00399	-0.870	-1.800	342348	342231	SI21AC0556	SI21AC0262	6.0	3.50	6.80	3.00			0.01240	0.02080	0.03500	0.19860	1.56500
345230	TCP	234.00	0.00342	-0.070	-0.870	379765	342348	SI21AC0552	SI21AC0556	6.0	2.70	3.50	3.00			0.00690	0.01170	0.02040	0.18380	1.44800
345250	TCP	122.34	0.04757	19.970	14.150	338867	338940	SI21AC0390	SI21AC0389	6.0	4.00	4.10	3.00			0.01190	0.02000	0.02630	0.68550	5.40200
345263	TCP	88.00	0.07000	63.000	56.840	338903	339016	SI21AC0421	SI21AC0420	6.0	7.00	7.00	1.00			0.00790	0.01320	0.01720	0.83150	6.55300
356673	TCP	35.00	0.00600	2.100	1.900	4051435	352963	---	SI21AJ0209	6.0	---	4.90	0.00		X	---	---	---	---	---
357124	TCP	136.79	0.05600	37.660	30.000	349566	349709	SI21AJ0515	SI21AJ0514	6.0	3.80	4.00	3.00		X	0.00150	0.00280	0.01240	0.74370	5.86100
357139	TCP	175.00	0.02857	30.000	25.000	349709	349933	SI21AJ0514	SI21AJ0513	6.0	4.00	8.10	7.00		X	0.00200	0.00390	0.02730	0.53120	4.18600
357237	TCP	198.00	0.01091	13.700	11.540	350870	351135	SI21AJ0351	SI21AJ0350	6.0	4.00	4.00	2.00			0.00620	0.01180	0.02790	0.32830	2.58700
357296	TCP	236.00	0.01653	14.500	10.600	351902	352197	SI21AJ0357	SI21AJ0356	6.0	2.60	5.10	11.00			0.00450	0.00850	0.03120	0.40400	3.18400
357310	TCP	70.00	0.01157	10.600	9.790	352197	352216	SI21AJ0356	SI21AJ0355	6.0	5.10	5.50	0.00			0.00840	0.01610	0.04740	0.33810	2.66400
357316	TCP	13.00	0.01077	10.100	9.960	352279	352267	SI21AJ0353	SI21AJ0354	6.0	5.40	5.60	0.00			0.00340	0.00640	0.00940	0.32610	2.57000
357319	TCP	240.00	0.02192	23.340	18.080	352350	352646	SI21AJ0334	SI21AJ0335	6.0	4.30	5.00	0.00			0.00780	0.01470	0.03460	0.46530	3.66700
357325	TCP	200.00	0.01900	5.780	1.980	352454	352662	SI21AJ0207	SI21AJ0205	6.0	6.20	4.60	5.00			0.01940	0.03600	0.06320	0.43320	3.41400
357327	TCP	100.00	0.01000	6.750	5.750	352496	352543	SI21AJ0214	SI21AJ0213	6.0	4.80	6.40	3.00		X	0.00980	0.01820	0.02690	0.31430	2.47700
357333	TCP	58.00	0.01000	5.750	5.170	352543	352606	SI21AJ0213	SI21AJ0212	6.0	6.40	6.20	1.00			0.01030	0.01920	0.02950	0.31430	2.47700
357334	TCP	201.00	0.00637	3.260	1.980	352595	352662	SI21AJ0206	SI21AJ0205	6.0	2.70	4.60	2.00			0.00590	0.01100	0.01840	0.25080	1.97600
357338	TCP	184.00	0.00995	5.170	3.340	352606	352812	SI21AJ0212	SI21AJ0211	6.0	6.20	4.90	1.00			0.03970	0.07360	0.11830	0.31340	2.47000
357342	TCP	65.00	0.00708	9.150	8.690	352645	352708	SI21AJ0231	SI21AJ0230	6.0	3.30	3.30	0.00			0.00240	0.00450	0.00780	0.26440	2.08300
357352	TCP	241.11	0.00900	7.340	5.170	352702	352606	SI21AJ0228	SI21AJ0212	6.0	4.80	6.20	3.00			0.02830	0.05250	0.08040	0.29820	2.35000
357353	TCP	63.00	0.00317	8.690	8.490	352708	352768	SI21AJ0230	SI21AJ0229	6.0	3.30	3.80	0.00			0.00240	0.00450	0.00900	0.17710	1.39500
357361	TCP	204.14	0.01450	16.400	13.440	352817	353054	SI21AJ0333	SI21AJ0332	6.0	5.20	5.70	3.00			0.00830	0.01580	0.02930	0.37840	2.98200
379562	VCP	28.61	0.00700	0.290	0.100	379509	4029319	SI21AC0129	---	6.0	4.30	13.10	0.00			---	---	---	---	---
379566	VCP	199.50	0.00400	1.090	0.290	379517	379509	SI21AC0130	SI21AC0129	6.0	3.60	4.30	2.00			0.12220	0.20570	0.28670	0.22470	1.77100
379573	VCP	202.60	0.00513	2.130	1.090	379528	379517	SI21AC0131	SI21AC0130	6.0	3.00	3.60	1.00			0.11530	0.19410	0.26460	0.22520	1.77400
379577	VCP	340.00	0.00050	2.300	2.130	379533	379528	SI21AC0132	SI21AC0131	6.0	2.90	3.00	1.00			0.06630	0.11160	0.15080	0.07030	0.55400
380438	TCP	257.00	0.00599	-1.490	-3.030	379756	379831	SI21AC0175	SI21AC0176	6.0	5.50	7.50	4.00		X	0.08070	0.13600	0.19420	0.24330	1.91700
380448	TCP	55.00	0.00400	1.440	1.220	379771	379754	SI21AC0558	SI21AC0557	6.0	4.20	3.60	3.00			0.01660	0.02800	0.03770	0.19880	1.56600
380477	TCP	235.00	0.00302	0.780	0.070	379810	379765	SI21AC0553	SI21AC0552	6.0	1.90	2.70	1.00			0.00690	0.01170	0.01830	0.17270	1.36100
380490	TCP	56.00	0.00393	1.000	0.780	379830	379810	SI21AC0554	SI21AC0553	6.0	1.80	1.90	1.00			0.00690	0.01170	0.01620	0.19700	1.55200
380491	TCP	65.00	0.00600	-3.030	-3.420	379831	379855	SI21AC0176	SI21AC0177	6.0	7.50	8.30	0.00		X	0.08640	0.14540	0.20730	0.24340	1.91800
380499	UNK	218.00	---	---	---	379840	379771	---	SI21AC0558	6.0	---	4.20	5.00			---	---	---	---	---
380571	UNK	246.00	---	---	---	379932	379830	---	SI21AC0554	6.0	---	1.80	5.00			---	---	---	---	---
383324	TCP	108.00	0.00694	15.160	14.410	381354	381284	SI21AJ0331	SI21AJ0330	6.0	2.50	4.00	3.00		X	0.00540	0.01030	0.01930	0.26190	2.06400
383429	CIP	260.00	0.00388	0.310	-0.700	381488	381535	SI21AJ0198	SI21AJ0199	6.0	4.30	5.50	1.00			0.02080	0.03850	0.06570	0.19590	1.54400
685367	TCP	263.00	0.00099	-3.270	-3.530	683806	683789	SI21AQ0008	SI21AQ0007	6.0	7.40	11.70	7.00		X	0.10670	0.24490	0.68340	0.09880	0.77900
685372	TCP	124.51	0.01502	-1.400	-3.270	683816	683806	SI21AQ0009	SI21AQ0008	6.0	5.90	7.40	4.00		X	0.09610	0.22050	0.59550	0.38520	3.03500
685394	TCP	201.00	0.01005	0.620	-1.400	683852	683816	SI21AQ0010	SI21AQ0009	6.0	4.40	5.90	2.00		X	0.08540	0.19610	0.51330	0.31510	2.48300

6" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
685423	TCP	235.00	0.00115	0.100	-0.170	683898	683865	SI21AC0220	SI21AC0219	6.0	4.40	5.00	10.00		X	---	---	---	0.10650	0.83900
685535	VCP	104.00	0.00096	-7.870	-7.970	684068	684075	SI21AQ1003	SI21AQ0003	6.0	11.90	13.60	0.00			0.03030	0.06960	0.11690	0.09750	0.76800
685705	TCP	258.00	0.00717	-1.620	-3.470	684306	684260	SI21AC9999	SI21AC9998	6.0	5.60	8.50	0.00			0.01740	0.02940	0.04120	0.26610	2.09700
2023674	VCP	5.00	0.01000	0.220	0.170	2023673	683634	---	SI21AC0234	6.0	5.90	4.50	0.00		X	---	---	---	---	---
3002644	VCP	175.00	0.03400	45.000	39.000	339301	339507	SI21AC0416	SI21AC0415	6.0	5.00	5.00	0.00		X	0.00250	0.00410	0.00930	0.58190	4.58600
3005675	TCP	124.50	0.00700	8.240	7.340	352768	352702	SI21AJ0229	SI21AJ0228	6.0	3.80	4.80	2.00			0.02300	0.04270	0.05990	0.26720	2.10600
3013483	CCP	108.00	0.00600	3.650	3.000	3013482	381370	---	SI21AJ0121	6.0	3.40	12.00	3.00			---	---	---	---	---
3013484	CCP	108.00	0.00600	4.300	3.650	3013477	3013482	---	---	6.0	3.00	3.40	1.00			---	---	---	---	--
4013596	VCP	69.00	0.00600	-0.530	-0.940	4013594	4013595	---	---	6.0	5.70	---	0.00			---	---	---	---	---
4013599	VCP	84.00	0.00600	---	-0.530	4013598	4013594	---	---	6.0	4.00	5.70	0.00			---	---	---	---	---
4026571	TCP	75.88	0.01300	-0.190	-1.200	341504	4026534	SI21AC0215	---	6.0	4.90	12.30	0.00			---	---	---	---	---
4034462	TCP	17.51	0.05600	59.200	58.220	338207	4034461	SI21AC0480	---	6.0	4.10	4.80	0.00			---	---	---	---	---
4038332	PVC	11.00	0.02500	-1.720	-2.000	683236	4038333	SI21AQ1052	---	6.0	6.20	---	0.00		X	---	---	---	---	---
TOTALS		**21,055.79**											**339**	**0**	**41**					

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
305828	VCP	230.00	0.00452	-0.540	-1.580	302517	30701	SI21AQ0218	SI21AQ0217	8.0	7.00	7.10	1.00		X	0.11400	0.26160	0.34000	0.45510	2.01700
305864	VCP	141.50	0.00601	1.220	0.370	302554	302636	SI21AQ0221	SI21AQ0219	8.0	6.80	6.80	0.00			0.03490	0.08010	0.10210	0.52460	2.32500
305926	VCP	158.00	0.00576	0.370	-0.540	302636	302517	SI21AQ0219	SI21AQ0218	8.0	6.80	7.00	0.00		X	0.11400	0.26160	0.33070	0.51370	2.27700
306012	VCP	145.00	0.02503	4.000	0.370	302742	302636	SI21AQ0222	SI21AQ0219	8.0	6.20	6.80	0.00			0.04510	0.10340	0.13390	1.07090	4.74700
306408	TCP	152.00	0.02849	15.370	11.040	303371	311646	SI21AQ0272	SI21AQ0271	8.0	5.10	5.50	3.00			0.09200	0.21110	0.24560	1.14240	5.06400
313717	TCP	175.40	0.00416	10.700	9.970	309695	309854	SI21AQ0307	SI21AQ0306	8.0	3.70	5.80	0.00			0.07140	0.16380	0.71060	0.43660	1.93600
313809	TCP	196.41	0.00423	9.970	9.140	309854	310015	SI21AQ0306	SI21AQ0305	8.0	5.80	5.70	4.00		X	0.07300	0.16760	0.77450	0.44000	1.95000
313919	TCP	267.00	0.02929	27.990	20.170	310017	310219	SI21AQ0301	SI21AQ0300	8.0	4.00	4.20	0.00		X	0.00160	0.00380	0.06670	1.15830	5.13500
313980	TCP	261.53	0.00421	9.140	8.040	310015	310208	SI21AQ0305	SI21AQ0298	8.0	5.70	5.90	5.00		X	0.07460	0.17130	0.84090	0.43900	1.94600
314031	TCP	165.67	0.01280	8.040	5.920	310208	310342	SI21AQ0298	SI21AQ0297	8.0	5.90	6.00	0.00		X	0.07750	0.17790	0.96470	0.76560	3.39400
314037	TCP	100.00	0.02930	20.170	17.240	310219	310318	SI21AQ0300	SI21AQ0299	8.0	4.20	4.10	1.00		X	0.00250	0.00560	0.09870	1.15860	5.13600
314098	TCP	103.00	0.08932	17.240	8.040	310318	310208	SI21AQ0299	SI21AQ0298	8.0	4.10	5.90	1.00		X	0.00290	0.00660	0.11700	2.02280	8.96700
314114	TCP	102.00	0.01000	5.920	4.900	310342	310419	SI21AQ0297	SI21AQ0290	8.0	6.00	6.10	0.00		X	0.07790	0.17890	0.98290	0.67680	3.00000
314163	TCP	88.00	0.01000	4.900	4.020	310419	310472	SI21AQ0290	SI21AQ0282	8.0	6.10	2.50	0.00			0.08230	0.18890	1.17510	0.67680	3.00000
314224	TCP	143.00	0.01203	7.250	5.530	310522	310419	SI21AQ0291	SI21AQ0290	8.0	4.00	6.10	1.00			0.00440	0.01000	0.18860	0.74230	3.29000
314321	TCP	334.20	0.02579	30.370	21.750	310669	310910	SI21AQ0289	SI21AQ0288	8.0	5.90	6.30	6.00			0.06490	0.14900	0.22820	1.08700	4.81800
314480	TCP	332.80	0.02536	21.750	13.310	310910	311138	SI21AQ0288	SI21AQ0286	8.0	6.30	7.20	7.00			0.06700	0.15370	0.31210	1.07790	4.77800
314502	TCP	310.00	0.00471	4.560	3.100	310943	311129	SI21AQ0251	SI21AQ0250	8.0	6.50	7.20	3.00			0.05600	0.12860	0.21410	0.46450	2.05900
314673	TCP	122.00	0.00426	7.630	7.110	311212	311230	SI21AQ0256	SI21AQ0255	8.0	5.50	10.20	0.00			0.06530	0.14990	0.29210	0.44190	1.95900
314686	TCP	350.20	0.00400	7.110	5.710	311230	311440	SI21AQ0255	SI21AQ0254	8.0	10.20	7.30	6.00			0.14960	0.34350	0.57660	0.42790	1.89700
314702	TCP	192.50	0.00405	14.090	13.310	311258	311138	SI21AQ0287	SI21AQ0286	8.0	5.40	7.20	2.00			0.00080	0.00190	0.03620	0.43080	1.91000
314704	TCP	80.00	0.01850	36.380	34.900	311260	311307	SI21AQ0153	SI21AQ0152	8.0	4.60	4.60	0.00			0.02920	0.06710	0.11190	0.92060	4.08100
314734	TCP	240.00	0.02171	34.900	29.690	311307	311410	SI21AQ0152	SI21AQ0150	8.0	4.60	5.60	1.00			0.05850	0.13420	0.23030	0.99720	4.42100
314775	TCP	21.00	0.01619	14.740	14.400	311367	311397	SI21AQ0260	SI21AQ0259	8.0	4.90	9.70	0.00			0.00040	0.00100	0.01510	0.86120	3.81800
314798	TCP	42.00	0.11667	14.400	9.500	311397	311408	SI21AQ0259	SI21AQ0257	8.0	9.70	9.00	0.00			0.00040	0.00100	0.01680	2.31180	10.24800
314807	TCP	277.00	0.00675	9.500	7.630	311408	311212	SI21AQ0257	SI21AQ0256	8.0	9.00	5.50	0.00			0.06530	0.14990	0.28710	0.55610	2.46500
314809	TCP	68.11	0.01307	29.420	28.530	311410	311451	SI21AQ0150	SI21AQ1149	8.0	5.60	5.20	0.00			0.06050	0.13900	0.27510	0.77370	3.43000
314829	VCP	5.00	0.32200	5.710	4.100	311440	311442	SI21AQ0254	SI21AQ0268	8.0	7.30	9.30	0.00			0.14960	0.34350	0.57680	3.84070	17.02500
314836	TCP	171.77	0.02824	28.530	23.680	311451	311532	SI21AQ1149	SI21AQ0149	8.0	5.20	6.80	0.00			0.06050	0.13900	0.28210	1.13730	5.04100
314884	TCP	175.72	0.01650	23.680	20.780	311532	311605	SI21AQ0149	SI21AQ0147	8.0	6.80	7.80	0.00			0.25520	0.58590	0.95020	0.86950	3.85400
314887	TCP	235.09	0.02552	15.500	9.500	311543	311408	SI21AQ0258	SI21AQ0257	8.0	9.70	9.00	0.00			0.06490	0.14900	0.25070	1.08130	4.79300

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
314934	TCP	200.00	0.01600	20.780	17.580	311605	311663	SI21AQ0147	SI21AQ0145	8.0	7.80	9.50	0.00			0.26270	0.60310	1.04680	0.85610	3.79500
314935	TCP	283.90	0.00821	24.680	22.350	315680	311605	SI21AQ0148	SI21AQ0147	8.0	8.40	7.80	8.00		X	0.00750	0.01720	0.08840	0.61320	2.71800
314945	TCP	296.00	0.00615	7.390	5.570	311616	311461	SI21AQ0270	SI21AQ0269	8.0	6.90	8.50	7.00			0.35440	0.79940	0.94290	0.53070	2.35300
314962	TCP	76.00	0.01829	29.770	28.380	311644	311750	SI21AQ0095	SI21AQ0094	8.0	7.30	7.30	4.00			0.01230	0.02810	0.15630	0.91530	4.05800
314963	TCP	88.00	0.04148	11.040	7.390	311646	311616	SI21AQ0271	SI21AQ0270	8.0	5.50	6.90	2.00			0.17850	0.40960	0.48050	1.37840	6.11000
314973	TCP	295.00	0.01085	16.140	12.940	311663	311760	SI21AQ0145	SI21AQ0144	8.0	9.50	7.80	0.00			0.26270	0.60310	1.06260	0.70490	3.12500
314987	TCP	209.90	0.00810	27.400	25.700	311686	311788	SI21AQ0092	SI21AQ0091	8.0	5.80	7.50	3.00		X	0.00240	0.00560	0.09750	0.60910	2.70000
315013	TCP	63.10	0.07290	12.940	8.340	311760	311731	SI21AQ0144	SI21AQ0277	8.0	7.80	9.10	0.00			0.32060	0.73240	1.27770	1.82750	8.10100
315022	TCP	157.30	0.00776	28.620	27.400	311745	311686	SI21AQ0093	SI21AQ0092	8.0	3.50	5.80	4.00		X	0.00120	0.00280	0.04770	0.59610	2.64200
315025	TCP	174.80	0.01728	28.380	25.360	311750	311788	SI21AQ0094	SI21AQ0091	8.0	7.30	7.50	3.00			0.01650	0.03780	0.26130	0.88960	3.94400
315032	TCP	45.08	0.01619	16.910	16.180	311769	311760	SI21AQ1143	SI21AQ0144	8.0	4.40	7.80	0.00			0.05530	0.12700	0.18260	0.86130	3.81800
315033	TCP	305.00	0.00485	25.220	23.740	311761	311959	SI21AQ7090	SI21AQ0090	8.0	7.80	5.90	11.00		X	0.00250	0.00570	0.03800	0.47150	2.09000
315039	TCP	185.00	0.01497	19.680	16.910	311824	311769	SI21AQ0143	SI21AQ1143	8.0	4.40	4.40	2.00			0.05530	0.12700	0.18080	0.82820	3.67100
315048	TCP	367.50	0.00400	25.360	23.890	311788	311945	SI21AQ0091	SI21AQ1091	8.0	7.50	4.80	3.00			0.02040	0.04690	0.42620	0.42810	1.89800
315069	TCP	217.90	0.00826	21.480	19.680	315681	311824	SI21AQ1142	SI21AQ0143	8.0	3.70	4.40	5.00			0.05520	0.12680	0.16930	0.61520	2.72700
315102	TCP	193.00	0.03472	19.800	13.100	311885	311760	SI21AQ0279	SI21AQ0144	8.0	8.60	7.80	0.00			0.00250	0.00570	0.03350	1.26110	5.59000
315135	TCP	37.50	0.00400	23.890	23.740	311945	311959	SI21AQ1091	SI21AQ0090	8.0	4.80	5.90	0.00			0.02540	0.05830	0.44940	0.42810	1.89800
315144	TCP	405.80	0.00399	23.740	22.120	311959	312168	SI21AQ0090	SI21AQ0088	8.0	5.90	5.60	2.00			0.03100	0.07130	0.55150	0.42760	1.89600
315177	TCP	233.90	0.01171	23.900	21.160	312014	312255	SI21AC1437	SI21AC0437	8.0	4.80	4.50	8.00			0.01830	0.03080	0.04130	0.73260	3.24700
315181	TCP	183.00	0.00519	23.200	22.250	312020	312210	SI21AQ0087	SI21AQ0086	8.0	5.60	5.60	0.00			0.01370	0.03150	0.06630	0.48770	2.16200
315272	TCP	68.00	0.00397	22.120	21.850	312168	312210	SI21AQ0088	SI21AQ0086	8.0	5.60	5.60	1.00			0.03330	0.07630	0.63940	0.42650	1.89100
315296	TCP	262.30	0.00404	21.850	20.790	312210	312359	SI21AQ0086	SI21AQ0084	8.0	5.60	5.80	5.00			0.06620	0.15200	0.79330	0.43030	1.90700
315325	TCP	175.00	0.01177	21.160	19.100	312255	312459	SI21AC0437	SI21AC1436	8.0	4.50	4.50	5.00		X	0.02270	0.03830	0.05280	0.73430	3.25500
315355	TCP	201.90	0.00505	46.610	45.590	312085	312314	SI21AC0451	SI21AC0450	8.0	5.40	5.40	5.00			0.00980	0.02530	0.03880	0.48110	2.13300
315385	TCP	176.90	0.00418	20.790	20.050	312359	312486	SI21AQ0084	SI21AQ0082	8.0	5.80	5.70	1.00			0.07560	0.17360	0.86660	0.43780	1.94000
315397	TCP	55.00	0.00382	45.590	45.380	312314	312377	SI21AC0450	SI21AC0445	8.0	5.40	4.60	0.00			0.01080	0.02800	0.04420	0.41820	1.85400
315443	TCP	36.00	0.01111	19.100	18.700	312459	312501	SI21AC1436	SI21AC0436	8.0	4.50	4.60	3.00		X	0.04230	0.07130	0.09740	0.71340	3.16300
315460	TCP	222.30	0.00800	22.260	20.400	312211	4055672	SI21AQ0083	---	8.0	5.10	5.10	1.00			0.02640	0.06060	0.12030	0.57800	2.56200
315461	TCP	57.00	0.00900	19.940	19.430	312486	312548	SI21AQ0082	SI21AQ0081	8.0	5.70	5.20	0.00			0.10210	0.23420	0.98920	0.70590	3.12900
315472	TCP	87.00	0.00598	18.700	18.180	312501	312586	SI21AC0436	SI21AC0433	8.0	4.60	4.80	3.00		X	0.04230	0.07130	0.10010	0.52330	2.32000
315475	TCP	333.00	0.00402	23.720	22.380	312507	312168	SI21AQ0089	SI21AQ0088	8.0	5.60	5.60	3.00			0.00190	0.00440	0.08230	0.42940	1.90300
315494	TCP	362.00	0.01649	18.460	12.490	312540	338106	SI21AC0440	SI21AC0369	8.0	9.30	8.60	6.00			0.02860	0.04820	0.08090	0.86920	3.85300
315501	VCP	154.42	0.01292	---	---	312548	4038591	SI21AQ0081	---	8.0	5.20	---	1.00			0.05780	0.13260	0.52260	0.76930	3.41000
315527	TCP	334.80	0.00780	17.690	15.080	312586	338106	SI21AC0433	SI21AC0369	8.0	4.80	8.60	12.00		X	0.06520	0.10980	0.15400	0.59760	2.64900
315536	TCP	177.00	0.00497	21.100	20.220	312601	312726	SI21AQ0169	SI21AQ0168	8.0	3.90	4.50	6.00			0.00940	0.02150	0.09110	0.47720	2.11600
315541	UNK	94.00	---	---	---	312607	312678	SI21AQ0163	SI21AQ1163	8.0	---	5.50	1.00			---	---	---	---	---
315569	TCP	176.73	0.01488	17.970	15.340	312653	312749	SI21AQ0080	SI21AQ0079	8.0	5.00	4.40	1.00			0.06550	0.15030	0.56290	0.82570	3.66000
315582	TCP	221.40	0.01206	14.830	12.160	312678	682185	SI21AQ1163	SI21AQ0162	8.0	5.50	6.00	6.00			---	---	---	0.74330	3.29500
315611	TCP	197.00	0.00508	19.620	18.620	312726	338141	SI21AQ0168	SI21AQ0167	8.0	4.50	5.00	6.00			0.01820	0.04170	0.18080	0.48220	2.13800
315627	TCP	292.30	0.01502	15.340	10.950	312749	338154	SI21AQ0079	SI21AQ0075	8.0	4.40	4.80	1.00			0.10480	0.24060	0.70460	0.82950	3.67700
315641	TCP	148.00	0.00811	44.400	43.200	312611	337969	SI21AC0446	SI21AC0431	8.0	5.20	7.60	3.00			0.02910	0.07500	0.13170	0.60950	2.70200
342521	TCP	33.20	0.00813	11.490	11.220	338106	338147	SI21AC0369	SI21AC0370	8.0	8.60	8.10	0.00			0.12000	0.20200	0.31880	0.61040	2.70600
342531	TCP	200.00	0.00495	42.550	41.560	338219	337969	SI21AC0430	SI21AC0431	8.0	8.40	7.60	0.00			0.05160	0.13310	0.20320	0.47620	2.11100
342540	TCP	226.01	0.00996	18.620	16.370	338141	338261	SI21AQ0167	SI21AQ0166	8.0	5.00	4.70	3.00			0.04350	0.09990	0.28420	0.67530	2.99400
342542	TCP	298.81	0.00810	11.220	8.800	338147	338431	SI21AC0370	SI21AC0371	8.0	8.10	7.40	2.00			0.21160	0.35640	0.53260	0.60910	2.70000
342551	TCP	156.50	0.00403	12.430	11.800	338160	338106	SI21AC0367	SI21AC0369	8.0	5.90	8.60	4.00		X	0.02620	0.04410	0.08360	0.42940	1.90400
342559	TCP	22.00	0.00409	12.520	12.430	338174	338160	SI21AC0368	SI21AC0367	8.0	6.00	5.90	1.00		X	0.01610	0.02720	0.05990	0.43290	1.91900
342609	TCP	225.00	0.01080	16.370	13.940	338261	338409	SI21AQ0166	SI21AQ0165	8.0	4.70	4.70	7.00			0.09200	0.21110	0.47330	0.70340	3.11800
342619	TCP	202.20	0.00495	11.950	10.950	338280	338154	SI21AQ0164	SI21AQ0075	8.0	4.00	4.80	5.00			0.06490	0.14900	0.32330	0.47600	2.11000

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
342653	TCP	101.00	0.00446	43.000	42.550	338337	338219	SI21AC0429	SI21AC0430	8.0	8.10	8.40	0.00			0.05160	0.13310	0.20000	0.45180	2.00300
342670	TCP	332.21	0.00385	13.800	12.520	338363	338174	SI21AC0363	SI21AC0368	8.0	7.10	6.00	15.00		X	0.01610	0.02720	0.05970	0.42010	1.86200
342700	TCP	198.00	0.01005	13.940	11.950	338409	338280	SI21AQ0165	SI21AQ0164	8.0	4.70	4.00	0.00			0.06200	0.14230	0.30410	0.67850	3.00800
342707	TCP	342.50	0.01150	13.780	9.840	338419	338598	SI21AQ0073	SI21AQ0072	8.0	4.90	5.20	4.00			0.06570	0.15080	0.32520	0.72590	3.21800
342716	TCP	281.90	0.00511	8.800	7.360	338431	338686	SI21AC0371	SI21AC0373	8.0	7.40	5.90	2.00			0.23860	0.40180	0.59840	0.48370	2.14400
342727	TCP	102.00	0.00451	43.460	43.000	338446	338337	SI21AC0428	SI21AC0429	8.0	7.90	8.10	0.00			0.05160	0.13310	0.19840	0.45450	2.01500
342825	TCP	363.00	0.01201	9.670	5.310	338598	682785	SI21AQ0072	SI21AQ0071	8.0	5.20	5.60	6.00			0.08450	0.19400	0.40990	0.74180	3.28800
342880	TCP	251.10	0.00510	7.360	6.080	338686	338831	SI21AC0373	SI21AC0361	8.0	5.90	4.90	2.00			0.24270	0.40870	0.62040	0.10460	0.46400
342913	TCP	293.00	0.00717	46.710	44.610	338733	338495	SI21AC0424	SI21AC1424	8.0	8.30	7.70	5.00			0.00540	0.01390	0.04320	0.57300	2.54000
342921	TCP	45.00	0.00733	47.040	46.710	338758	338733	SI21AC0423	SI21AC0424	8.0	8.30	8.30	0.00			0.00520	0.01350	0.03680	0.57960	2.56900
342974	TCP	320.00	0.00609	7.300	5.350	338831	339018	SI21AC0361	SI21AC0376	8.0	4.90	6.10	0.00			0.24270	0.40870	0.62550	0.52840	2.34200
343073	TCP	242.00	0.00479	48.200	47.040	339005	338758	SI21AC0422	SI21AC0423	8.0	6.90	8.30	9.00			0.00520	0.01350	0.03610	0.46860	2.07700
343082	TCP	37.00	0.00200	4.470	4.380	339018	339056	SI21AC0376	SI21AC0374	8.0	6.10	7.00	0.00			0.26060	0.43880	0.66220	0.89710	3.97700
343090	TCP	238.00	0.00718	7.790	6.080	339032	338852	SI21AC0358	SI21AC0360	8.0	4.90	4.90	3.00			0.06240	0.10510	0.14340	0.57370	2.54300
343117	TCP	263.90	0.00496	12.110	10.800	339069	339272	SI21AQ0046	SI21AQ0045	8.0	4.20	5.20	7.00		X	0.07220	0.16560	0.28290	0.47690	2.11400
343138	VCP	163.00	0.00399	56.470	55.820	339110	339226	SI21AC0414	SI21AC0413	8.0	5.50	3.40	1.00		X	0.00380	0.00730	0.00810	0.42740	1.89500
343151	TCP	177.82	0.06844	44.260	32.090	339132	339274	SI21AC0419	SI21AC0399	8.0	7.10	8.30	1.00			0.01310	0.02200	0.02820	1.77070	7.84900
343158	TCP	52.00	0.02300	5.770	4.570	339146	339108	SI21AC0381	SI21AC0375	8.0	4.70	7.30	0.00			0.18520	0.31190	0.42070	0.75090	3.32800
343197	TCP	238.00	0.00887	9.900	7.790	339218	339032	SI21AC0359	SI21AC0358	8.0	4.40	4.90	3.00			0.03490	0.05880	0.08000	0.63730	2.82500
343204	VCP	207.00	0.00444	55.820	54.900	339226	339357	SI21AC0413	SI21AC0412	8.0	3.40	6.30	1.00			0.00380	0.00730	0.00840	0.45120	2.00000
343206	TCP	122.20	0.00802	45.240	44.260	339230	339132	SI21AC0418	SI21AC0419	8.0	7.00	7.10	0.00			0.02130	0.03580	0.04130	0.60610	2.68700
343225	TCP	110.00	0.00500	6.320	5.770	339261	339146	SI21AC0382	SI21AC0381	8.0	5.00	4.70	1.00			0.13330	0.22440	0.30730	0.47860	2.12200
343234	TCP	263.90	0.00500	10.800	9.480	339272	339527	SI21AQ0045	SI21AQ0044	8.0	5.20	4.10	4.00		X	0.13140	0.30150	0.51350	0.47870	2.12200
343235	TCP	300.20	0.05336	32.090	16.070	339274	339645	SI21AC0399	SI21AC0394	8.0	8.30	6.00	1.00			0.12370	0.20840	0.26240	1.56350	6.93100
343236	TCP	251.20	0.00653	6.370	4.730	339275	339549	SI21AC0291	SI21AC0292	8.0	6.10	5.40	9.00		X	0.02600	0.04380	0.06020	0.54690	2.42400
343282	VCP	293.00	0.00451	54.900	53.580	339357	339506	SI21AC0412	SI21AC0411	8.0	6.30	12.30	1.00			0.00380	0.00730	0.00890	0.45430	2.01400
343337	TCP	343.00	0.00402	33.470	32.090	339458	339274	SI21AC0400	SI21AC0399	8.0	7.50	8.30	8.00			0.10930	0.18400	0.22850	0.42930	1.90300
343347	TCP	261.00	0.00379	9.500	8.510	339480	339665	SI21AQ0042	SI21AQ0041	8.0	4.70	4.60	2.00			0.07350	0.16870	0.29300	0.41690	1.84800
343381	TCP	186.00	0.00522	9.480	8.510	339527	339665	SI21AQ0044	SI21AQ0041	8.0	4.10	4.60	0.00			0.13140	0.30150	0.52110	0.48880	2.16700
343388	TCP	202.59	0.01160	8.670	6.320	339438	339261	SI21AC0383	SI21AC0382	8.0	6.30	5.00	3.00			0.11350	0.19120	0.26230	0.72900	3.23100
343397	TCP	179.20	0.00647	4.730	3.570	339549	339640	SI21AC0292	SI21AC0293	8.0	5.40	6.40	9.00		X	0.05200	0.08760	0.11980	0.54460	2.41400
343404	TCP	207.00	0.07261	53.380	38.350	339559	339815	SI21AC0410	SI21AC0409	8.0	7.90	5.30	7.00			0.03790	0.07300	0.07600	1.82380	8.08500
343411	TCP	367.20	0.00286	34.520	33.470	339570	339458	SI21AC0401	SI21AC0400	8.0	8.90	7.50	2.00			0.10160	0.17100	0.20490	0.36190	1.60400
343439	TCP	152.24	0.02240	13.600	10.190	339621	339537	SI21AC0385	SI21AC0384	8.0	4.80	4.90	2.00			0.02170	0.03650	0.04970	1.01300	4.49000
343443	TCP	108.00	0.00389	34.940	34.520	339629	339570	SI21AC0402	SI21AC0401	8.0	8.90	8.90	4.00			0.08710	0.14660	0.16680	0.42210	1.87100
343451	TCP	201.50	0.00700	3.570	2.260	339640	4046344	SI21AC0293	---	8.0	6.40	7.90	12.00		X	0.06760	0.11390	0.15690	0.54650	2.42300
343454	TCP	65.00	0.01031	16.070	15.400	339645	339686	SI21AC0394	SI21AC0393	8.0	6.00	5.40	0.00			0.12370	0.20840	0.26300	0.71730	3.18000
343467	TCP	247.91	0.00770	8.510	6.600	339665	339841	SI21AQ0041	SI21AQ0040	8.0	4.60	4.40	5.00			0.23380	0.53660	0.93160	0.59410	2.63300
343481	TCP	398.00	0.01771	15.400	8.350	339686	340051	SI21AC0393	SI21AC0351	8.0	5.40	5.10	1.00			0.29380	0.49470	0.62960	0.89310	3.95900
343514	TCP	92.00	0.06989	47.200	40.770	339737	339848	SI21AJ0395	SI21AJ0394	8.0	7.30	8.50	2.00			0.00340	0.00660	0.00690	1.78930	7.93200
343516	TCP	371.71	0.00761	8.200	5.370	339739	340006	SI21AC0277	SI21AC0278	8.0	4.80	4.90	1.00			0.02330	0.03930	0.05530	0.59060	2.61800
343540	TCP	363.30	0.00402	36.400	34.940	339778	339629	SI21AC0403	SI21AC0402	8.0	7.30	8.90	7.00			0.06810	0.11470	0.12830	0.42910	1.90200
343547	TCP	85.00	0.00300	2.480	2.250	339789	339746	SI21AC0285	SI21AC0284	8.0	7.00	8.00	1.00		X	0.00420	0.00710	0.01020	0.57340	2.54200
343565	TCP	360.50	0.04480	38.350	22.200	339815	340313	SI21AC0409	SI21AC0405	8.0	5.30	5.20	3.00			0.04480	0.08550	0.12650	1.43260	6.35000
343581	TCP	272.00	0.00400	16.400	15.400	339770	339686	SI21AC0600	SI21AC0393	8.0	7.70	5.40	2.00			0.13190	0.22210	0.27800	0.42250	1.87300
343583	TCP	433.00	0.00600	33.750	31.150	339837	340080	SI21AJ0380	SI21AJ0379	8.0	8.90	7.80	5.00			0.01160	0.02240	0.02490	0.52450	2.32500
343585	TCP	248.00	0.00758	6.600	4.720	339841	340015	SI21AQ0040	SI21AQ0039	8.0	4.40	4.50	0.00			0.26270	0.60290	1.04910	0.58930	2.61200
343591	TCP	163.00	0.05902	40.770	31.150	339848	340080	SI21AJ0394	SI21AJ0379	8.0	8.50	7.80	3.00			0.01020	0.01970	0.02080	1.64430	7.28900
343649	TCP	190.00	0.00474	17.500	16.600	339933	339834	SI21AC0620	SI21AC0395	8.0	7.00	7.50	3.00			0.10220	0.17210	0.20500	0.46580	2.06500

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
343698	TCP	103.00	0.00291	17.800	17.500	340004	339933	SI21AC0396	SI21AC0620	8.0	7.00	7.00	1.00			0.05700	0.09600	0.12400	0.36530	1.61900
343700	TCP	283.00	0.00678	5.370	3.450	340006	340195	SI21AC0278	SI21AC0279	8.0	4.90	4.90	1.00			0.05430	0.09140	0.12680	0.55750	2.47100
343705	TCP	135.51	0.00753	4.720	3.700	340015	683492	SI21AQ0039	SI21AQ0037	8.0	4.50	5.30	0.00			0.29160	0.66930	1.16200	0.81190	3.59900
343718	TCP	191.50	0.00501	6.420	5.460	340032	340287	SI21AC0276	SI21AC0275	8.0	4.10	5.00	3.00			0.02430	0.04090	0.06120	0.47920	2.12400
343788	TCP	267.90	0.00399	18.870	17.800	340148	340004	SI21AC0397	SI21AC0396	8.0	6.80	7.00	5.00			0.05460	0.09190	0.11760	0.42770	1.89600
343813	TCP	116.10	0.00680	3.450	2.660	340195	340282	SI21AC0279	SI21AC0280	8.0	4.90	4.30	0.00			0.06460	0.10870	0.15080	0.55830	2.47500
343867	TCP	140.50	0.02000	2.660	-0.150	340282	340340	SI21AC0280	SI21AC0281	8.0	4.30	5.30	0.00			0.06460	0.10870	0.15210	0.93830	4.15900
343870	TCP	169.91	0.01001	5.460	3.760	340287	340497	SI21AC0275	SI21AC1273	8.0	5.00	4.40	3.00			0.03310	0.05570	0.09210	0.67700	3.00100
343875	TCP	234.90	0.00396	19.800	18.870	340293	340148	SI21AC0398	SI21AC0397	8.0	5.30	6.80	2.00			0.01590	0.02680	0.03400	0.42590	1.88800
343878	TCP	331.00	0.03103	31.150	20.880	340080	340546	SI21AJ0379	SI21AJ0376	8.0	7.80	5.50	6.00			0.01670	0.03210	0.03500	1.19220	5.28500
343913	TCP	216.50	0.00397	22.600	21.740	340345	340416	SI21AJ0378	SI21AJ0377	8.0	3.80	4.70	0.00			---	---	---	0.42660	1.89100
343958	TCP	216.00	0.00398	21.740	20.880	340416	340546	SI21AJ0377	SI21AJ0376	8.0	4.70	5.50	2.00			0.00810	0.01560	0.01740	0.42710	1.89300
344001	TCP	247.03	0.00498	4.400	3.170	340479	340746	SI21AC0240	SI21AC0239	8.0	4.10	4.90	7.00			0.01030	0.01730	0.04980	0.47760	2.11700
344013	TCP	216.93	0.02558	3.760	-1.790	340497	340778	SI21AC1273	SI21AC4008	8.0	4.40	13.10	2.00			0.03310	0.05570	0.09400	1.08260	4.79900
344028	TCP	208.00	0.00543	11.930	10.800	340534	340435	SI21AC0354	SI21AC2223	8.0	6.30	8.20	2.00			0.03740	0.07120	0.13940	0.49890	2.21100
344060	TCP	352.00	0.00406	13.360	11.930	340754	340534	SI21AC0355	SI21AC0354	8.0	5.60	6.30	6.00			0.02590	0.04920	0.09480	0.43140	1.91200
344075	TCP	288.00	0.01601	19.440	14.830	340762	340928	SI21AJ0941	SI21AJ0371	8.0	5.10	11.60	1.00			0.00700	0.01330	0.03330	0.85630	3.79600
344076	TCP	314.40	0.00401	17.870	16.610	340608	350167	SI21AJ0522	SI21AJ0521	8.0	7.30	6.60	4.00			0.04550	0.08670	0.15280	0.42850	1.89900
344195	TCP	280.00	0.00400	3.780	2.660	340789	341034	SI21AC0296	SI21AC0298	8.0	5.00	4.50	6.00			0.04000	0.06740	0.09880	0.42810	1.89800
344239	TCP	286.00	0.00430	0.450	-0.780	340860	340523	SI21AC0304	SI21AC4034	8.0	5.80	11.40	0.00			0.16550	0.27870	0.35640	0.44390	1.96800
344245	TCP	248.00	0.00403	2.660	1.660	341034	341193	SI21AC0298	SI21AC0301	8.0	4.50	4.30	2.00			0.06460	0.10880	0.15930	0.42980	1.90500
344281	TCP	348.10	0.00399	7.110	5.720	340928	341283	SI21AJ0371	SI21AJ0366	8.0	11.60	8.30	1.00			0.04860	0.09250	0.17260	0.42770	1.89600
344361	TCP	306.60	0.00401	8.340	7.110	341075	340928	SI21AJ0372	SI21AJ0371	8.0	9.10	11.60	3.00			0.09170	0.17440	0.33610	0.42870	1.90000
344395	TCP	273.80	0.00398	1.540	0.450	341127	340860	SI21AC0306	SI21AC0304	8.0	4.20	5.80	5.00			0.09540	0.16060	0.17860	0.42710	1.89300
344425	VCP	150.00	0.00600	2.440	1.540	341183	341127	SI21AC0307	SI21AC0306	8.0	2.90	4.20	4.00			0.07660	0.12890	0.13930	0.52430	2.32400
344471	TCP	285.68	0.00399	1.610	0.470	341263	341407	SI21AC0309	SI21AC0311	8.0	3.80	4.80	4.00			0.01110	0.02120	0.03800	0.42760	1.89500
344532	TCP	193.41	0.00400	0.340	-0.400	341360	4026564	SI21AC0270	---	8.0	4.60	7.00	2.00			---	---	---	---	---
344560	UNK	245.00	---	---	---	345267	341508	---	SI21AC0268	8.0	---	5.70	0.00			---	---	---	---	---
344569	TCP	200.00	0.00400	1.910	1.110	341418	341533	SI21AC0339	SI21AC0337	8.0	6.50	6.00	1.00			0.06560	0.12170	0.15340	0.42810	1.89800
344581	TCP	250.00	0.00300	2.550	1.800	341438	341574	SI21AC0312	SI21AC0315	8.0	3.50	4.50	4.00			0.02460	0.04570	0.06220	0.37070	1.64300
344614	TCP	192.00	0.00313	2.400	1.800	1004956	341615	SI21AC0640	SI21AC0314	8.0	4.30	4.50	4.00			---	---	---	0.37840	1.67700
344634	TCP	137.00	0.00387	-0.070	-0.600	341527	341599	SI21AC0216	SI21AC0217	8.0	4.60	5.40	1.00			---	---	---	0.42100	1.86600
344637	TCP	30.00	0.00433	1.110	0.980	341533	341561	SI21AC0337	SI21AC1337	8.0	6.00	5.90	1.00			0.08100	0.15020	0.20030	0.44550	1.97500
344651	TCP	196.77	0.00711	2.880	1.480	341556	341677	SI21AC0318	SI21AC0317	8.0	4.00	4.90	4.00		X	0.03080	0.05710	0.10380	0.57090	2.53100
344654	TCP	82.00	0.00402	0.980	0.650	341561	341588	SI21AC1337	SI21AC0535	8.0	5.90	5.40	1.00			0.09640	0.17880	0.24810	0.42940	1.90300
344664	TCP	66.00	0.00303	1.800	1.600	341574	341625	SI21AC0315	SI21AC1316	8.0	4.50	4.90	0.00			0.02460	0.04570	0.06350	0.37260	1.65200
344670	TCP	122.00	0.00393	0.650	0.170	341588	341656	SI21AC0535	SI21AC0336	8.0	5.40	4.50	1.00			0.10060	0.18660	0.25990	0.42450	1.88200
344678	TCP	200.00	0.00400	-0.600	-1.400	341599	683930	SI21AC0217	SI21AC3030	8.0	5.40	11.00	2.00			---	---	---	0.42810	1.89800
344687	TCP	66.00	0.00303	1.800	1.600	341615	341625	SI21AC0314	SI21AC1316	8.0	4.50	4.90	0.00			---	---	---	0.37260	1.65200
344695	TCP	217.00	0.00438	1.600	0.650	341625	341743	SI21AC1316	SI21AC0316	8.0	4.90	5.50	1.00			0.05490	0.10190	0.16890	0.44780	1.98500
344702	TCP	400.00	0.00400	-0.990	-2.590	341634	341383	SI21AC0212	SI21AC0244	8.0	5.70	7.70	8.00			0.00580	0.00970	0.02570	0.42810	1.89800
344713	TCP	233.00	0.00197	0.170	-0.290	341656	341798	SI21AC0336	SI21AC0334	8.0	4.50	4.40	1.00			0.10060	0.18660	0.27060	0.30070	1.33300
344726	TCP	157.41	0.00400	1.480	0.850	341677	341743	SI21AC0317	SI21AC0316	8.0	4.90	5.50	1.00		X	0.03080	0.05710	0.10790	0.42820	1.89800
344753	TCP	200.00	0.00400	-0.190	-0.990	341725	341634	SI21AC0211	SI21AC0212	8.0	5.00	5.70	8.00			0.00540	0.00910	0.01970	0.42810	1.89800
344756	TCP	245.00	0.00400	-0.550	-1.530	341729	341619	SI21AC0191	SI21AC0246	8.0	5.20	7.00	2.00			0.02780	0.05300	0.12440	0.42810	1.89800
344757	TCP	400.00	0.00400	1.060	-0.540	341730	341508	SI21AC0267	SI21AC0268	8.0	4.30	5.70	9.00			0.07470	0.14210	0.25430	0.42810	1.89800
344774	TCP	247.00	0.00385	0.650	-0.300	341764	341914	SI21AC1315	SI21AC1314	8.0	4.90	5.20	6.00			0.10880	0.20190	0.35650	0.41980	1.86100
344789	TCP	298.00	0.00399	-0.340	-1.530	341787	341619	SI21AC0248	SI21AC0246	8.0	5.40	7.00	11.00			0.02710	0.05150	0.11360	0.42770	1.89600
344804	TCP	92.50	0.00400	0.070	-0.300	341812	341729	SI21AC0193	SI21AC0191	8.0	4.60	5.20	4.00			0.00310	0.00590	0.01550	0.42810	1.89800

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
344865	TCP	76.00	0.00368	-0.300	-0.580	341914	341965	SI21AC1314	SI21AC1331	8.0	5.20	6.20	0.00			0.10880	0.20190	0.35800	0.41080	1.82100
344881	TCP	243.00	0.00551	1.000	-0.340	341934	341787	SI21AC0249	SI21AC0248	8.0	4.10	5.40	5.00			0.00950	0.01810	0.04290	0.50260	2.22800
344883	TCP	236.00	0.00479	1.230	0.100	341935	342028	SI21AC0208	SI21AC0161	8.0	3.50	8.80	5.00		X	0.00050	0.00090	0.07030	0.46830	2.07600
344908	TCP	300.00	0.00340	-1.870	-2.890	341970	684119	SI21AC0163	SI21AC0164	8.0	7.20	7.90	2.00			0.02200	0.03700	0.05170	0.39470	1.74900
345097	CIP	338.79	0.01119	-1.810	-5.600	342244	379722	SI21AC0261	SI21AC0551	8.0	6.80	13.50	3.00			0.07960	0.14200	0.23370	0.71590	3.17300
345180	TCP	170.00	0.00400	-0.830	-1.510	342402	342356	SI21AC0152	SI21AC0151	8.0	4.80	5.90	0.00			0.04130	0.06950	0.10080	0.42810	1.89800
345222	TCP	299.50	0.00401	9.540	8.340	350859	341075	SI21AJ0373	SI21AJ0372	8.0	6.70	9.10	3.00			0.05940	0.11300	0.22810	0.42840	1.89900
345225	TCP	77.00	0.00688	-0.560	-1.090	379734	342402	SI21AC3016	SI21AC0152	8.0	4.30	4.80	0.00			0.01740	0.02930	0.04180	0.56150	2.48900
345251	TCP	98.72	0.01540	10.190	8.670	339537	339438	SI21AC0384	SI21AC0383	8.0	4.90	6.30	1.00			0.03980	0.06700	0.09090	0.83990	3.72300
345258	TCP	33.00	0.00606	0.850	0.650	341743	341764	SI21AC0316	SI21AC1315	8.0	5.50	4.90	0.00			0.08570	0.15900	0.27740	0.52690	2.33600
345262	TCP	136.45	0.00843	44.610	43.460	338495	338446	SI21AC1424	SI21AC0428	8.0	7.70	7.90	0.00			0.05160	0.13310	0.19670	0.62140	2.75400
345264	TCP	63.00	0.00317	16.600	16.400	339834	339770	SI21AC0395	SI21AC0600	8.0	7.50	7.70	0.00			0.10220	0.17210	0.20550	0.38140	1.69000
345265	UNK	152.00	---	---	---	340546	340762	SI21AJ0376	SI21AJ0941	8.0	5.50	5.10	0.00			---	---	---	---	---
356794	VCP	243.00	0.00292	0.680	-0.030	353119	381415	SI21AJ0201	SI21AJ0200	8.0	4.10	4.00	5.00			0.01680	0.03110	0.05130	0.36590	1.62200
356886	TCP	245.00	0.00420	14.410	13.380	381284	352988	SI21AJ0330	SI21AJ0329	8.0	4.00	4.00	3.00		X	0.03030	0.05770	0.09880	0.43890	1.94500
356916	TCP	367.40	0.00400	16.610	15.140	350167	350412	SI21AJ0521	SI21AJ0520	8.0	6.60	6.10	11.00			0.09150	0.17410	0.31130	0.42810	1.89800
357152	TCP	255.00	0.02004	26.000	20.890	349814	349933	SI21AJ0512	SI21AJ0513	8.0	7.30	8.10	8.00			0.05780	0.11000	0.18470	0.95810	4.24700
357154	TCP	204.20	0.02547	22.200	17.000	349885	350092	SI21AJ0518	SI21AJ0517	8.0	7.80	8.00	5.00			0.01680	0.03200	0.07790	1.08010	4.78800
357157	TCP	80.00	0.01963	20.890	19.320	349933	349968	SI21AJ0513	SI21AJ0516	8.0	8.10	8.70	3.00			0.06600	0.12570	0.23160	0.94820	4.20300
357159	TCP	315.00	0.00737	19.320	17.000	349968	350086	SI21AJ0516	SI21AJ0930	8.0	8.70	14.80	5.00			---	---	---	---	---
357163	UNK	74.00	---	---	---	350078	350134	---	SI21AJ0537	8.0	---	7.80	1.00			---	---	---	---	---
357167	TCP	361.80	0.00802	16.900	14.000	350092	350613	SI21AJ0517	SI21AJ0519	8.0	8.00	6.20	3.00			0.09840	0.18720	0.38650	0.60600	2.68600
357172	TCP	294.20	0.00503	18.710	17.230	350123	350302	SI21AJ0536	SI21AJ0535	8.0	5.40	8.00	8.00			0.05900	0.11230	0.15660	0.48010	2.12800
357174	TCP	174.00	0.00224	19.420	19.030	350134	350415	SI21AJ0537	SI21AJ0940	8.0	7.80	5.70	0.00			0.01680	0.03230	0.03600	0.84780	3.75800
357189	TCP	275.00	0.00545	17.230	15.730	350302	350472	SI21AJ0535	SI21AJ0534	8.0	8.00	8.10	2.00			0.06320	0.12030	0.19830	0.49990	2.21600
357191	TCP	333.00	0.00631	21.520	19.420	350337	350134	SI21AJ0545	SI21AJ0537	8.0	5.00	7.80	7.00			0.01460	0.02820	0.03140	0.53750	2.38300
357197	TCP	343.60	0.00399	15.140	13.770	350412	350613	SI21AJ0520	SI21AJ0519	8.0	6.10	6.20	6.00			0.10190	0.19390	0.35210	0.42740	1.89400
357203	TCP	23.00	0.01261	15.730	15.440	350472	350485	SI21AJ0534	SI21AJ0533	8.0	8.10	8.40	0.00			0.06320	0.12030	0.19890	0.76000	3.36900
357207	TCP	359.90	0.01192	15.440	11.150	350485	351037	SI21AJ0533	SI21AJ0524	8.0	8.40	7.70	4.00			0.14230	0.27070	0.47840	0.73900	3.27600
357208	TCP	328.50	0.00755	24.000	21.520	350512	350337	SI21AJ0546	SI21AJ0545	8.0	6.00	5.00	12.00			0.00910	0.01750	0.01940	0.58810	2.60700
357209	TCP	325.70	0.00400	24.000	22.860	350512	350715	SI21AJ0546	SI21AJ0547	8.0	6.00	6.00	8.00			---	---	---	---	---
357219	TCP	323.00	0.00307	13.770	12.780	350613	350828	SI21AJ0519	SI21AJ0523	8.0	6.20	6.70	5.00			0.21200	0.40350	0.80320	0.37470	1.66100
357224	TCP	333.20	0.00504	20.550	18.870	350677	350485	SI21AJ0532	SI21AJ0533	8.0	4.80	8.40	10.00			0.07090	0.13490	0.22780	0.48060	2.13000
357228	TCP	330.00	0.00352	22.860	21.700	350715	350929	SI21AJ0547	SI21AJ0548	8.0	6.00	7.00	4.00			0.01150	0.02180	0.06040	0.40130	1.77900
357233	TCP	333.00	0.00444	12.780	11.300	350828	351037	SI21AJ0523	SI21AJ0524	8.0	6.70	7.70	2.00			0.21930	0.41730	0.85530	0.45120	2.00000
357238	TCP	330.00	0.00500	22.200	20.550	350892	350677	SI21AJ0531	SI21AJ0532	8.0	4.90	4.80	9.00			---	---	---	---	---
357239	TCP	334.60	0.00406	22.200	20.840	350892	351074	SI21AJ0531	SI21AJ0530	8.0	4.90	5.80	8.00			0.01110	0.02120	0.05360	0.43150	1.91300
357241	TCP	238.30	0.00919	21.700	19.510	350929	351228	SI21AJ0548	SI21AJ0529	8.0	7.00	6.80	2.00			0.08140	0.15500	0.44410	0.64880	2.87600
357247	TCP	299.30	0.00401	10.740	9.540	351042	350859	SI21AJ0374	SI21AJ0373	8.0	4.60	6.70	4.00			0.03620	0.06880	0.13160	0.42860	1.90000
357257	TCP	197.80	0.00485	11.700	10.740	351135	351042	SI21AJ0350	SI21AJ0374	8.0	4.00	4.60	3.00			0.01710	0.03250	0.06760	0.47150	2.09000
357259	TCP	332.90	0.00400	20.840	19.510	351074	351228	SI21AJ0530	SI21AJ0529	8.0	5.80	6.80	9.00			0.02990	0.05700	0.12400	0.42780	1.89600
357261	TCP	273.00	0.00399	11.900	10.810	351189	351329	SI21AJ0349	SI21AJ0348	8.0	3.20	3.40	14.00			0.02710	0.05160	0.10270	0.42770	1.89600
357262	TCP	367.60	0.00868	16.600	13.410	351204	351037	SI21AJ0525	SI21AJ0524	8.0	4.80	7.70	6.00			0.04850	0.09220	0.18070	0.63050	2.79500
357265	VCP	3.00	0.31667	19.510	18.560	351228	351235	SI21AJ0529	SI21AJ0549	8.0	6.80	6.70	0.00			0.11140	0.21200	0.56820	3.80880	16.88300
357267	TCP	255.00	0.00800	10.440	8.400	351260	351590	SI21AJ0362	SI21AJ0361	8.0	4.20	5.10	4.00			0.02800	0.05330	0.08380	0.60540	2.68400
357270	TCP	272.10	0.00401	10.810	9.720	351329	351460	SI21AJ0348	SI21AJ0347	8.0	3.40	5.20	8.00			0.04010	0.07640	0.16380	0.42840	1.89900
357272	TCP	346.40	0.00900	19.600	16.600	351401	351204	SI21AJ0526	SI21AJ0525	8.0	4.70	4.80	6.00			0.02390	0.04560	0.09340	0.62990	2.79200
357273	TCP	315.00	0.00400	19.600	18.340	351401	351554	SI21AJ0526	SI21AJ0527	8.0	4.70	5.00	12.00			---	---	---	---	---
357274	TCP	322.10	0.00602	23.180	21.240	351421	351235	SI21AJ0550	SI21AJ0549	8.0	5.00	6.70	4.00			0.00830	0.01580	0.05230	0.52530	2.32800

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
357277	TCP	331.20	0.00399	18.340	17.020	351554	351707	SI21AJ0527	SI21AJ0528	8.0	5.00	5.00	6.00			0.04480	0.08520	0.18120	0.42730	1.89400
357280	TCP	332.00	0.01500	29.130	24.150	351627	351447	SI21AJ0560	SI21AJ0559	8.0	4.90	5.20	5.00			0.02850	0.05420	0.11410	0.82900	3.67500
357281	TCP	333.20	0.00624	11.800	9.720	351644	351460	SI21AJ0346	SI21AJ0347	8.0	4.90	5.20	3.00			0.03150	0.05990	0.13320	0.53480	2.37000
357283	TCP	129.80	0.00616	12.600	11.800	351703	351644	SI21AJ0345	SI21AJ0346	8.0	5.20	4.90	3.00			0.01520	0.02890	0.07430	0.53140	2.35500
357288	TCP	104.10	0.00576	13.200	12.600	351747	351703	SI21AJ0344	SI21AJ0345	8.0	5.60	5.20	1.00			0.00830	0.01580	0.04720	0.51380	2.27800
357290	TCP	241.00	0.00855	19.170	17.110	351828	351717	SI21AJ0552	SI21AJ0551	8.0	4.80	6.50	4.00			0.02200	0.04180	0.12470	0.62580	2.77400
357291	TCP	243.30	0.00600	14.660	13.200	351868	351747	SI21AJ0343	SI21AJ0344	8.0	4.20	5.60	5.00			---	---	---	---	---
357292	TCP	330.30	0.00403	14.660	13.330	351868	352021	SI21AJ0343	SI21AJ0342	8.0	4.20	4.90	8.00			0.02250	0.04290	0.09130	0.42950	1.90400
357298	TCP	317.00	0.01101	22.660	19.170	351978	351828	SI21AJ0553	SI21AJ0552	8.0	4.80	4.80	7.00			0.01460	0.02780	0.09360	0.71020	3.14800
357299	TCP	232.50	0.00409	13.350	12.400	352021	352143	SI21AJ0342	SI21AJ0341	8.0	4.90	6.10	6.00			0.03590	0.06830	0.14790	0.43260	1.91800
357304	VCP	3.00	0.01000	12.400	12.370	352143	352147	SI21AJ0341	SI21AJ0340	8.0	6.10	6.70	0.00			0.03590	0.06830	0.14800	0.67680	3.00000
357311	TCP	140.60	0.00448	13.000	12.370	352202	352147	SI21AJ0339	SI21AJ0340	8.0	5.40	6.70	0.00			0.06810	0.12970	0.30760	0.45310	2.00800
357315	TCP	151.00	0.00397	13.600	13.000	352278	352202	SI21AJ0338	SI21AJ0339	8.0	4.60	5.40	2.00			0.06380	0.12150	0.28620	0.42660	1.89100
357322	VCP	13.05	0.19464	3.920	1.380	352389	352390	SI21AJ0149	SI21AJ0156	8.0	2.20	4.60	0.00			0.06750	0.12530	0.20700	2.98600	13.23600
357323	VCP	209.00	0.00622	1.380	0.080	352390	352633	SI21AJ0156	SI21AJ0157	8.0	4.60	5.20	5.00			0.07760	0.14390	0.24230	0.53380	2.36600
357324	TCP	300.40	0.00659	15.580	13.600	352438	352278	SI21AJ0337	SI21AJ0338	8.0	7.30	4.60	3.00			0.04920	0.09360	0.22930	0.54950	2.43600
357335	TCP	299.60	0.00501	17.080	15.580	352564	352438	SI21AJ0336	SI21AJ0337	8.0	7.10	7.30	4.00			0.03080	0.05860	0.14310	0.47890	2.12300
357345	TCP	217.00	0.00276	1.980	1.380	352662	352913	SI21AJ0205	SI21AJ0204	8.0	4.60	4.30	3.00			0.03250	0.06030	0.11280	0.35590	1.57800
357370	TCP	192.00	0.00380	1.330	0.600	352913	353100	SI21AJ0204	SI21AJ0119	8.0	4.30	10.90	3.00			0.04420	0.08200	0.14990	0.41730	1.85000
357384	VCP	20.00	0.01600	-4.760	-5.080	353011	353017	SI21AJ0194	SI21AJ0193	8.0	9.60	9.90	0.00			0.00270	0.00500	0.01320	0.85610	3.79500
357389	UNK	266.00	---	---	---	353032	353119	SI21AJ1194	SI21AJ0201	8.0	2.60	4.10	1.00			---	---	---	---	---
357431	VCP	282.00	0.00440	-3.840	-5.080	381371	353017	SI21AJ0192	SI21AJ0193	8.0	8.80	9.90	3.00			0.05260	0.09760	0.17920	0.44880	1.99000
379576	RCP	270.00	0.00600	1.000	-0.620	379532	379527	SI21AC0134	SI21AC0133	8.0	3.60	6.60	0.00			0.11230	0.18900	0.33640	0.52430	2.32400
379578	VCP	218.00	0.01138	3.480	1.000	379534	379532	SI21AC2200	SI21AC0134	8.0	2.90	3.60	0.00			0.09460	0.15920	0.29070	0.72190	3.20000
379581	VCP	82.00	0.00549	3.930	3.480	379537	379534	SI21AC0135	SI21AC2200	8.0	4.20	2.90	0.00			0.01820	0.03060	0.04150	0.50140	2.22300
380661	VCP	202.80	0.00355	-2.110	-2.830	380055	380002	SI21AC0547	SI21AC0546	8.0	9.10	8.00	2.00			0.08460	0.14250	0.19210	0.40330	1.78800
380705	VCP	189.00	0.00370	-1.410	-2.110	380113	380055	SI21AC0548	SI21AC0547	8.0	7.40	9.10	2.00			0.04230	0.07120	0.09600	0.41190	1.82600
380903	VCP	175.00	0.00440	-0.500	-1.270	380368	380380	SI25MA0036	SI25MA0035	8.0	5.30	5.70	0.00		X	0.04850	0.12380	0.13260	0.44900	1.99000
380915	VCP	12.00	0.00417	-1.270	-1.320	380380	380381	SI25MA0035	SI25MA0034	8.0	5.70	5.70	0.00		X	0.07270	0.18570	0.19670	0.43690	1.93700
380916	VCP	189.30	0.01680	-1.320	-4.500	380381	380394	SI25MA0034	SI25MA0032	8.0	5.70	7.10	0.00		X	0.07270	0.18570	0.19700	0.87720	3.88900
383307	VCP	44.00	0.00318	1.250	1.110	381328	381376	SI21AJ0196	SI21AJ0197	8.0	3.50	3.50	0.00			0.01080	0.02000	0.03230	0.38180	1.69200
383337	VCP	240.00	0.00442	-2.780	-3.840	381502	381371	SI21AJ0191	SI21AJ0192	8.0	7.40	8.80	4.00			0.05260	0.09760	0.17390	0.44980	1.99400
383368	VCP	243.00	0.00276	-0.030	-0.700	381415	381535	SI21AJ0200	SI21AJ0199	8.0	4.00	5.50	5.00			0.03190	0.05910	0.09840	0.35540	1.57500
383440	VCP	250.00	0.00800	-0.780	-2.780	381550	381502	SI21AJ0190	SI21AJ0191	8.0	5.60	7.40	2.00			0.05260	0.09760	0.16930	0.60540	2.68400
383463	VCP	23.00	0.00348	-0.700	-0.780	381535	381550	SI21AJ0199	SI21AJ0190	8.0	5.50	5.60	0.00			0.05260	0.09760	0.16450	0.39920	1.76900
383505	VCP	46.00	0.01100	---	-0.500	4039271	381581	---	SI21AJ0224	8.0	---	6.50	0.00		X	---	---	---	---	---
384301	CIP	352.00	0.00494	-0.450	-2.190	382676	382707	SI21AJ0045	SI21AJ0043	8.0	5.50	7.20	1.00			0.02120	0.05410	0.05580	0.47590	2.10900
384311	UNK	14.00	---	---	---	382688	382690	---	SI25MA0006	8.0	---	5.70	0.00			---	---	---	---	---
384313	TCP	280.00	0.01075	-1.030	-4.040	382690	382713	SI25MA0006	SI25MA0005	8.0	5.70	7.50	0.00			0.12040	0.30770	0.32520	0.70180	3.11100
384328	CIP	240.00	0.00500	-2.190	-3.390	382707	382729	SI21AJ0043	SI21AJ0042	8.0	7.20	7.80	0.00			0.03840	0.09820	0.10270	0.47860	2.12200
384349	CIP	20.80	0.02500	-3.390	-3.910	382729	382718	SI21AJ0042	SI21AJ0041	8.0	7.80	8.10	0.00			0.03840	0.09820	0.10280	1.07020	4.74400
684397	TCP	225.00	0.01160	8.190	5.580	682189	682281	SI21AQ2118	SI21AQ0118	8.0	4.80	5.30	3.00			0.03800	0.08730	0.15530	0.72900	3.23100
684447	TCP	288.30	0.00503	4.320	2.870	682280	682404	SI21AQ0157	SI21AQ0158	8.0	4.20	4.20	4.00			0.03380	0.07750	0.13710	0.48000	2.12800
684487	TCP	286.00	0.00399	2.240	1.100	682352	682524	SI21AQ0068	SI21AQ0067	8.0	4.30	5.10	1.00			0.02760	0.06330	0.11410	0.42730	1.89400
684513	TCP	299.70	0.00524	2.870	1.300	682404	682594	SI21AQ0158	SI21AQ1068	8.0	4.20	7.60	3.00			0.05910	0.13560	0.24340	0.48990	2.17200
684542	TCP	200.00	0.00500	-2.800	-3.800	682458	682382	SI21AQ0104	SI21AQ0103	8.0	8.50	12.30	1.00		X	0.04760	0.10920	0.39950	0.47860	2.12200
684579	TCP	51.00	0.00412	1.100	0.890	682524	682562	SI21AQ0067	SI21AQ0066	8.0	5.10	5.30	0.00			0.02760	0.06330	0.11610	0.43430	1.92500
684611	TCP	228.00	0.00500	-1.660	-2.800	682576	682458	SI21AQ0105	SI21AQ0104	8.0	6.90	8.50	9.00		X	0.04630	0.10640	0.38230	0.47860	2.12200
684758	TCP	255.00	0.00400	1.320	0.300	682827	682576	SI21AQ0107	SI21AQ0105	8.0	4.90	6.90	13.00		X	0.00050	0.00110	0.02700	0.42810	1.89800

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
684768	TCP	343.90	0.00555	3.720	1.810	682839	682606	SI21AQ0159	SI21AQ0059	8.0	5.10	5.60	17.00			0.06200	0.14220	0.25260	0.50440	2.23600
684785	TCP	302.00	0.00596	3.500	1.700	682871	683039	SI21AQ0022	SI21AQ0021	8.0	4.70	5.00	3.00			0.01880	0.04310	0.08200	0.52250	2.31600
684876	TCP	336.10	0.00684	6.020	3.720	683031	682839	SI21AQ0160	SI21AQ0159	8.0	4.90	5.10	3.00			0.03950	0.09070	0.16050	0.55990	2.48200
684883	TCP	223.80	0.00523	1.700	0.530	683039	683139	SI21AQ0021	SI21AQ0020	8.0	5.00	5.70	5.00			0.08160	0.18740	0.31850	0.48940	2.16900
684916	TCP	364.00	0.00992	6.610	3.000	683101	683264	SI21AQ0035	SI21AQ0034	8.0	4.60	9.50	8.00			0.03020	0.06940	0.12710	0.67400	2.98800
684924	PVC	128.73	0.00900	-0.690	-1.900	683115	683232	SI21AQ0055	SI21AQ0053	8.0	6.40	7.00	0.00		X	0.01050	0.02410	0.08110	0.86440	2.45200
684926	TCP	200.27	0.00400	-2.750	-3.580	683117	683041	SI21AQ0051	SI21AQ0050	8.0	8.20	12.10	0.00		X	0.03000	0.06890	0.18270	0.47740	2.11600
684940	TCP	223.00	0.00475	0.530	-0.530	683139	683253	SI21AQ0020	SI21AQ0019	8.0	5.70	13.10	2.00			0.08930	0.20490	0.35590	0.46660	2.06900
684976	PVC	207.47	0.00400	-1.900	-2.750	683232	683117	SI21AQ0053	SI21AQ0051	8.0	7.00	8.20	2.00		X	0.02610	0.06000	0.15770	0.47720	2.11500
684993	TCP	303.00	0.00495	3.200	1.700	683245	683039	SI21AQ0023	SI21AQ0021	8.0	4.20	5.00	4.00			0.05950	0.13660	0.21490	0.47620	2.11100
685005	TCP	241.30	0.00501	-0.150	-1.360	683264	683359	SI21AQ0034	SI21AQ0033	8.0	9.50	9.00	2.00		X	0.41470	0.91690	1.63210	0.47930	2.12500
685034	TCP	140.00	0.00464	-3.750	-4.400	683319	683253	SI21AQ0024	SI21AQ0019	8.0	8.80	13.10	0.00			0.58710	1.24240	2.24300	0.46120	2.04400
685058	TCP	126.00	0.00492	-1.360	-1.980	683359	683413	SI21AQ0033	SI21AQ0032	8.0	9.00	9.00	2.00		X	0.43490	0.95580	1.70480	0.47480	2.10500
685085	TCP	101.00	0.00495	-1.980	-2.480	683413	683445	SI21AQ0032	SI21AQ0029	8.0	9.00	8.20	2.00		X	0.44840	0.98170	1.75410	0.47620	2.11100
685092	TCP	284.00	0.00451	1.350	0.070	683424	683264	SI21AQ0036	SI21AQ0034	8.0	6.80	9.50	1.00			0.38090	0.85130	1.49390	0.45440	2.01400
685106	TCP	215.00	0.00502	-2.670	-3.750	683452	683319	SI21AQ0025	SI21AQ0024	8.0	9.10	8.80	0.00			0.09800	0.22490	0.37270	0.47970	2.12600
685131	TCP	284.20	0.00500	2.770	1.350	683492	683424	SI21AQ0037	SI21AQ0036	8.0	5.30	6.80	2.00			0.30890	0.70910	1.23800	0.47840	2.12100
685224	UNK	23.00	---	---	---	683587	683588	SI21AC4017	SI21AC0228	8.0	9.70	5.00	0.00			---	---	---	---	---
685300	TCP	305.00	0.00662	1.220	-0.800	683689	683766	SI21AC0168	SI21AC0169	8.0	3.60	6.40	7.00			0.04260	0.07180	0.10040	0.55080	2.44200
685344	TCP	298.10	0.00403	-0.800	-2.000	683766	683858	SI21AC0169	SI21AC4011	8.0	6.40	13.50	3.00			0.04260	0.07180	0.10310	0.42940	1.90400
685454	UNK	96.00	---	---	---	683935	683960	---	SI21AC0166	8.0	---	6.10	1.00			---	---	---	---	---
685468	TCP	300.00	0.00400	-1.800	-3.000	683960	684015	SI21AC0166	SI21AC0165	8.0	6.10	7.60	4.00			0.02380	0.04000	0.05660	0.42810	1.89800
685538	TCP	131.00	0.00397	-4.200	-4.720	684074	684110	SI21AC0141	SI21AC0140	8.0	8.00	8.70	1.00			0.00630	0.01060	0.01520	0.42640	1.89000
685563	TCP	169.00	0.00402	-4.720	-5.400	684110	684151	SI21AC0140	SI21AC1159	8.0	8.70	12.60	1.00			0.01950	0.03280	0.04610	0.42930	1.90300
685621	VCP	325.00	0.01003	-2.000	-5.260	684192	684291	SI21AC3022	SI21AC3023	8.0	6.60	9.90	4.00			0.00400	0.00670	0.01180	0.67790	3.00500
685633	TCP	300.00	0.00400	-3.950	-5.150	684209	684296	SI21AC0143	SI21AC0142	8.0	8.90	12.00	2.00			0.00980	0.01650	0.02460	0.42810	1.89800
685668	TCP	197.00	0.00447	-4.270	-5.150	684260	684204	SI21AC9998	SI21AC4140	8.0	8.50	13.30	0.00			0.03470	0.05840	0.08510	0.45240	2.00500
685692	VCP	45.00	0.01000	-5.260	-5.710	684291	684302	SI21AC3023	SI21AC3024	8.0	9.90	11.70	0.00			0.02380	0.04010	0.05640	0.67680	3.00000
1004977	TCP	175.00	0.00497	3.170	2.300	340746	1004976	SI21AC0239	SI21AC4030	8.0	4.90	11.30	7.00			0.01030	0.01730	0.05140	0.47720	2.11500
2023278	VCP	44.00	0.00386	0.630	0.460	2023277	381586	---	SI21AJ0258	8.0	5.00	5.80	0.00			---	---	---	---	---
2023414	VCP	26.00	0.00731	-1.780	-1.970	2023413	2023411	---	---	8.0	7.60	---	0.00		X	---	---	---	---	---
3004569	UNK	20.70	---	---	---	379736	379734	SI21AC3017	SI21AC3016	8.0	4.20	4.30	0.00			0.01740	0.02930	0.04110	0.45400	2.01300
3005917	UNK	113.62	---	3.420	2.340	381583	381639	SI21AJ0314	SI21AJ0310	8.0	5.90	6.70	1.00		X	0.06050	0.11230	0.15110	0.67070	2.97300
3005918	UNK	128.33	---	2.990	2.340	381669	381639	SI21AJ0311	SI21AJ0310	8.0	6.30	6.70	0.00		X	0.16140	0.29950	0.39630	0.47860	2.12200
3005919	UNK	51.11	---	3.440	2.990	381676	381669	SI21AJ0312	SI21AJ0311	8.0	6.20	6.30	0.00		X	0.10090	0.18720	0.24470	0.67680	3.00000
3010455	UNK	298.54	---	24.290	22.660	352136	351978	SI21AJ0554	SI21AJ0553	8.0	4.80	4.80	2.00			0.00020	0.00040	0.02610	0.49920	2.21300
3010715	VCP	14.11	---	-1.560	---	3010712	3010714	---	---	8.0	8.50	---	0.00			---	---	---	---	---
3013167	TCP	364.50	0.01200	30.510	25.990	3013166	349814	---	SI21AJ0512	8.0	---	7.30	6.00			---	---	---	---	---
4013742	TCP	90.33	0.00600	18.080	17.560	352646	4013744	SI21AJ0335	---	8.0	5.00	6.10	1.00			---	---	---	---	---
4013743	TCP	93.67	0.00500	17.560	17.080	4013744	352564	---	SI21AJ0336	8.0	6.10	7.10	1.00			---	---	---	---	---
4014191	TCP	44.00	0.00800	12.300	11.950	4014196	338147	---	SI21AC0370	8.0	8.10	8.10	0.00			---	---	---	---	---
4014194	TCP	78.00	0.03500	22.840	20.100	338035	4014198	SI21AC0432	---	8.0	8.20	8.80	2.00			---	---	---	---	---
4014269	VCP	86.00	0.00400	-2.250	-2.630	4014268	380159	---	SI21AJ0063	8.0	6.00	6.80	0.00			---	---	---	---	---
4014271	VCP	23.00	0.00500	-2.140	-2.250	4014270	4014268	---	---	8.0	5.70	6.00	0.00		X	---	---	---	---	---
4020188	VCP	158.50	0.00400	-0.120	-0.750	4020187	4020183	---	---	8.0	3.50	5.00	3.00			---	---	---	---	---
4020190	VCP	158.50	0.00400	0.500	-0.120	4020189	4020187	---	---	8.0	3.00	3.50	5.00			---	---	---	---	---
4026533	VCP	7.00	0.11400	-0.200	-1.000	341331	4026531	SI21AC0218	---	8.0	5.90	12.70	0.00			---	---	---	---	---
4026537	VCP	130.00	0.00400	-6.540	-7.110	4026536	4026534	---	---	8.0	11.30	12.30	2.00			---	---	---	---	---
4026539	VCP	260.00	0.00400	-5.400	-6.540	4026538	4026536	---	---	8.0	10.40	11.30	1.00			---	---	---	---	---

8" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
4026541	VCP	57.00	0.01800	-4.400	-5.400	4026540	4026538	---	---	8.0	9.40	10.40	0.00			---	---	---	---	---
4026543	VCP	187.00	0.00600	-3.300	-4.400	4026542	4026540	---	---	8.0	8.20	9.40	1.00			---	---	---	---	---
4026558	VCP	8.00	0.06300	-0.300	-0.800	4026561	4026560	---	---	8.0	5.40	9.90	0.00			---	---	---	---	---
4026567	VCP	69.00	0.00400	-1.330	-1.630	4026566	4026564	---	---	8.0	7.00	7.00	0.00		X	---	---	---	---	---
4026569	VCP	344.00	0.00600	0.600	-1.330	4026568	4026566	---	---	8.0	5.60	7.00	2.00		X	---	---	---	---	---
4026585	VCP	100.00	0.00500	-4.580	-5.040	4026584	4026546	---	---	8.0	9.70	9.50	0.00		X	---	---	---	---	---
4026587	VCP	249.00	0.00500	-3.340	-4.580	4026586	4026584	---	---	8.0	8.10	9.70	3.00		X	---	---	---	---	---
4026631	VCP	9.50	0.11800	-0.740	-1.860	379527	4026629	SI21AC0133	---	8.0	6.60	8.90	0.00			---	---	---	---	---
4029322	VCP	60.00	0.00600	-6.580	-6.910	4029321	4029319	---	---	8.0	12.10	13.10	0.00			---	---	---	---	---
4029324	VCP	181.00	0.00600	-5.580	-6.580	4029323	4029321	---	---	8.0	10.30	12.10	1.00			---	---	---	---	---
4029378	VCP	83.00	0.02400	-7.140	-9.130	4029377	4029375	---	---	8.0	12.10	14.70	0.00		X	---	---	---	---	---
4029380	VCP	25.00	0.02400	-6.540	-7.140	4029379	4029377	---	---	8.0	11.60	12.10	0.00		X	---	---	---	---	---
4044867	VCP	35.00	0.05000	-1.590	-3.340	4044866	4026586	---	---	8.0	6.40	8.10	0.00		X	---	---	---	---	---
4046322	VCP	48.56	0.00500	4.730	4.500	4046321	339108	---	SI21AC0375	8.0	6.10	7.30	0.00		X	---	---	---	---	---
4051544	VCP	16.50	0.40000	-4.400	-11.000	4051543	3010721	---	---	8.0	8.60	---	0.00			---	---	---	---	---
4055673	TCP	80.70	0.00600	20.400	19.940	4055672	312486	---	SI21AQ0082	8.0	5.10	5.70	0.00			---	---	---	---	---
TOTALS		**68,140.93**											**950**	**0**	**57**					

10" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
314320	TCP	272.70	0.00818	6.250	4.020	310668	310472	SI21AQ0283	SI21AQ0282	10.0	6.10	2.50	1.00			0.12650	0.29030	0.57390	1.10970	3.14800
314434	TCP	227.00	0.00507	7.400	6.250	310840	310668	SI21AQ0284	SI21AQ0283	10.0	4.90	6.10	1.00			0.11730	0.26910	0.52860	0.87350	2.47800
314561	TCP	232.80	0.00790	9.240	7.400	311032	310840	SI21AQ0285	SI21AQ0284	10.0	5.40	4.90	3.00			0.10800	0.24800	0.48510	1.09100	3.09500
314624	TCP	203.60	0.01925	13.160	9.240	311138	311032	SI21AQ0286	SI21AQ0285	10.0	7.20	5.40	1.00			0.08140	0.18680	0.39680	1.70280	4.83100
314931	VCP	221.00	0.00900	7.670	5.680	311701	311603	SI21AQ0276	SI21AQ0275	10.0	5.50	6.70	4.00			0.43360	0.95330	1.57240	1.16450	3.30400
314997	VCP	58.10	0.01153	8.340	7.670	311731	311701	SI21AQ0277	SI21AQ0276	10.0	9.10	5.50	0.00			0.34760	0.78590	1.34570	1.31780	3.73900
315021	VCP	32.00	0.05313	11.180	9.480	311744	311731	SI21AQ0278	SI21AQ0277	10.0	6.00	9.10	0.00		X	0.02700	0.06200	0.07400	2.82850	8.02400
342547	TCP	309.30	0.01167	10.950	7.340	338154	682336	SI21AQ0075	SI21AQ0074	10.0	4.80	4.90	10.00			0.28580	0.65600	1.82300	1.32580	3.76100
342989	TCP	322.00	0.00600	6.080	4.270	338852	339056	SI21AC0360	SI21AC0374	10.0	4.90	7.00	1.00			0.06240	0.10510	0.14630	0.80340	2.27900
343150	TCP	51.00	0.51490	44.260	18.000	339132	339188	SI21AC0419	SI21AC0013	10.0	7.10	29.90	0.00			0.02040	0.03440	0.04230	8.80590	24.98200
343572	TCP	17.00	1.28412	38.350	16.520	339815	339824	SI21AC0409	SI21AC0010	10.0	5.30	27.00	0.00			0.02310	0.04450	0.04640	13.90630	39.45200
344309	VCP	217.00	0.00318	-5.790	-6.480	340971	340801	SI21AC4031	SI21AC4007	10.0	11.20	13.00	0.00			0.02120	0.03570	0.06330	0.69200	1.96300
344417	VCP	190.00	0.00321	-5.180	-5.790	341165	340971	SI21AC4032	SI21AC4031	10.0	10.80	11.20	0.00			0.01800	0.03030	0.04820	0.69530	1.97300
344500	VCP	180.00	0.00322	-4.600	-5.180	341308	341165	SI21AC4033	SI21AC4032	10.0	10.40	10.80	0.00			0.01290	0.02170	0.03030	0.69660	1.97600
344511	VCP	149.29	0.00549	-0.880	-1.700	341328	341205	SI21AC0323	SI21AC0300	10.0	6.50	8.00	0.00			---	---	---	0.90950	2.58000
344615	VCP	283.00	0.00548	0.670	-0.880	341444	341328	SI21AC0322	SI21AC0323	10.0	5.40	6.50	1.00		X	---	---	---	0.90820	2.57700
344795	TCP	200.00	0.00200	-0.290	-0.690	341798	341927	SI21AC0334	SI21AC0332	10.0	4.40	5.20	2.00			0.10060	0.18660	0.28110	0.54880	1.55700
344877	TCP	68.00	0.00191	-0.690	-0.820	341927	341965	SI21AC0332	SI21AC1331	10.0	5.20	6.20	0.00			0.10060	0.18660	0.28240	0.53660	1.52200
344902	TCP	28.00	0.00179	-0.820	-0.870	341965	341980	SI21AC1331	SI21AC0331	10.0	6.20	5.90	0.00			0.20940	0.38850	0.64100	0.51860	1.47100
344903	CIP	210.00	0.00552	-1.350	-2.510	342088	342168	SI21AC0539	SI21AC0564	10.0	6.10	6.40	1.00			0.14960	0.27760	0.46120	0.91210	2.58800
344925	TCP	217.98	0.00206	-0.870	-1.320	341980	342078	SI21AC0331	SI21AC0328	10.0	5.90	6.00	0.00			0.21750	0.40360	0.67400	0.55760	1.58200
344981	TCP	13.00	0.00231	-1.320	-1.350	342078	342088	SI21AC0328	SI21AC0539	10.0	6.00	6.10	0.00			0.29920	0.55510	0.91440	0.58950	1.67200
345040	CIP	185.00	0.00849	-2.510	-4.080	342168	342249	SI21AC0564	SI21AC0563	10.0	6.40	11.30	0.00			0.14960	0.27760	0.46480	1.13050	3.20700
345102	CIP	245.00	0.00380	-4.080	-5.010	342249	342358	SI21AC0563	SI21AC0562	10.0	11.30	12.50	2.00			0.14960	0.27760	0.46940	0.75610	2.14500
345110	TCP	244.00	0.00193	-1.740	-2.210	342157	342231	SI21AC0264	SI21AC0262	10.0	6.40	6.80	0.00			0.21920	0.39470	0.63530	0.53860	1.52800
345257	VCP	192.88	0.00550	1.730	0.670	341498	341444	SI21AC0320	SI21AC0322	10.0	5.30	5.40	0.00		X	---	---	---	0.90970	2.58100
345259	TCP	250.00	0.00156	-1.350	-1.740	342088	342157	SI21AC0539	SI21AC0264	10.0	6.10	6.40	0.00			0.15060	0.27930	0.46200	0.48470	1.37500
357336	VCP	229.13	0.01501	10.410	6.970	352578	352842	SI21AJ0323	SI21AJ0320	10.0	5.60	6.80	2.00			0.21160	0.40220	0.93520	1.50370	4.26600

10" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
357359	TCP	150.00	0.00960	3.340	1.900	352812	352963	SI21AJ0211	SI21AJ0209	10.0	4.90	4.90	3.00			0.04930	0.09150	0.14820	1.20240	3.41100
357378	TCP	235.00	0.00298	1.900	1.200	352963	353204	SI21AJ0209	SI21AJ0120	10.0	4.90	10.50	5.00			0.07990	0.14820	0.24620	0.66980	1.90000
380584	VCP	235.00	0.00217	-4.520	-5.030	379950	379906	SI21AC0544	SI21AC0182	10.0	10.00	9.30	3.00			0.12120	0.20400	0.27750	0.57170	1.62200
380620	VCP	202.80	0.00833	-2.830	-4.520	380002	379950	SI21AC0546	SI21AC0544	10.0	8.00	10.00	2.00			0.11010	0.18540	0.25070	1.12030	3.17800
384333	TCP	263.00	0.00369	-4.040	-5.010	382713	382737	SI25MA0005	SI25MA0004	10.0	7.50	7.50	0.00			0.12040	0.30770	0.32570	0.74530	2.11400
384350	TCP	88.00	0.05795	-5.010	-10.110	382737	382730	SI25MA0004	SI25MA0003	10.0	7.50	12.50	0.00			0.12040	0.30770	0.32590	2.95430	8.38100
384361	VCP	98.00	0.00300	-3.580	-3.900	382744	382725	SI21AJ0040	SI21AJ0039	10.0	8.10	8.90	0.00			0.08940	0.22850	0.23310	0.70240	1.99300
684477	TCP	254.82	0.01240	7.340	4.180	682336	682447	SI21AQ0074	SI21AQ1074	10.0	4.90	4.60	14.00			0.32360	0.73850	1.96960	1.36660	3.87700
684534	TCP	60.48	0.01124	4.180	3.500	682447	682478	SI21AQ1074	SI21AQ0063	10.0	4.60	5.30	0.00			0.32540	0.74200	1.97820	1.30120	3.69200
685220	TCP	128.45	0.00335	0.710	0.280	683617	683647	SI21AQ0014	SI21AQ0013	10.0	4.80	5.40	0.00			0.04160	0.09540	0.15960	0.71000	2.01400
685274	TCP	104.00	0.00462	-0.260	-0.740	683647	683669	SI21AQ0013	SI21AQ0012	10.0	5.40	5.40	0.00			0.05540	0.12720	0.21530	0.83370	2.36500
685287	TCP	425.00	0.00360	-0.740	-2.270	683669	683754	SI21AQ0012	SI21AQ0011	10.0	5.40	11.70	1.00			0.12470	0.28620	0.49000	0.73630	2.08900
685424	VCP	185.00	0.00300	-7.640	-8.270	683899	683872	SI21AC3031	SI21AC3032	10.0	12.20	13.40	0.00			0.00570	0.00950	0.03500	0.82200	2.33200
685446	VCP	238.00	0.00450	-6.570	-7.640	683930	683899	SI21AC3030	SI21AC3031	10.0	11.00	12.20	0.00			0.00570	0.00950	0.03330	0.82280	2.33400
2023436	VCP	16.97	0.01296	16.220	16.000	2023435	351717	---	SI21AJ0551	10.0	6.40	6.50	0.00			---	---	---	---	---
2023438	VCP	208.03	0.00500	17.260	16.220	2023437	2023435	---	---	10.0	7.10	6.40	1.00			---	---	---	---	---
2023443	VCP	27.50	0.07018	19.190	17.260	2023442	2023437	---	---	10.0	5.50	7.10	0.00			---	---	---	---	---
4025649	VCP	54.00	0.00800	-8.270	-8.700	683872	4025647	SI21AC3032	---	10.0	13.40	14.60	0.00			---	---	---	---	---
4026535	VCP	237.00	0.00300	-7.280	-8.040	4026534	4026531	---	---	10.0	12.30	12.70	0.00			---	---	---	---	---
4026563	VCP	27.00	0.06100	-2.530	-4.170	4026562	341598	---	SI21AC4026	10.0	7.70	8.00	0.00			---	---	---	---	---
4026565	VCP	227.00	0.00300	-1.800	-2.530	4026564	4026562	---	---	10.0	7.00	7.70	0.00		X	---	---	---	---	---
4026598	VCP	337.00	0.00500	-2.500	-4.210	4026597	340514	---	SI21AC0287	10.0	9.00	12.30	0.00			---	---	---	---	---
4026600	VCP	301.00	0.00300	-1.500	-2.500	4026599	4026597	---	---	10.0	7.30	9.00	1.00			---	---	---	---	---
4026602	VCP	22.00	0.12300	1.400	-1.300	341193	4026601	SI21AC0301	---	10.0	4.30	7.10	0.00			---	---	---	---	---
4026603	VCP	40.00	0.00500	-1.300	-1.500	4026601	4026599	---	---	10.0	7.10	7.30	0.00			---	---	---	---	---
4029374	VCP	191.00	0.00300	-9.400	-10.010	4029373	4029371	---	---	10.0	14.80	17.40	0.00		X	---	---	---	---	---
4029376	DIP	32.00	0.00300	-9.300	-9.400	4029375	4029373	---	---	10.0	14.70	14.80	0.00		X	---	---	---	---	---
4046380	VCP	152.14	0.00400	-3.870	-4.550	4046379	4046377	---	---	10.0	8.20	9.10	0.00		X	---	---	---	---	---
4046382	VCP	100.00	0.00400	-3.430	-3.870	4046381	4046379	---	---	10.0	7.60	8.20	0.00		X	---	---	---	---	---
4046384	VCP	100.00	0.00400	-2.990	-3.430	4046383	4046381	---	---	10.0	7.30	7.60	0.00		X	---	---	---	---	---
4046386	VCP	100.00	0.00400	-2.550	-2.990	4046385	4046383	---	---	10.0	6.80	7.30	0.00		X	---	---	---	---	---
4055684	VCP	202.00	0.00700	7.100	5.600	682225	682281	SI21AQ0119	SI21AQ0118	10.0	5.80	5.30	1.00			---	---	---	---	---
TOTALS		**10,090.97**											**60**	**0**	**10**					

12" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
305571	TCP	250.00	0.00384	2.460	1.500	302065	302200	SI21AQ0281	SI21AQ0280	12.0	3.50	8.10	1.00			0.24230	0.55610	1.87290	1.23660	2.43600
305610	TCP	10.00	0.04200	1.500	1.080	302200	302206	SI21AQ0280	SI21AQ0248	12.0	8.10	8.30	0.00			0.24230	0.55610	1.87330	4.08960	8.05700
306988	TCP	284.00	0.00549	4.020	2.460	310472	302065	SI21AQ0282	SI21AQ0281	12.0	2.50	3.50	0.00			0.20880	0.47920	1.76060	1.47900	2.91400
314832	VCP	261.00	0.00540	5.510	4.100	311603	311442	SI21AQ0275	SI21AQ0268	12.0	6.70	9.30	4.00			0.49860	1.07710	1.74440	1.46670	2.89000
343876	TCP	38.90	0.00800	0.170	-0.150	340295	340340	SI21AC1281	SI21AC0281	12.0	8.40	5.30	0.00			0.59060	0.99360	1.42820	1.80990	3.56600
343909	TCP	135.00	0.00300	-0.150	-0.500	340340	340475	SI21AC0281	SI21AC0288	12.0	5.30	8.10	0.00		X	0.65510	1.09180	1.57100	1.03050	2.03000
345085	TCP	41.00	0.00171	-2.140	-2.210	342231	342244	SI21AC0262	SI21AC0261	12.0	6.80	6.80	0.00			0.25880	0.46140	0.73840	0.82450	1.62400
345095	TCP	239.76	0.00179	-2.210	-2.640	342244	342321	SI21AC0261	SI21AC0185	12.0	6.80	7.40	0.00			0.17910	0.31940	0.51330	0.84510	1.66500
345149	TCP	258.70	0.00178	-2.640	-3.100	342321	379737	SI21AC0185	SI21AC0183	12.0	7.40	7.50	0.00			0.21110	0.37330	0.59720	0.84150	1.65800
356854	VCP	287.50	0.00814	3.870	1.530	353196	381458	SI21AJ0318	SI21AJ0317	12.0	5.50	6.00	3.00			0.28280	0.53430	1.16100	1.80030	3.54700
357246	RCP	350.00	0.00409	11.150	9.720	351037	351460	SI21AJ0524	SI21AJ0347	12.0	7.70	5.20	6.00			0.41230	0.78450	1.53130	1.27550	2.51300
357276	TCP	338.10	0.00361	9.720	8.500	351460	351869	SI21AJ0347	SI21AJ0359	12.0	5.20	3.20	3.00			0.49880	0.93720	1.87160	1.19870	2.36200

12" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
357294	VCP	166.00	0.02199	8.520	4.870	351869	352091	SI21AJ0359	SI21AJ0178	12.0	3.20	5.80	0.00			0.36190	0.68870	1.46300	2.95900	5.83000
357302	VCP	36.85	0.02280	4.870	4.030	352091	352146	SI21AJ0178	SI21AJ0177	12.0	5.80	8.30	0.00			0.36190	0.68870	1.46370	3.01290	5.93600
357306	VCP	265.15	0.00298	3.030	2.240	352146	352471	SI21AJ0177	SI21AJ0176	12.0	8.30	5.80	2.00			0.38970	0.74020	1.54190	1.08920	2.14600
357326	VCP	204.15	0.00299	2.240	1.630	352471	352684	SI21AJ0176	SI21AJ0175	12.0	5.80	6.00	1.00			0.39350	0.74720	1.55780	1.09080	2.14900
357349	VCP	192.00	0.00297	1.630	1.060	352684	352912	SI21AJ0175	SI21AJ0116	12.0	6.00	12.00	1.00			0.39390	0.74800	1.57020	1.08730	2.14200
357365	VCP	171.09	0.00871	6.800	5.310	352842	353019	SI21AJ0320	SI21AJ0319	12.0	6.80	5.70	1.00			0.22280	0.42300	0.97920	1.86230	3.66900
357386	VCP	166.21	0.00866	5.310	3.870	353019	353196	SI21AJ0319	SI21AJ0318	12.0	5.70	5.50	3.00			0.25520	0.48320	1.07110	1.85740	3.65900
380425	TCP	250.00	0.00180	-3.100	-3.550	379737	379790	SI21AC0183	SI21AC0540	12.0	7.50	7.80	1.00			0.25430	0.44600	0.71190	0.84660	1.66800
384254	UNK	155.00	---	---	---	382619	382664	SI21AJ0046	SI21AJ1100	12.0	---	6.00	0.00		X	---	---	---	---	---
384289	VCP	46.00	0.00261	-0.660	-0.780	382664	382675	SI21AJ1100	SI21AJ0044	12.0	6.00	5.80	0.00		X	0.02120	0.05410	0.05530	1.01920	2.00800
384300	VCP	352.00	0.00153	-0.490	-1.030	382675	382694	SI21AJ0044	SI21AJ1000	12.0	5.80	5.70	0.00			0.02120	0.05410	0.05590	0.78160	1.54000
384317	VCP	280.00	0.00950	-1.030	-3.690	382694	382718	SI21AJ1000	SI21AJ0041	12.0	5.70	8.10	0.00			0.02120	0.05410	0.05640	1.94500	3.83200
684552	VCP	69.00	0.00406	-0.200	-0.480	682476	682515	SI21AQ0070	SI21AQ1070	12.0	8.80	7.90	0.00			0.04650	0.10670	0.22340	1.27120	2.50400
684564	TCP	258.00	0.00800	3.370	1.220	682478	682606	SI21AQ0063	SI21AQ0059	12.0	5.30	5.60	0.00			---	---	---	---	---
684587	VCP	81.57	0.00405	-0.480	-0.810	682515	682569	SI21AQ1070	SI21AQ1069	12.0	7.90	7.50	0.00			0.04650	0.10670	0.22960	1.26930	2.50100
684606	VCP	11.00	0.00455	-0.810	-0.860	682569	682571	SI21AQ1069	SI21AQ0069	12.0	7.50	7.50	0.00			0.04650	0.10670	0.26670	1.34540	2.65100
684607	VCP	51.00	0.00392	-0.860	-1.060	682571	682594	SI21AQ0069	SI21AQ1068	12.0	7.50	7.60	0.00			0.04650	0.10670	0.26880	1.24970	2.46200
684624	VCP	32.00	0.00438	-1.060	-1.200	682594	682631	SI21AQ1068	SI21AQ1059	12.0	7.60	7.80	0.00			0.10560	0.24240	0.51350	1.31990	2.60000
684631	VCP	15.00	0.14933	1.220	-1.020	682606	682631	SI21AQ0059	SI21AQ1059	12.0	5.60	7.80	0.00			0.21630	0.49640	1.19580	7.71150	15.19300
684645	VCP	62.50	0.00600	-2.410	-2.760	4025720	682636	---	SI21AQ0058	12.0	8.40	9.50	0.00			---	---	---	---	---
684647	VCP	244.00	0.00600	-1.020	-2.410	682631	4025720	SI21AQ1059	---	12.0	7.80	8.40	5.00			---	---	---	---	---
684773	VCP	152.00	0.00704	-2.830	-3.900	682852	682949	SI21AQ0057	SI21AQ1057	12.0	8.60	9.60	1.00			0.33420	0.75940	1.76660	1.67430	3.29900
684851	VCP	93.00	0.00731	-3.900	-4.580	682949	683011	SI21AQ1057	SI21AQ0056	12.0	9.60	10.40	1.00			0.33560	0.76230	1.77530	1.70640	3.36200
684865	VCP	121.00	0.00727	-4.580	-5.460	683011	683044	SI21AQ0056	SI21AQ0049	12.0	10.40	12.10	0.00			0.33560	0.76230	1.78020	1.70180	3.35300
2023310	VCP	66.00	0.02600	-8.960	-10.660	2023309	382730	---	SI25MA0003	12.0	13.60	12.50	0.00		X	---	---	---	---	---
3012435	VCP	13.00	0.00500	-2.760	-2.830	682636	682852	SI21AQ0058	SI21AQ0057	12.0	9.50	8.60	0.00			---	---	---	---	---
4025646	UNK	15.90	---	-9.200	-9.200	683933	4025645	---	---	12.0	15.30	15.20	0.00			---	---	---	---	---
4025712	VCP	12.00	0.00300	3.950	3.910	682478	4025711	SI21AQ0063	---	12.0	5.30	4.70	0.00			---	---	---	---	---
4025714	VCP	16.00	0.00300	3.910	3.870	4025711	4025713	---	---	12.0	4.70	4.60	0.00			---	---	---	---	---
4025716	VCP	18.00	0.00500	1.900	1.810	4025715	682606	---	SI21AQ0059	12.0	5.10	5.60	0.00			---	---	---	---	---
4025718	VCP	16.00	0.00500	2.630	2.550	4025717	4025715	---	---	12.0	---	5.10	0.00			---	---	---	---	---
4025719	VCP	155.00	0.00500	3.400	2.630	4025713	4025717	---	---	12.0	4.60	---	4.00			---	---	---	---	---
4026532	VCP	200.00	0.00300	-8.210	-8.770	4026531	341186	---	SI21AC4018	12.0	12.70	14.30	4.00			---	---	---	---	---
4026628	VCP	80.00	0.00300	-3.980	-4.190	4026627	4026619	---	---	12.0	9.60	10.00	0.00			---	---	---	---	---
4026630	VCP	220.67	0.00300	-3.360	-3.980	4026629	4026627	---	---	12.0	8.90	9.60	2.00			---	---	---	---	---
4029318	VCP	172.00	0.00300	-7.670	-8.220	4029317	4029315	---	---	12.0	12.80	14.50	0.00			---	---	---	---	---
4029320	VCP	132.00	0.00300	-7.250	-7.670	4029319	4029317	---	---	12.0	13.10	12.80	1.00			---	---	---	---	---
4038816	VCP	15.00	0.00500	-2.420	-2.500	4038817	4038811	---	---	12.0	---	9.60	0.00		X	---	---	---	---	---
4046378	VCP	147.02	0.00300	-4.720	-5.090	4046377	4046375	---	---	12.0	9.10	10.10	0.00		X	---	---	---	---	---
4055478	PVC	38.00	0.06000	-3.840	-6.120	4055477	341243	---	SI21AC4021	12.0	9.60	10.50	0.00		X	---	---	---	---	---
TOTALS		7,285.07											44	0	7					

14" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
357300	TCP	348.20	0.00184	9.140	8.500	352040	351869	SI21AJ0358	SI21AJ0359	14.0	4.60	3.20	8.00			0.50650	0.95020	2.15790	1.29050	1.86800
357312	TCP	366.00	0.00178	9.790	9.140	352216	352040	SI21AJ0355	SI21AJ0358	14.0	5.50	4.60	9.00			0.47440	0.89620	2.06380	1.26850	1.83600
357314	TCP	101.00	0.00168	9.960	9.790	352267	352216	SI21AJ0354	SI21AJ0355	14.0	5.60	5.50	0.00			0.43810	0.83360	1.92760	1.23490	1.78800
357321	TCP	233.50	0.00184	10.390	9.960	352386	352267	SI21AJ0352	SI21AJ0354	14.0	5.90	5.60	7.00			0.43470	0.82730	1.91540	1.29170	1.87000
357329	TCP	349.20	0.00180	11.020	10.390	352529	352386	SI21AJ0324	SI21AJ0352	14.0	5.90	5.90	6.00			0.42070	0.80050	1.85600	1.27850	1.85100
357332	TCP	8.00	0.00125	11.030	11.020	352541	352529	SI21AJ0325	SI21AJ0324	14.0	6.00	5.90	0.00			0.60250	1.10970	2.65320	1.06420	1.54000
357347	TCP	312.30	0.00202	11.660	11.030	352667	352541	SI21AJ0326	SI21AJ0325	14.0	5.80	6.00	6.00			0.10390	0.19770	0.39050	1.35200	1.95700
357360	TCP	297.00	0.00199	12.250	11.660	352813	352667	SI21AJ0327	SI21AJ0326	14.0	5.20	5.80	4.00			0.08810	0.16760	0.32500	1.34160	1.94200
357371	TCP	299.00	0.00201	12.850	12.250	352931	352813	SI21AJ0328	SI21AJ0327	14.0	3.40	5.20	6.00			0.06900	0.13130	0.24810	1.34840	1.95200
357381	TCP	138.00	0.00203	13.130	12.850	352988	352931	SI21AJ0329	SI21AJ0328	14.0	4.00	3.40	3.00			0.04780	0.09090	0.16940	1.35590	1.96300
357390	TCP	158.00	0.00196	13.440	13.130	353054	352988	SI21AJ0332	SI21AJ0329	14.0	5.70	4.00	0.00			0.01410	0.02680	0.05460	1.33330	1.93000
380462	TCP	250.00	0.00180	-3.550	-4.000	379790	379855	SI21AC0540	SI21AC0177	14.0	7.80	8.30	0.00			0.25530	0.44770	0.71630	1.27710	1.84900
380508	TCP	70.00	0.00643	-4.000	-4.450	379855	379874	SI21AC0177	SI21AC0178	14.0	8.30	9.30	0.00			0.34170	0.59310	0.92430	2.41350	3.49300
380548	TCP	47.00	0.00170	-5.090	-5.170	379901	379920	SI21AC0181	SI21AC0180	14.0	9.40	10.10	1.00			0.12450	0.20970	0.28550	1.24190	1.79800
3012425	UNK	392.70	0.00300	-2.620	-3.830	682825	683041	SI21AQ1058	SI21AQ0050	14.0	8.90	12.10	3.00			---	---	---	---	---
4025722	TCP	289.58	0.00360	1.220	-2.620	682606	682825	SI21AQ0059	SI21AQ1058	14.0	5.60	8.90	0.00			---	---	---	---	---
TOTALS		**3,659.48**											**53**	**0**	**0**					

15" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
314784	VCP	216.00	0.00032	3.230	3.160	311423	311313	SI21AQ0400	SI21AQ0252	15.0	9.30	8.40	2.00			1.10310	2.15830	3.25080	0.65130	0.82100
314817	VCP	15.00	0.00467	3.300	3.230	311442	311423	SI21AQ0268	SI21AQ0400	15.0	9.30	9.30	0.00			1.00270	1.98500	3.03100	2.47170	3.11600
380551	VCP	19.00	0.00316	-5.030	-5.090	379906	379901	SI21AC0182	SI21AC0181	15.0	9.30	9.40	0.00			0.12120	0.20400	0.27760	2.03320	2.56400
4029308	VCP	350.00	0.00500	-10.550	-12.320	4029307	4029305	---	---	15.0	16.40	17.00	2.00			---	---	---	---	---
4029310	VCP	289.00	0.00300	-9.820	-10.550	4029309	4029307	---	---	15.0	15.20	16.40	2.00			---	---	---	---	---
4029312	VCP	14.80	0.00500	-4.520	-4.600	4029311	4029309	---	---	15.0	10.20	15.20	0.00			---	---	---	---	---
4029314	VCP	267.00	0.00300	-8.970	-9.820	4029313	4029309	---	---	15.0	14.10	15.20	0.00			---	---	---	---	---
4029316	VCP	155.00	0.00300	-8.470	-8.970	4029315	4029313	---	---	15.0	14.50	14.10	0.00			---	---	---	---	---
4029384	VCP	8.00	0.00400	-10.400	-10.430	4029385	4029371	---	---	15.0	---	17.40	0.00		X	---	---	---	---	---
4029387	VCP	42.00	0.00300	-10.300	-10.430	4029388	4029371	---	---	15.0	---	17.40	0.00		X	---	---	---	---	---
TOTALS		**1,375.80**											**6**	**0**	**2**					

16" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
4029299	DIP	21.00	0.00200	-12.560	-12.610	4029298	4029296	---	---	16.0	17.70	18.50	0.00		X	---	---	---	---	---
4029306	DIP	95.50	0.00300	-12.320	-12.560	4029305	4029298	---	---	16.0	17.00	17.70	1.00		X	---	---	---	---	---
TOTALS		**116.50**											**1**	**0**	**2**					

18" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
344129	VCP	218.95	0.00562	1.210	-0.020	340679	340869	SI21AC0295	SI21AC0297	18.0	8.30	7.80	2.00			1.29700	2.20600	5.31040	4.40980	3.86100
344244	VCP	220.00	0.00559	-0.020	-1.250	340869	341085	SI21AC0297	SI21AC0299	18.0	7.80	7.80	1.00			1.29700	2.20600	5.31670	4.39920	3.85200
344369	VCP	248.00	0.00452	-1.250	-2.370	341085	341205	SI21AC0299	SI21AC0300	18.0	7.80	8.00	1.00			1.29700	2.20600	5.32370	3.95380	3.46200
TOTALS		**686.95**											**4**	**0**	**0**					

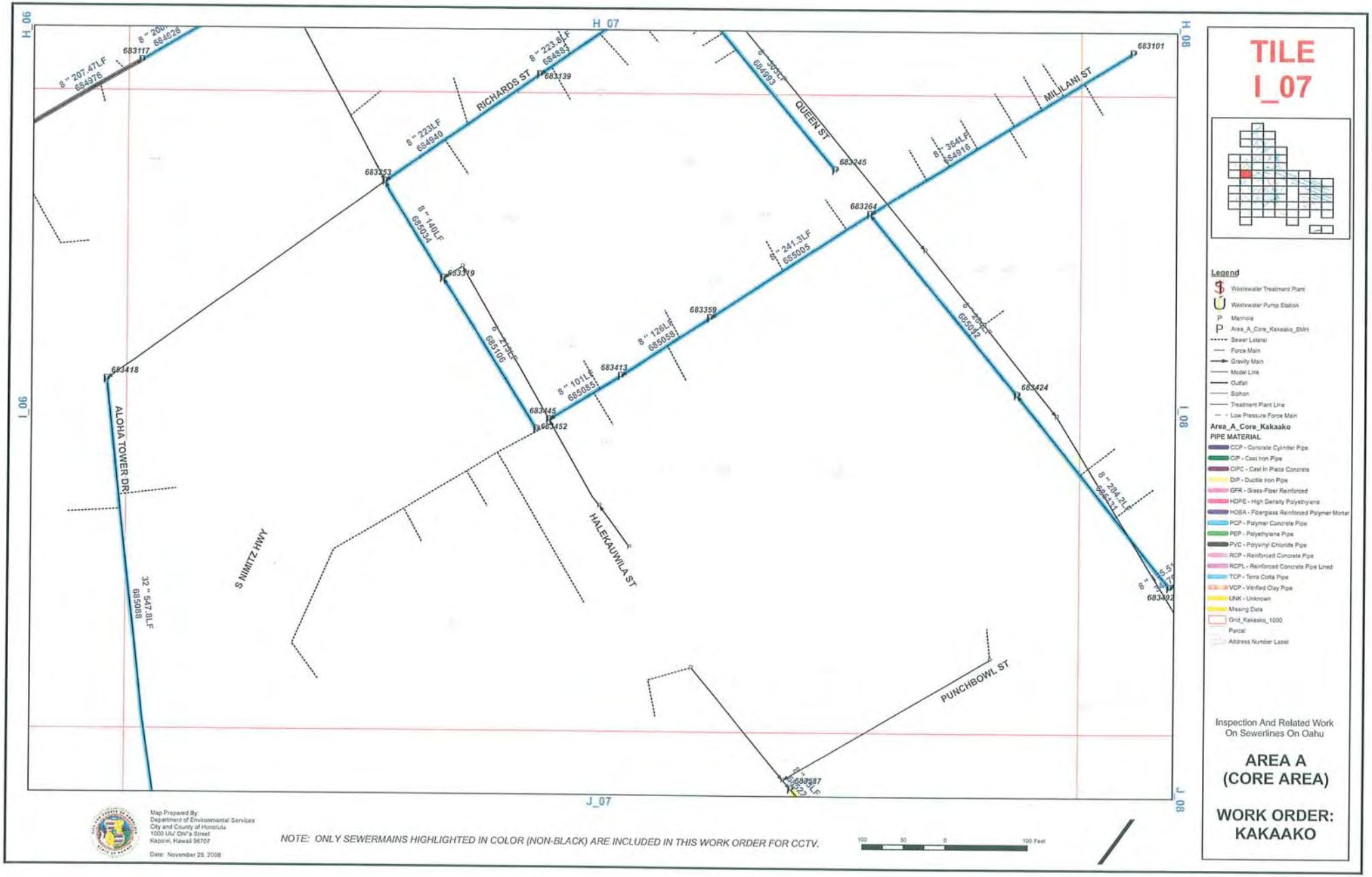
21" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
344440	VCP	102.78	0.01099	-1.700	-2.830	341205	341258	SI21AC0300	SI21AC0308	21.0	8.00	8.20	0.00			1.29700	2.20600	5.34420	10.73730	6.90700
344468	VCP	274.00	0.00201	-2.830	-3.380	341258	341403	SI21AC0308	SI21AC0310	21.0	8.20	8.70	0.00			1.30250	2.21450	5.36480	4.58790	2.95100
344557	VCP	253.00	0.00198	-3.380	-3.880	341403	341511	SI21AC0310	SI21AC0269	21.0	8.70	9.30	0.00			1.31920	2.23990	5.41890	4.55230	2.92900
4029297	VCP	250.00	0.00700	-10.890	-12.590	4029295	4029296	---	---	21.0	17.30	18.50	3.00		X	---	---	---	---	---
4029370	VCP	45.00	0.00200	-11.070	-11.150	4029369	4029295	---	---	21.0	17.10	17.30	0.00		X	---	---	---	---	---
4029372	VCP	137.00	0.00100	-10.930	-11.070	4029371	4029369	---	---	21.0	17.40	17.10	0.00		X	---	---	---	---	---
TOTALS		**1,061.78**											**3**	**0**	**3**					

24" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
344623	VCP	247.96	0.00121	-4.130	-4.430	341511	341617	SI21AC0269	SI21AC0247	24.0	9.30	10.00	1.00			1.42580	2.40190	5.74080	5.08540	2.50500
344689	VCP	305.17	0.00100	-4.430	-4.800	341617	4026560	SI21AC0247	---	24.0	10.00	9.90	0.00			---	---	---	---	---
344940	VCP	240.00	0.00121	-5.350	-5.640	342021	342098	SI21AC0195	SI21AC0160	24.0	9.90	10.30	1.00			1.50210	2.51700	6.06370	5.08210	2.50300
344994	VCP	290.00	0.00121	-5.640	-5.990	342098	342180	SI21AC0160	SI21AC0157	24.0	10.30	10.70	0.00			1.50930	2.52790	6.21120	5.07910	2.50200
345049	VCP	259.00	0.00120	-5.990	-6.300	342180	684295	SI21AC0157	SI21AC1157	24.0	10.70	15.00	0.00			1.50930	2.52790	6.21850	5.05810	2.49100
4016067	VCP	60.00	0.00100	-5.030	-5.080	4016066	382772	---	SI21AJ0037	24.0	8.90	10.70	0.00		X	---	---	---	---	---
4016069	VCP	162.00	0.00100	-4.900	-5.030	4016068	4016066	---	---	24.0	8.90	8.90	0.00		X	---	---	---	---	---
4026547	VCP	252.00	0.00100	-5.040	-5.350	4026546	342021	---	SI21AC0195	24.0	9.50	9.90	3.00			---	---	---	---	---
4026549	VCP	134.50	0.00100	-4.870	-5.040	341780	4026546	SI21AC0192	---	24.0	9.90	9.50	0.00			---	---	---	---	---
4026559	VCP	57.53	0.00100	-4.800	-4.870	4026560	341780	---	SI21AC0192	24.0	9.90	9.90	0.00			---	---	---	---	---
TOTALS		**2,008.16**											**5**	**0**	**2**					

32" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
685088	TCP	547.80	0.00100	-6.380	-6.840	683418	683595	SI21AQ0018	SI21AQ0017	32.0	11.00	12.80	2.00		X	4.97850	8.11980	17.52780	7.84430	2.17300
685269	TCP	542.90	0.00100	-6.840	-7.450	683595	683754	SI21AQ0017	SI21AQ0011	32.0	12.80	11.70	0.00			5.06580	8.24520	17.91220	8.75770	2.42600
TOTALS		**1,090.70**											**2**	**0**	**1**					

36" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
383586	RCP	284.00	0.00032	-5.450	-5.540	4044793	379945	SI21AJ0102A	SI21AJ0102	36.0	---	10.40	3.00			5.52530	8.54710	12.57280	9.59590	2.10100
4044794	RCP	284.00	0.00300	-4.640	-5.450	381768	4044793	SI21AJ1166	SI21AJ0102A	36.0	11.60	---	4.00			---	---	---	---	---
TOTALS		**568.00**											**7**	**0**	**0**					

72" MAIN SEWER ID	MAT'L	PIPE LENGTH (ft)	SLOPE (ft/ft)	UP INV (ft)	DOWN INV (ft)	UpMH ID	DnMH ID	UpMHOld_ID	DnMHOld_ID (ft)	DIAM (in)	UpMH Depth (ft)	DnMH Depth (ft)	laterals	Within Hazard Areas	Within Easem'ts	Q_{AVG} (mgd)	Q_{MAX} (mgd)	Q_{PEAK} (mgd)	$Q_{Capacity}$ (mgd)	$V_{Capacity}$ (fps)
685522	RCP	287.33	0.00017	-12.600	-12.650	684051	4044526	SI21AC0004	---	72.0	17.40	18.50	3.00			5.31150	7.57960	15.41000	85.86440	3.69100
TOTALS		**287.33**											**3**	**0**	**0**					



TILE I_07

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Grass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

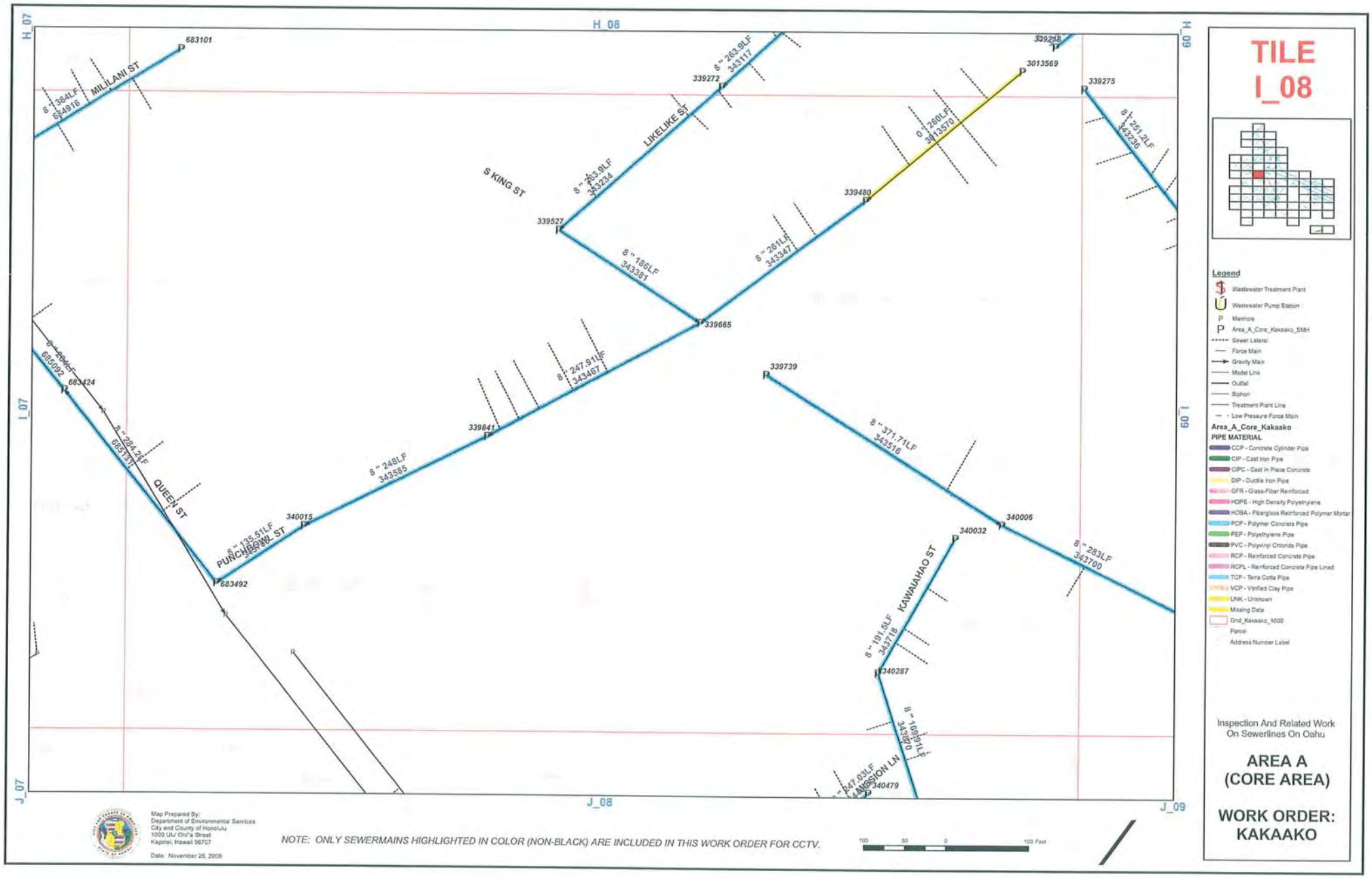
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Oloʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE I_08

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast in Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HDSA - Fiberglass Reinforced Polymer Mortar
- RCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

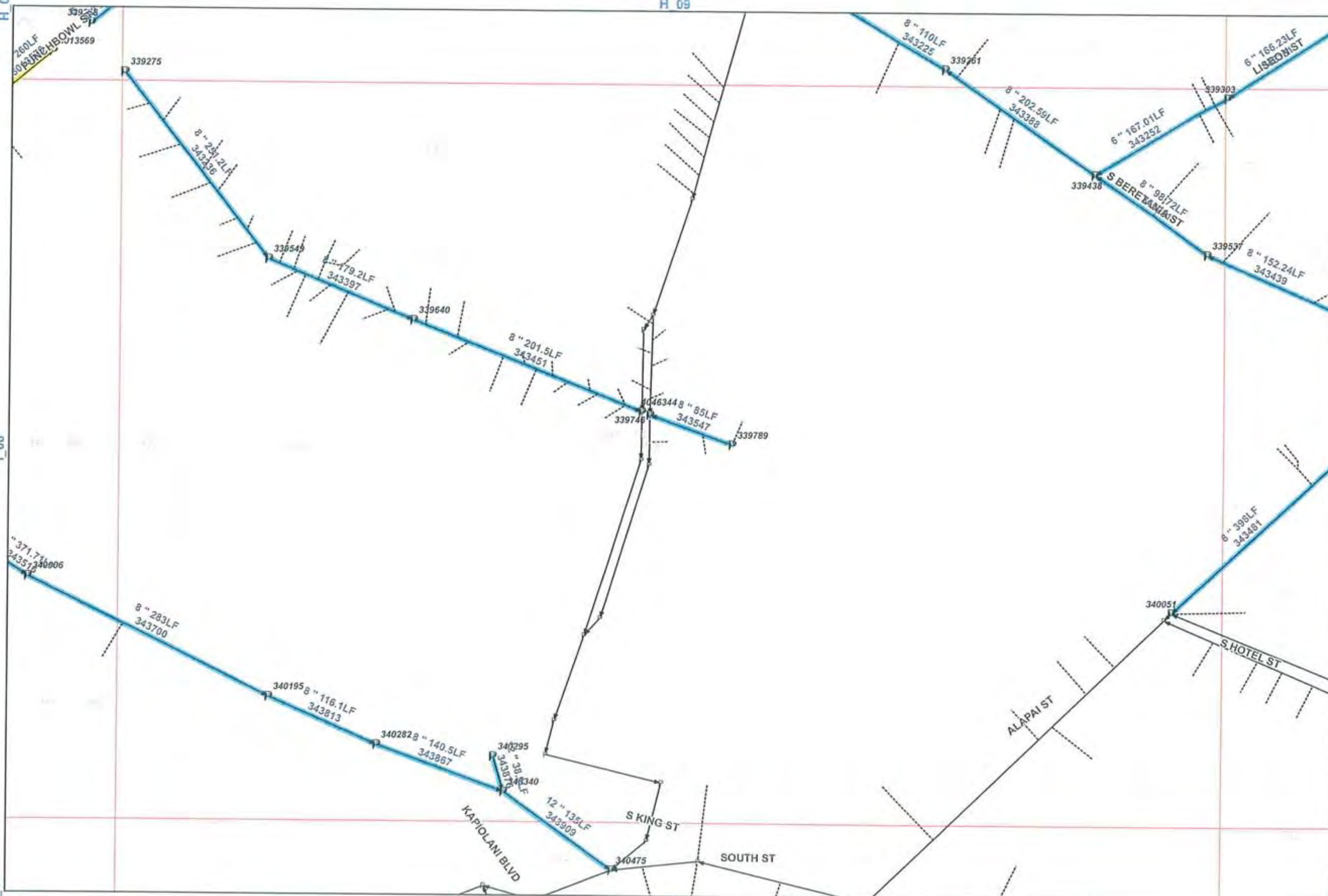
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻōtiʻa Street
Kapolei, Hawaii 96707

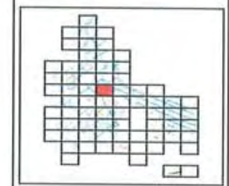
Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE I_09



Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- P Manhole
- P Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

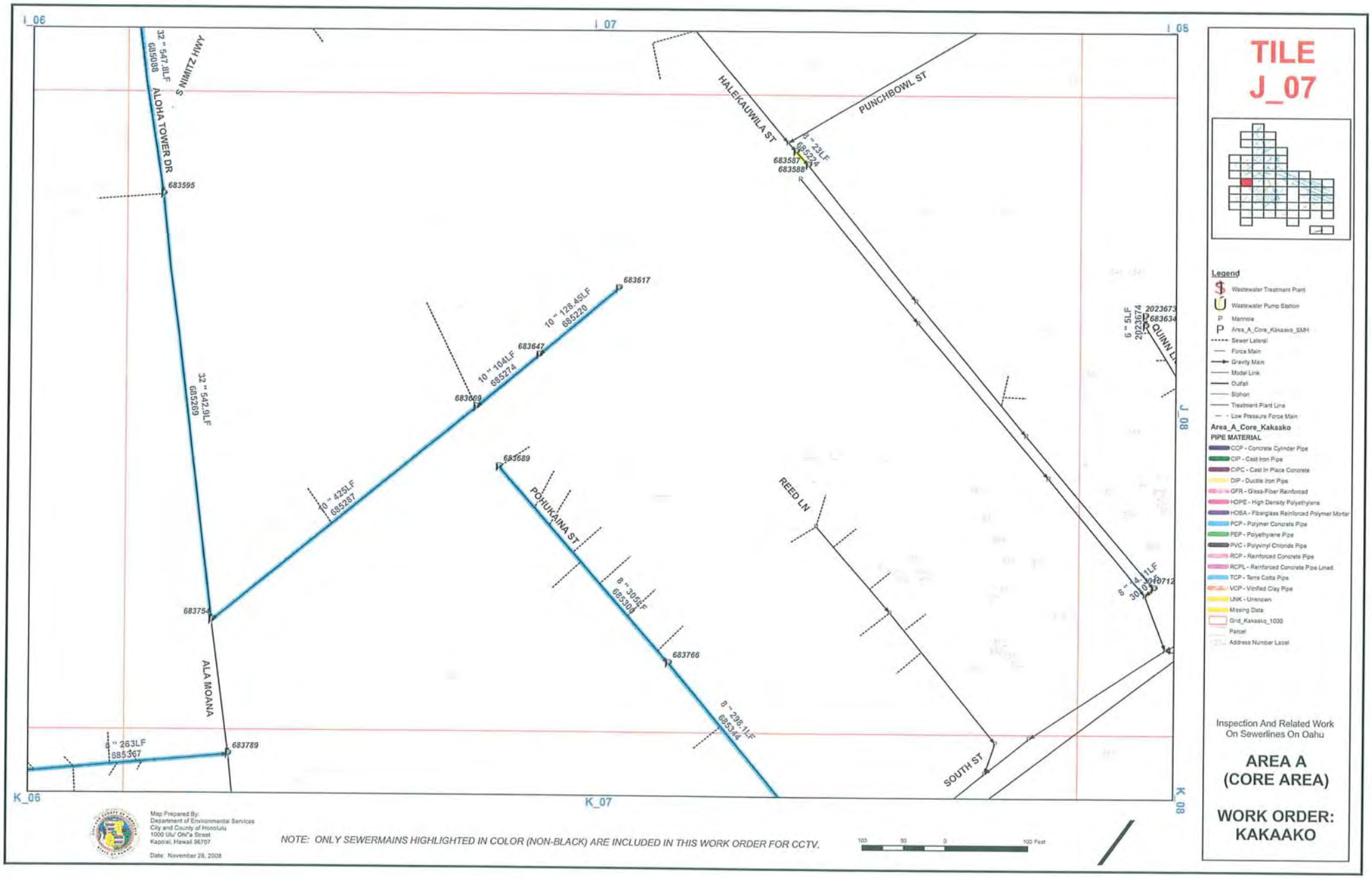
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Ulu' Ohi'a Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet

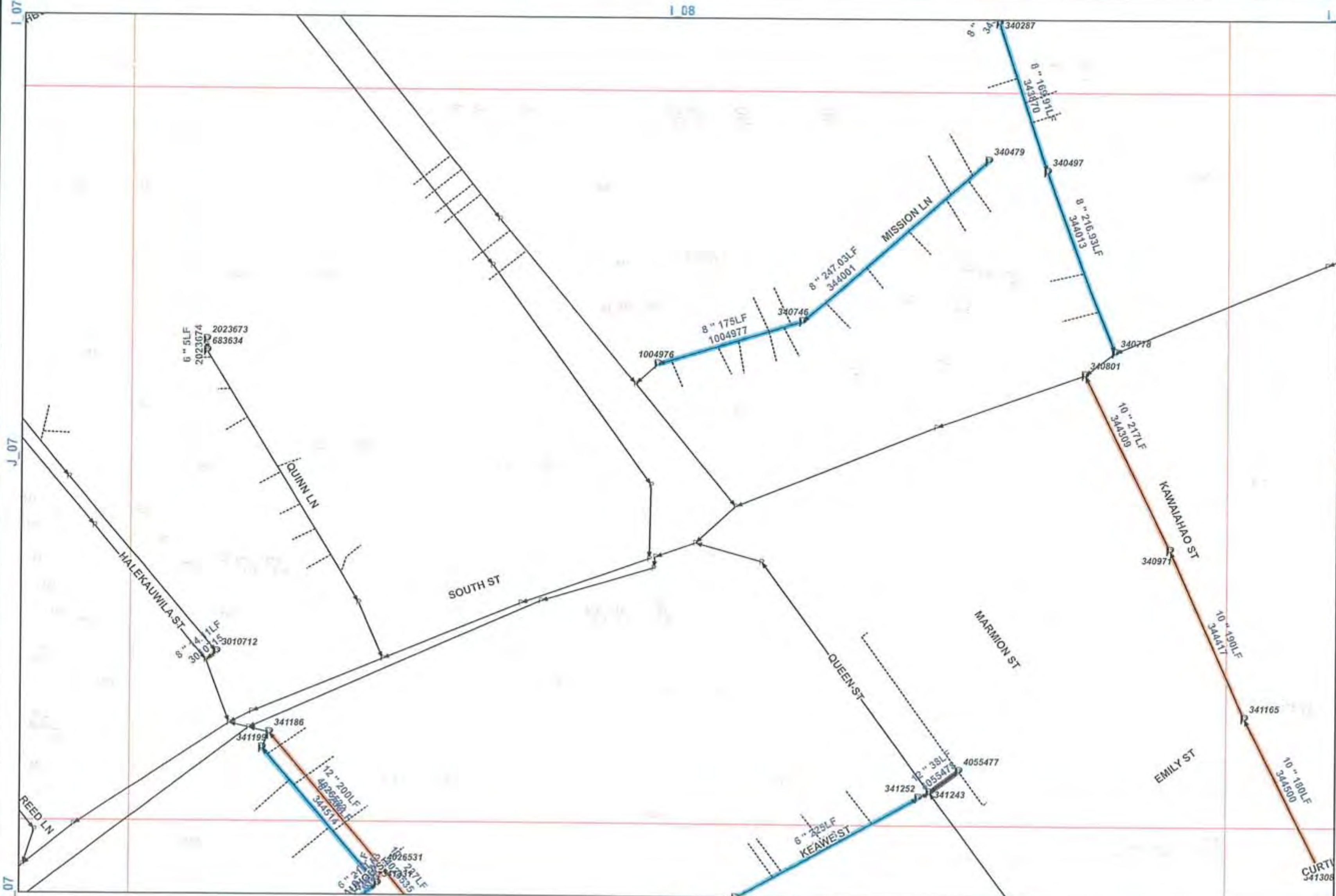


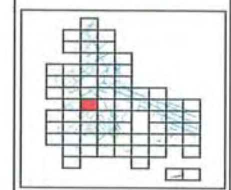
Inspection And Related Work
On Sewerlines On Oahu

AREA A
(CORE AREA)

WORK ORDER:
KAKAAKO

TILE J_08





Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Line
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
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- TCP - Terra Cotta Pipe
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- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

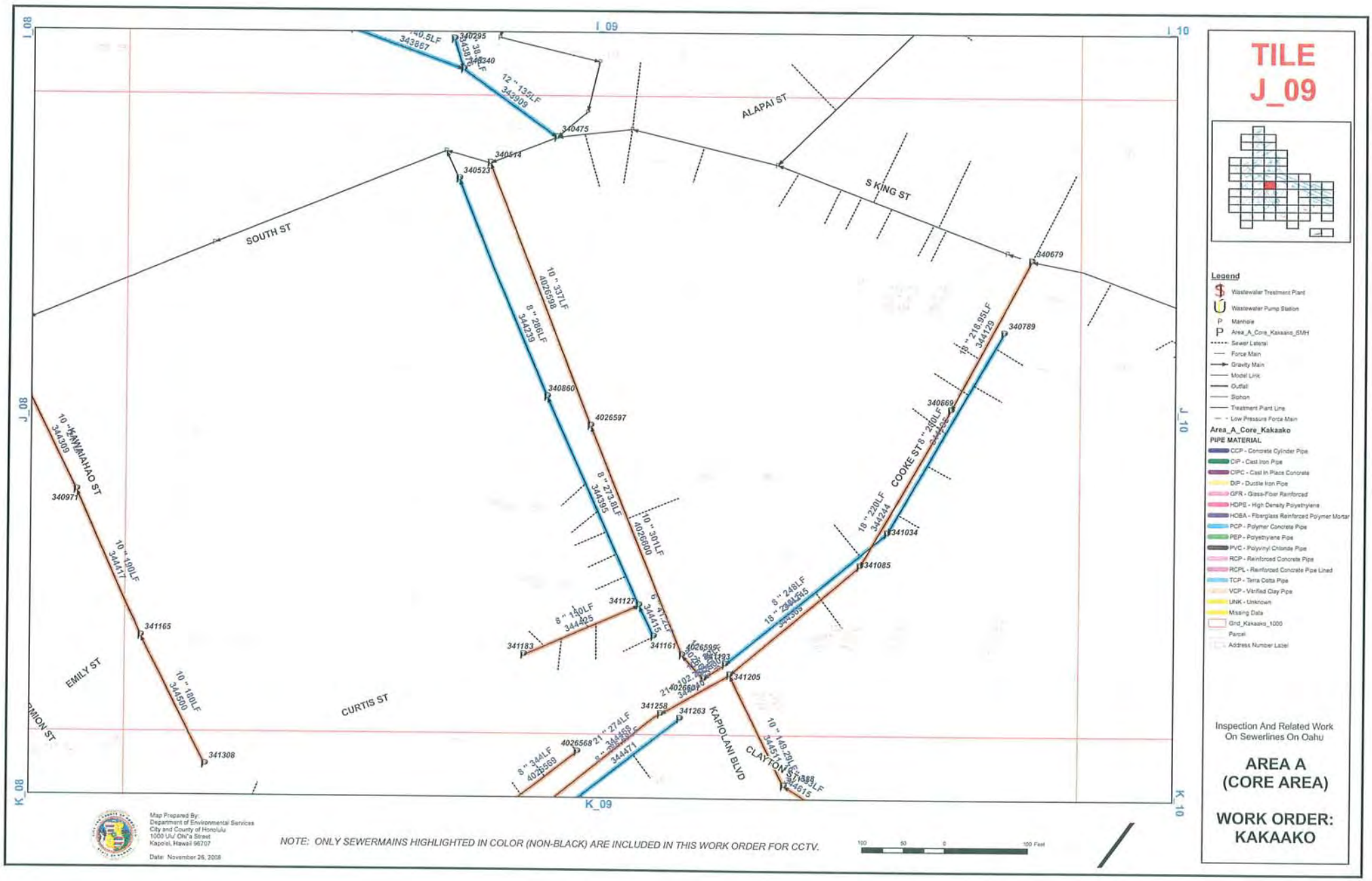
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE J_09

Inspection And Related Work On Sewerlines On Oahu

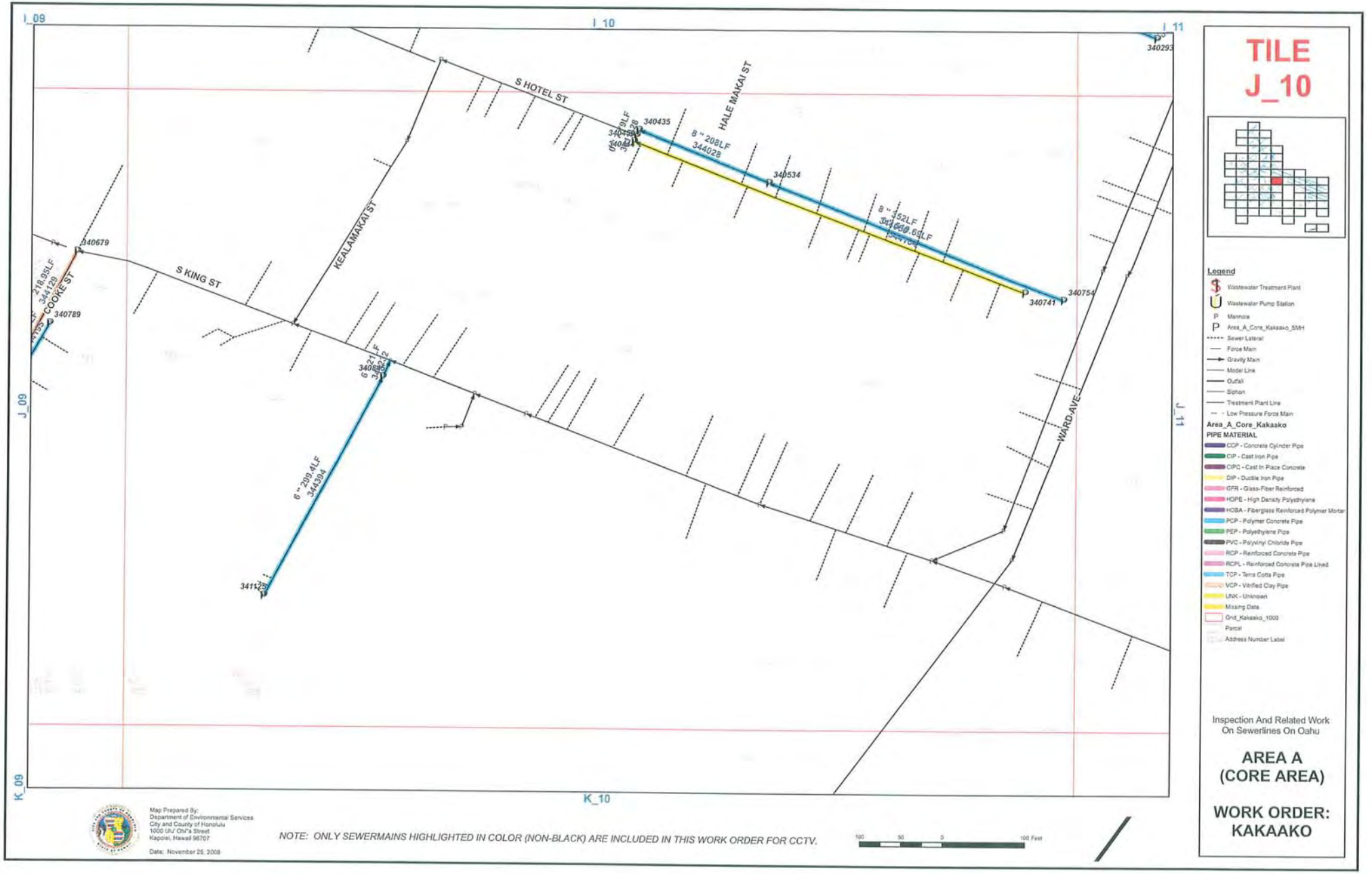
AREA A (CORE AREA)

WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.



Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 25, 2008

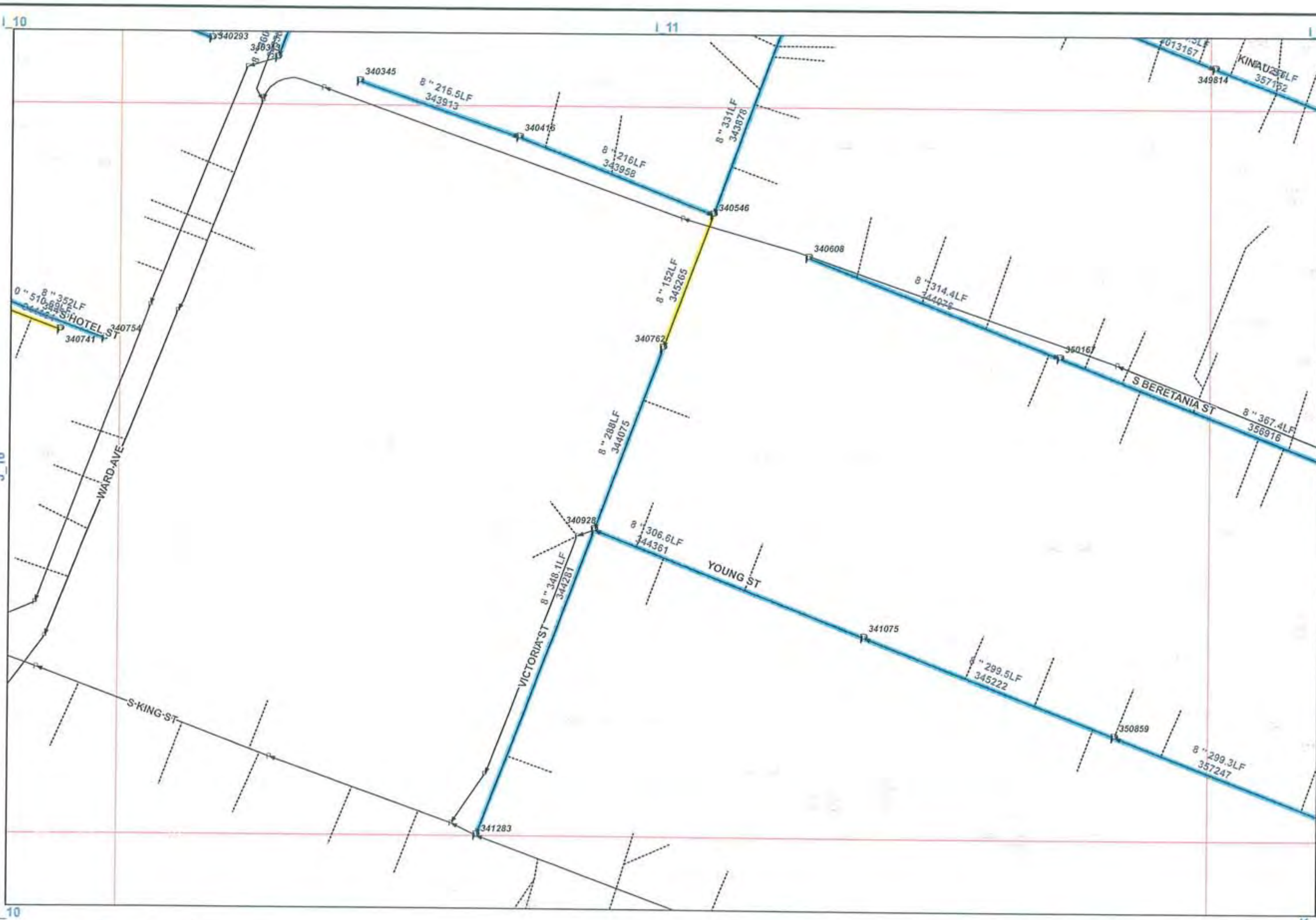
NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

Inspection And Related Work
On Sewerlines On Oahu

AREA A
(CORE AREA)

WORK ORDER:
KAKAAKO

TILE J_11



Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
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- HOBA - Fiberglass Reinforced Polymer Mortar
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- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

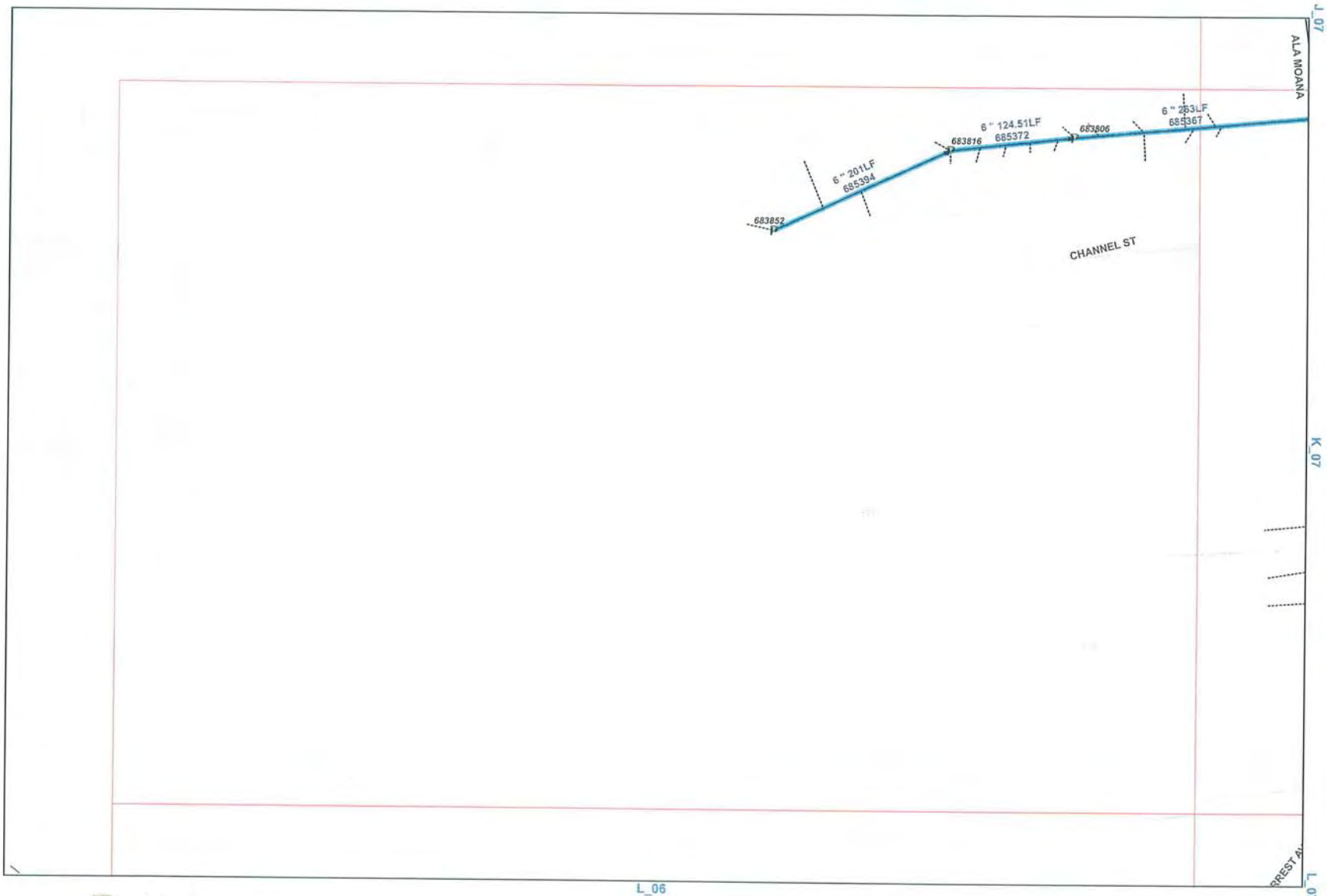
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Ulu' Ohi'a Street
Kapolei, Hawaii 96707

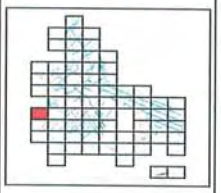
Date: November 25, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE K_06



Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
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- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
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- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

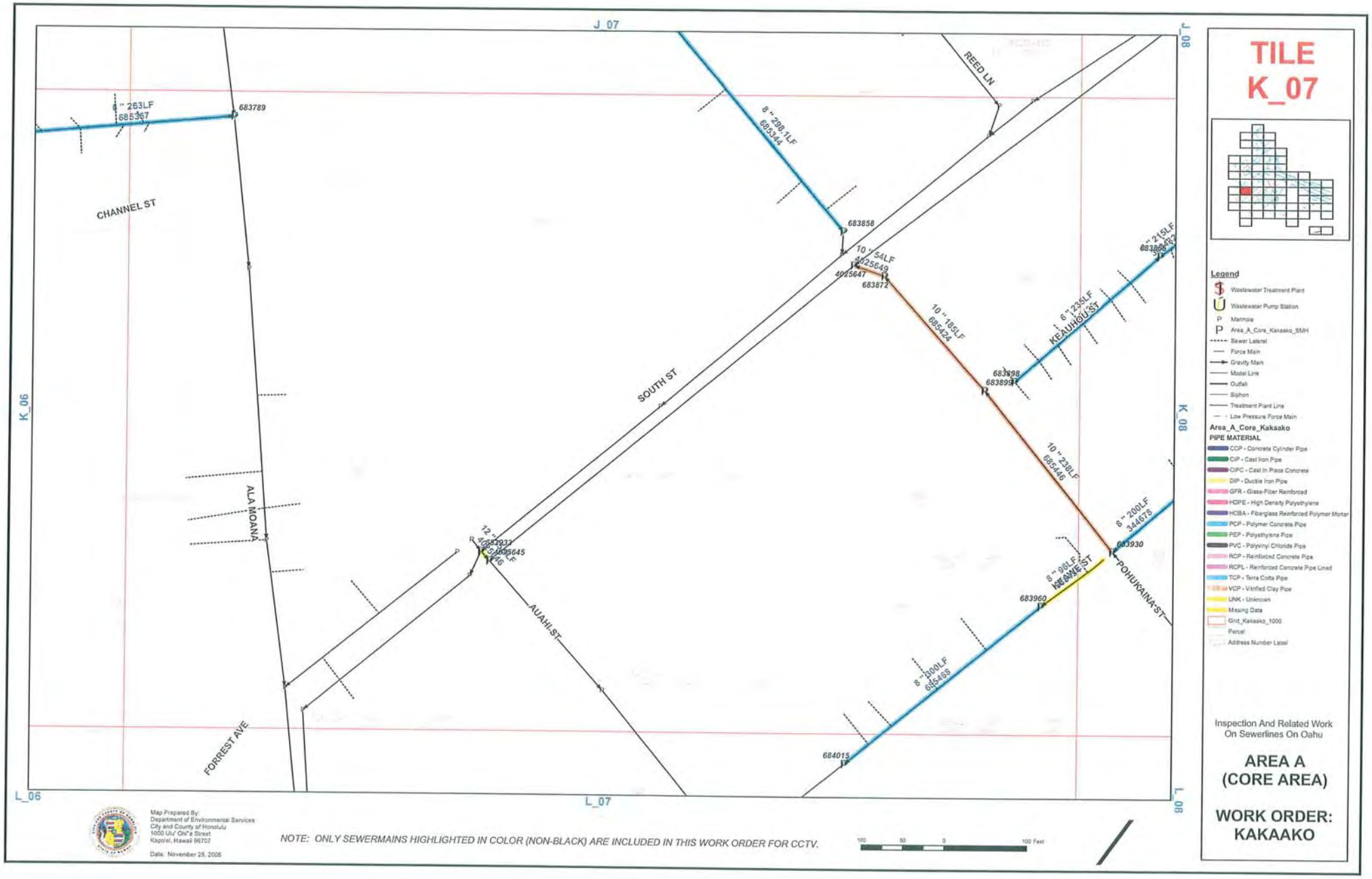
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet


J_07
J_08
K_06
K_08
L_06
L_07
L_08
CHANNEL ST
SOUTH ST
ALA MOANA
FORREST AVE
AUAHI ST
REED LN
KEAUHOU ST
POHUKAINA ST
8 " 263LF
685367
683789
8 " 298.1LF
685344
683858
10 " 54LF
4025649
4025647
683872
10 " 165LF
685424
683898
683899
6 " 215LF
683865
6 " 235LF
10 " 238LF
685446
6 " 200LF
344675
683930
8 " 39LF
683960
8 " 100LF
685455
684015
12 "
4025645
TILE
K_07
Legend
Wastewater Treatment Plant
Wastewater Pump Station
Manhole
Area_A_Core_Kakaako_SMH
Sewer Lateral
Force Main
Gravity Main
Model Link
Outfall
Siphon
Treatment Plant Line
Low Pressure Force Main
Area_A_Core_Kakaako
PIPE MATERIAL
CCP - Concrete Cylinder Pipe
CIP - Cast Iron Pipe
CIPC - Cast In Place Concrete
DIP - Ductile Iron Pipe
GFR - Glass-Fiber Reinforced
HDPE - High Density Polyethylene
HDBA - Fiberglass Reinforced Polymer Mortar
PCP - Polymer Concrete Pipe
PEP - Polyethylene Pipe
PVC - Polyvinyl Chloride Pipe
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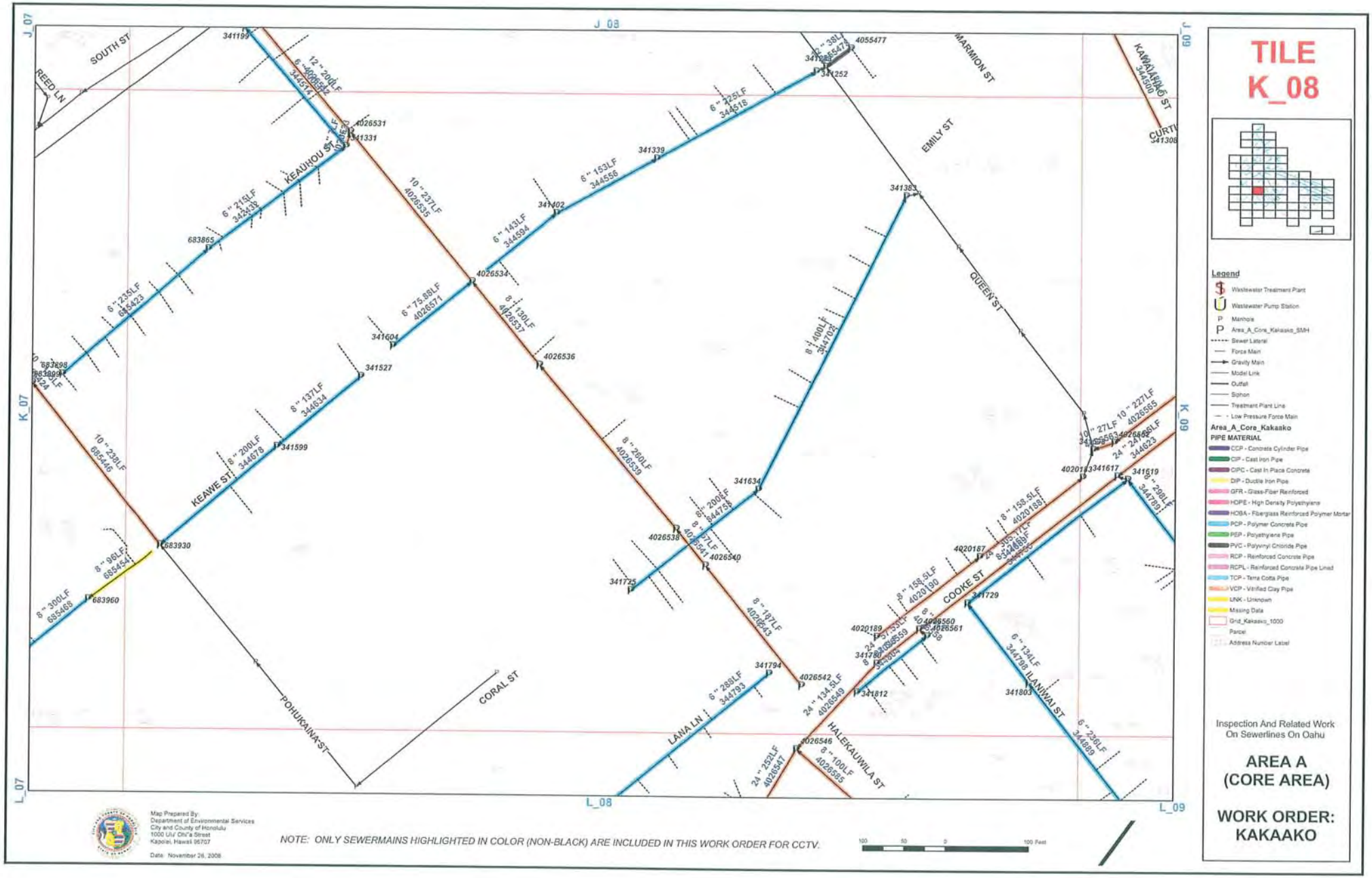
RCPL - Reinforced Concrete Pipe Lined
TCP - Terra Cotta Pipe
VCP - Vitrified Clay Pipe
UNK - Unknown
Missing Data
Grid_Kakaako_1000
Parcel
Address Number Label
Inspection And Related Work
On Sewerlines On Oahu
AREA A
(CORE AREA)
WORK ORDER:
KAKAAKO
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Oniʻa Street
Kapolei, Hawaii 96707
Date: November 25, 2008
NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.
100 50 0 100 Feet



TILE K_08

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
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- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

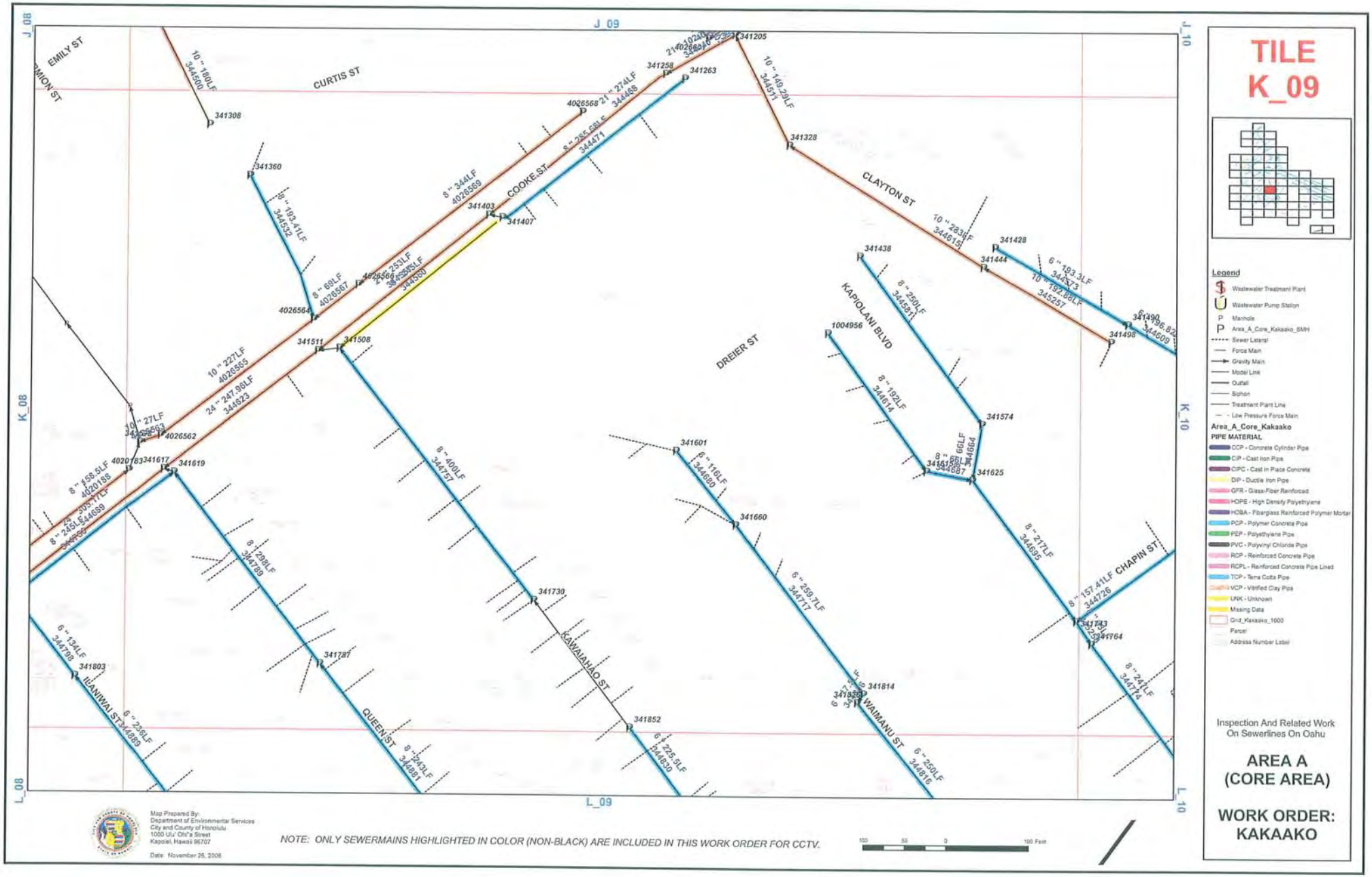
WORK ORDER: KAKAAKO

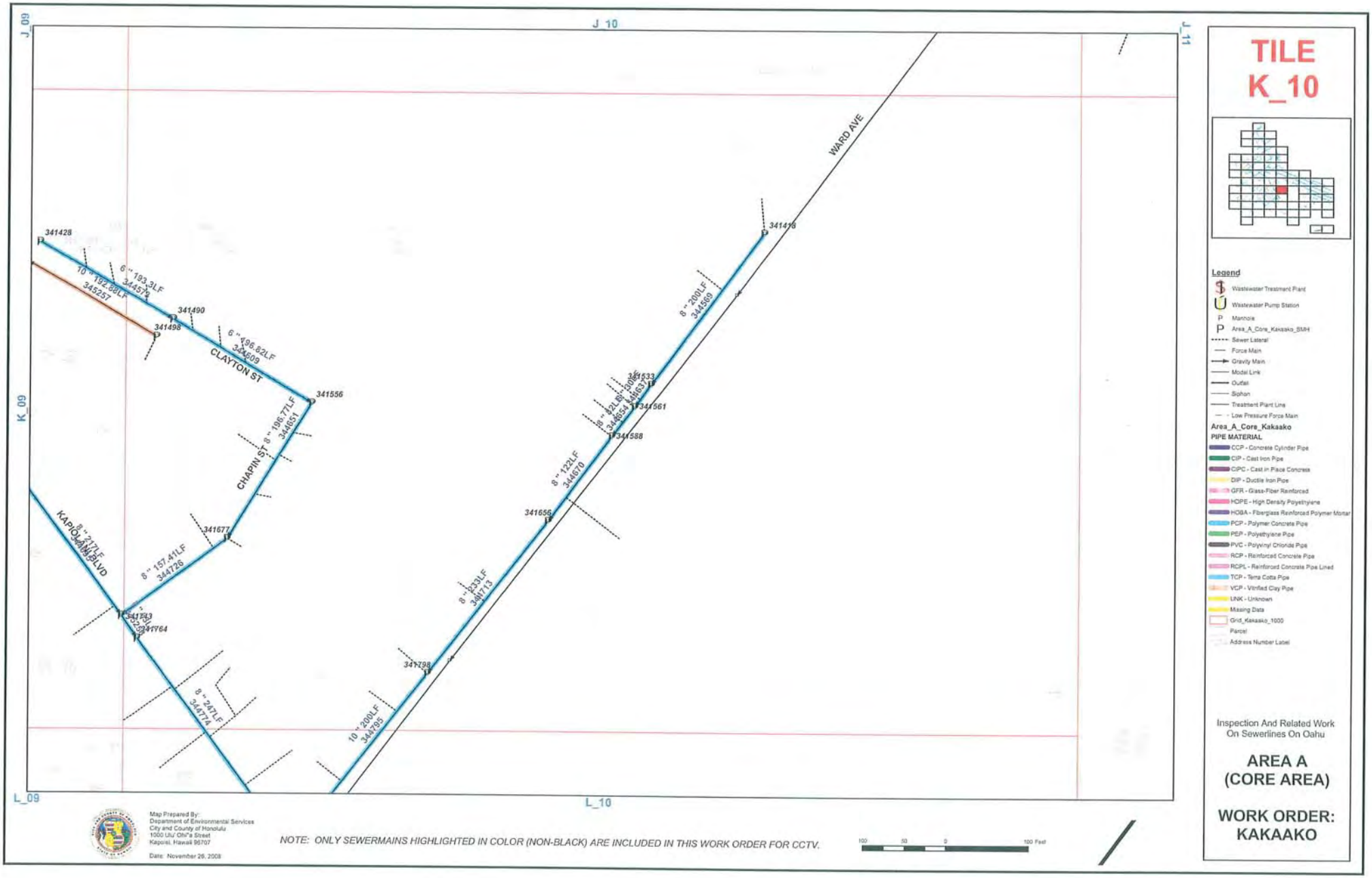
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet


TILE
K_09
J_08
J_09
J_10
K_08
K_10
L_08
L_09
EMILY ST
CURTIS ST
COOKE ST
CLAYTON ST
DREIER ST
KAPIOLANI BLVD
KAWAIAHAO ST
QUEEN ST
ILIANIMAI ST
WAIMANU ST
CHAPIN ST
Legend
Wastewater Treatment Plant
Wastewater Pump Station
Manhole
Area_A_Core_Kakaako_SMH
Sewer Lateral
Force Main
Gravity Main
Model Link
Outfall
Siphon
Treatment Plant Link
Low Pressure Force Main
Area_A_Core_Kakaako
PIPE MATERIAL
CCP - Concrete Cylinder Pipe
CIP - Cast Iron Pipe
CIPC - Cast in Place Concrete
DIP - Ductile Iron Pipe
GFR - Glass-Fiber Reinforced
HDPE - High Density Polyethylene
HOBA - Fiberglass Reinforced Polymer Mortar
PCP - Polymer Concrete Pipe
PEP - Polyethylene Pipe
PVC - Polyvinyl Chloride Pipe
RCP - Reinforced Concrete Pipe
RCPL - Reinforced Concrete Pipe Lined
TCP - Terra Cotta Pipe
VCP - Vitrified Clay Pipe
UNK - Unknown
Missing Data
Grid_Kakaako_1000
Parcel
Address Number Label
Inspection And Related Work
On Sewerlines On Oahu
AREA A
(CORE AREA)
WORK ORDER:
KAKAAKO
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707
Date: November 26, 2008
NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.
100 50 0 100 Feet



TILE K_10

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
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- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet

TILE K_12

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Mannole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
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- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

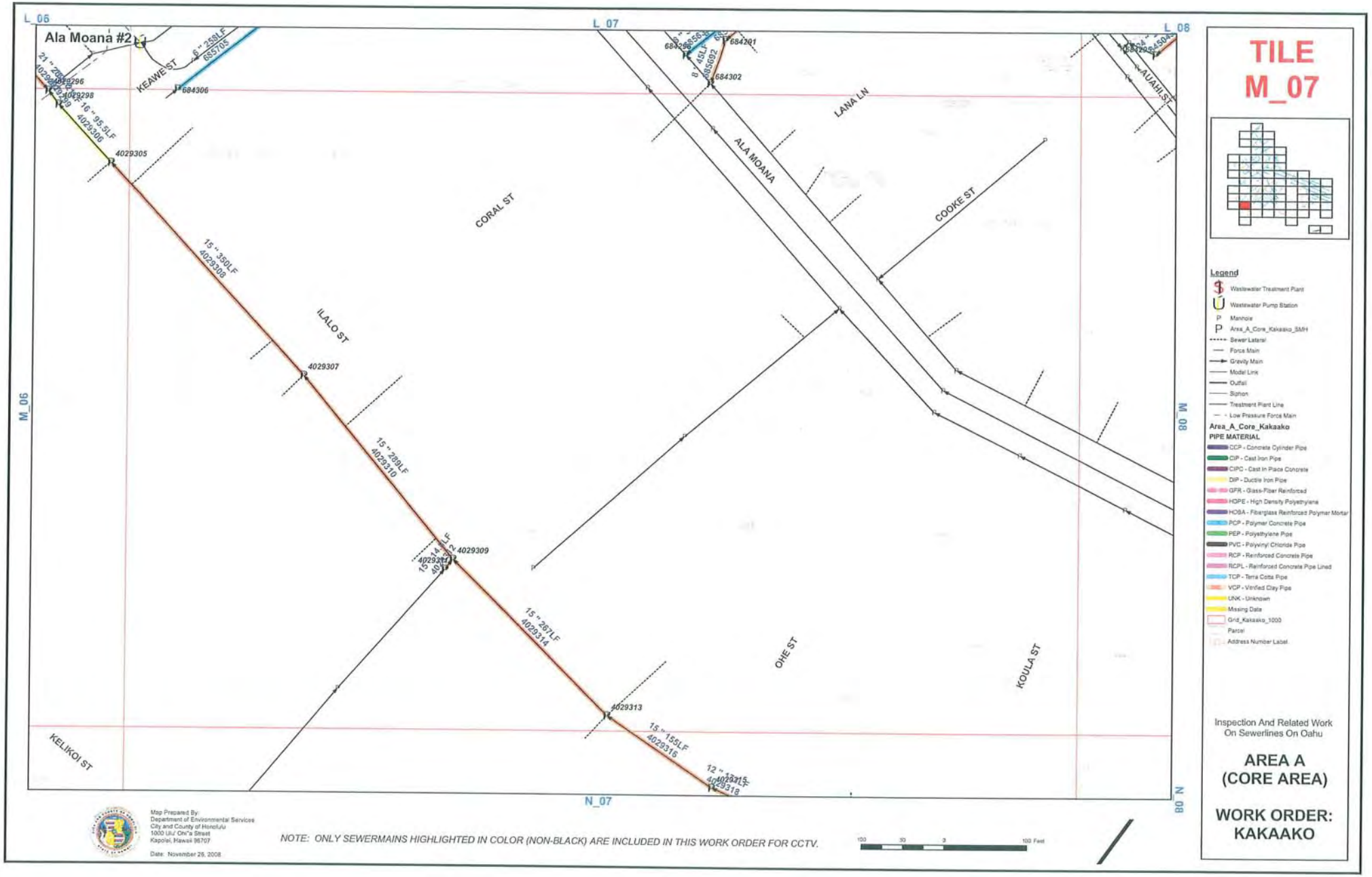
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 28, 2006

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE M_07

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
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- HDPE - High Density Polyethylene
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- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

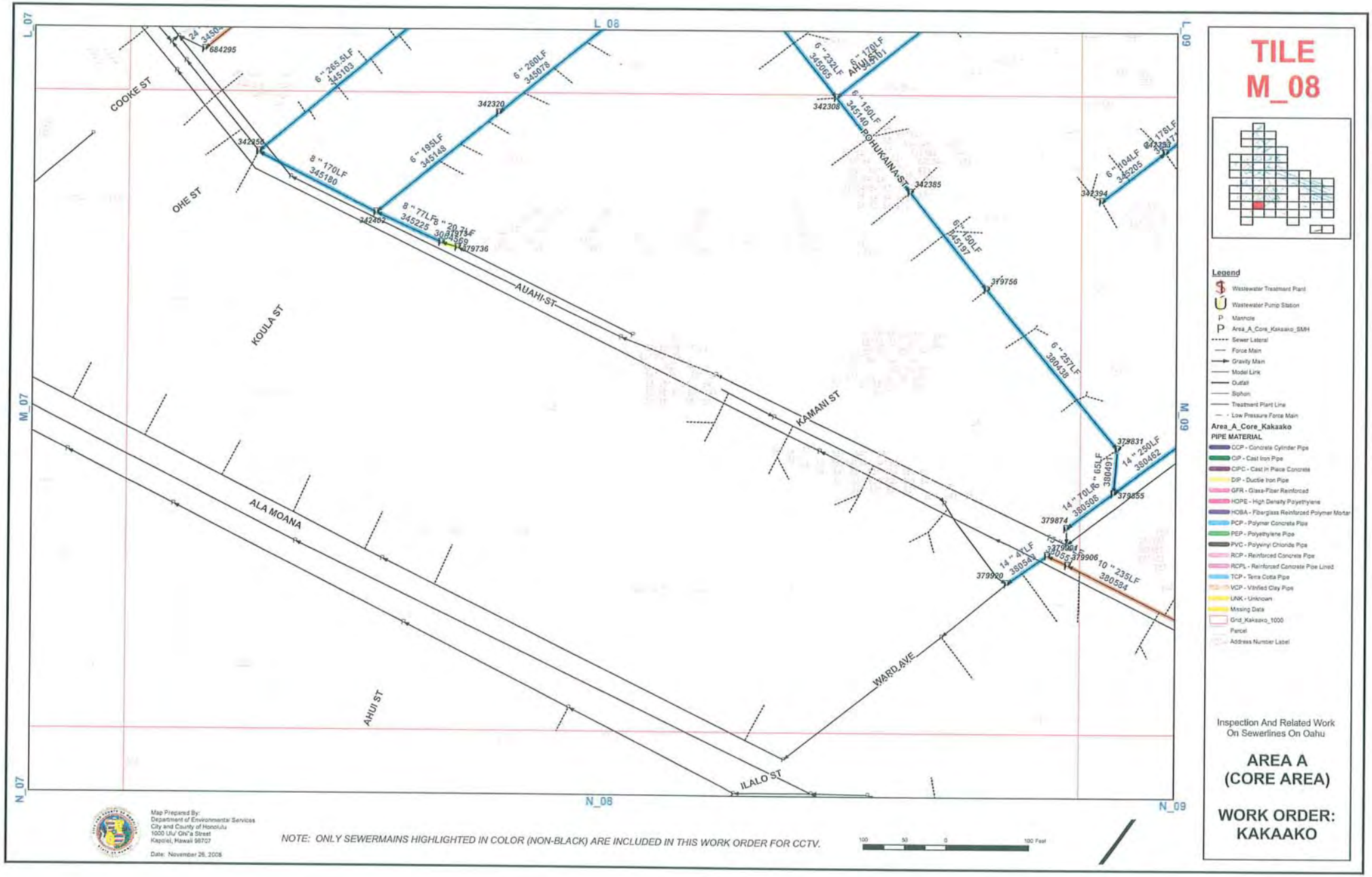
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 30 0 100 Feet



TILE M_08

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
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- Treatment Plant Line
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Area_A_Core_Kakaako

PIPE MATERIAL

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- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

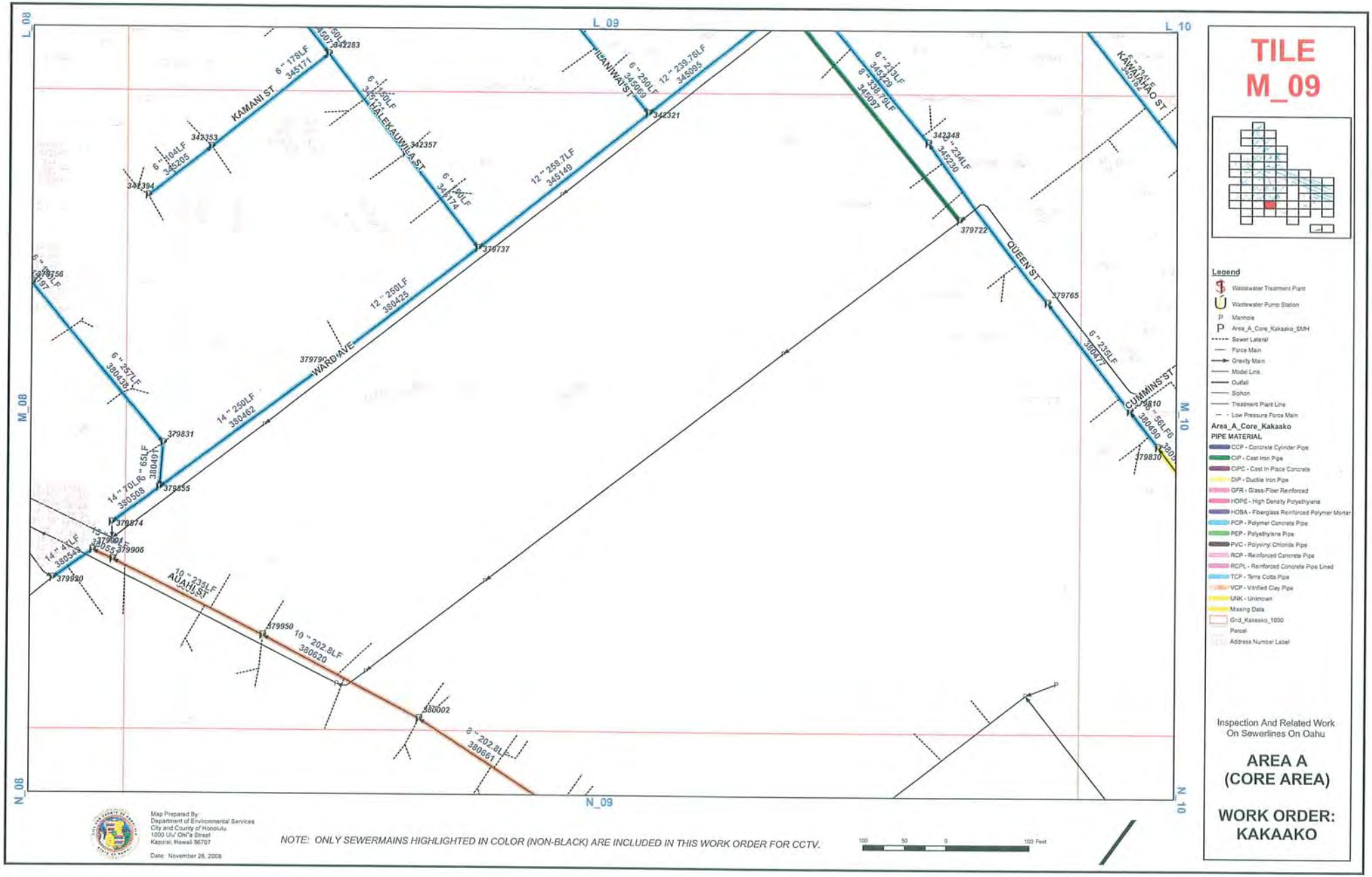
AREA A (CORE AREA)

WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Oloʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.



Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet

TILE M_09

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

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- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

WORK ORDER: KAKAAKO

TILE M_10

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
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- Treatment Plant Line
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Area_A_Core_Kakaako
PIPE MATERIAL

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- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

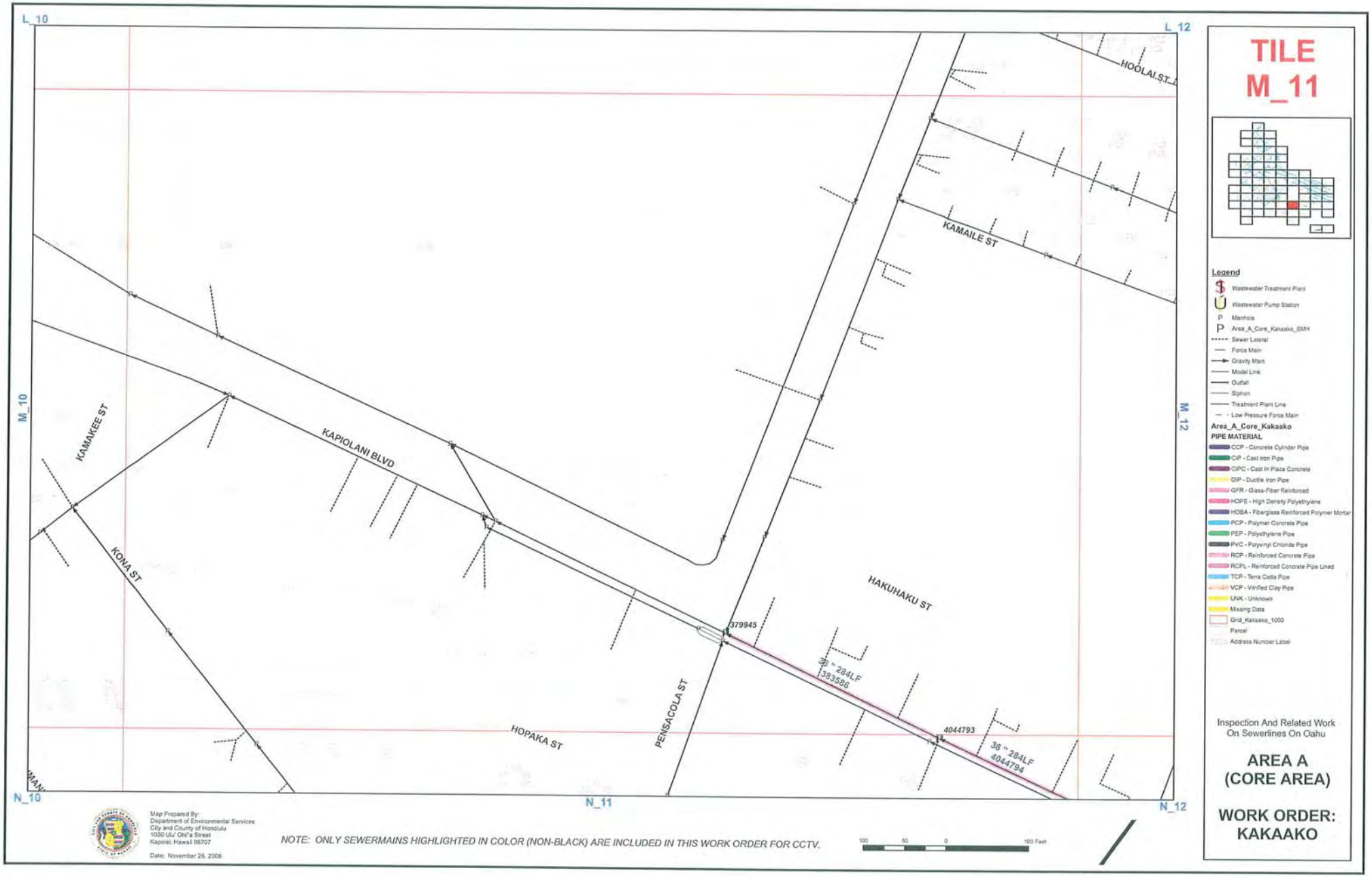
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

Inspection And Related Work
On Sewerlines On Oahu

AREA A
(CORE AREA)

WORK ORDER:
KAKAAKO

TILE M_12

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako
PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

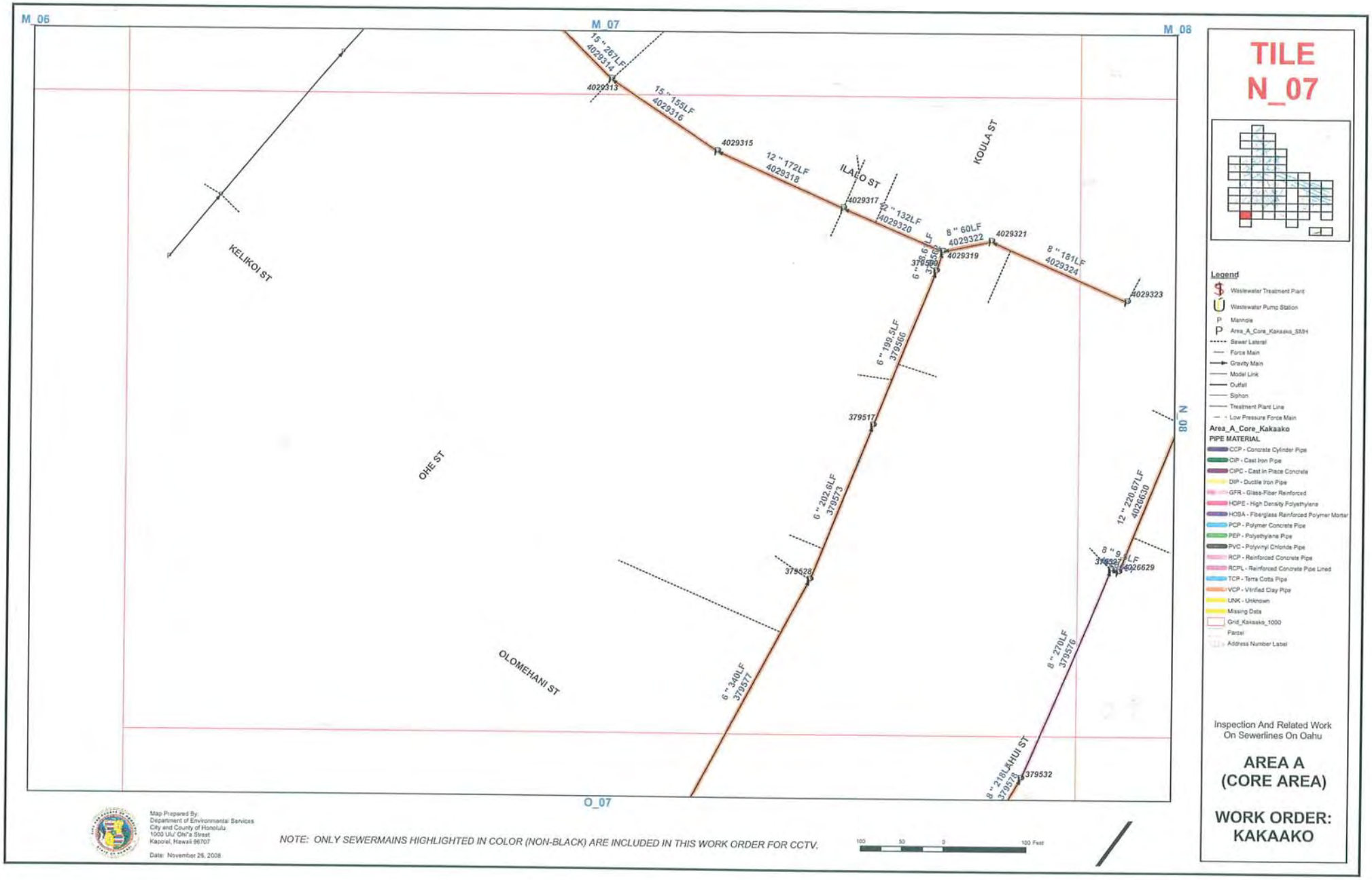
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE N_07

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work
On Sewerlines On Oahu

AREA A
(CORE AREA)

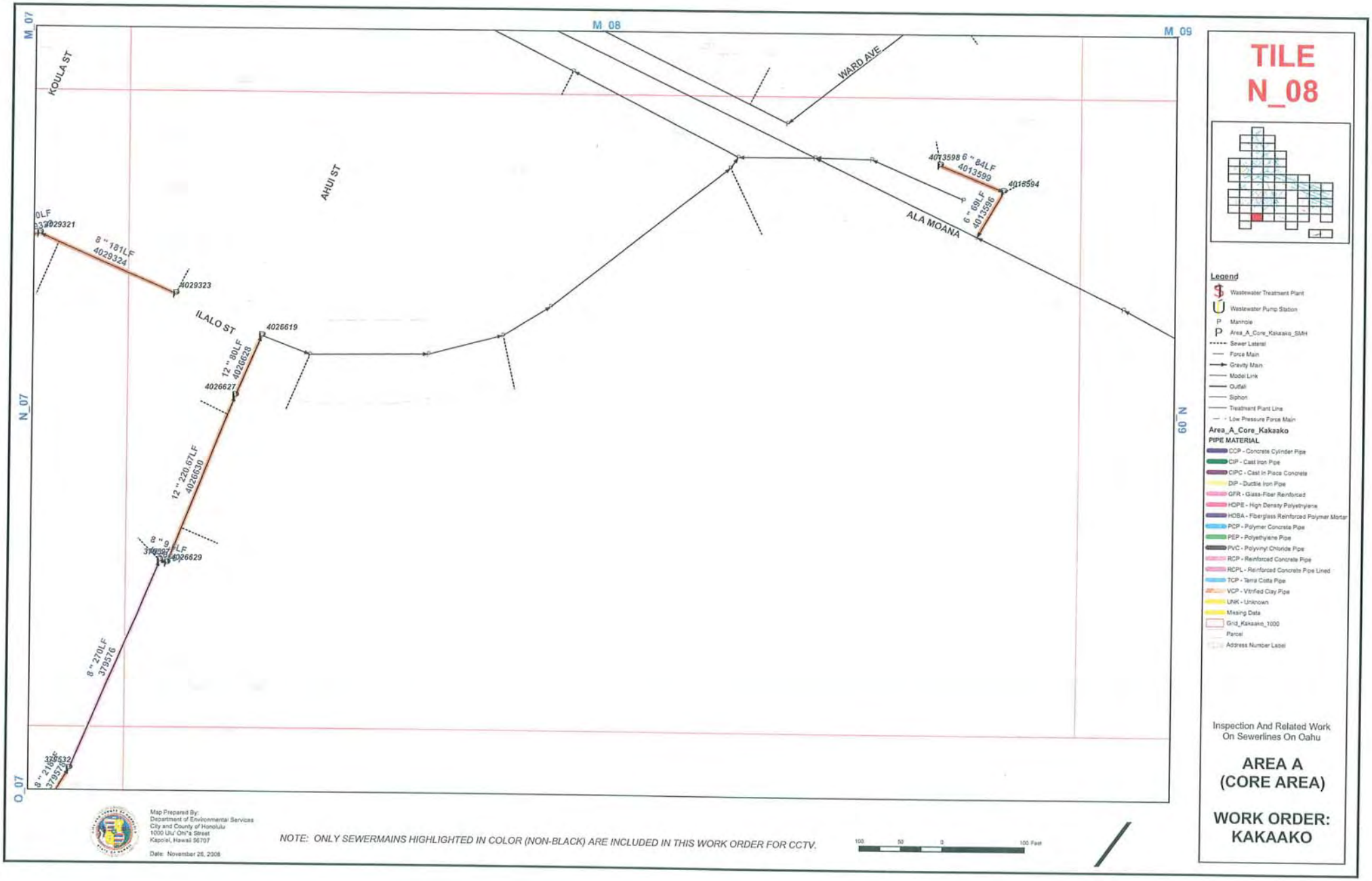
WORK ORDER:
KAKAAKO

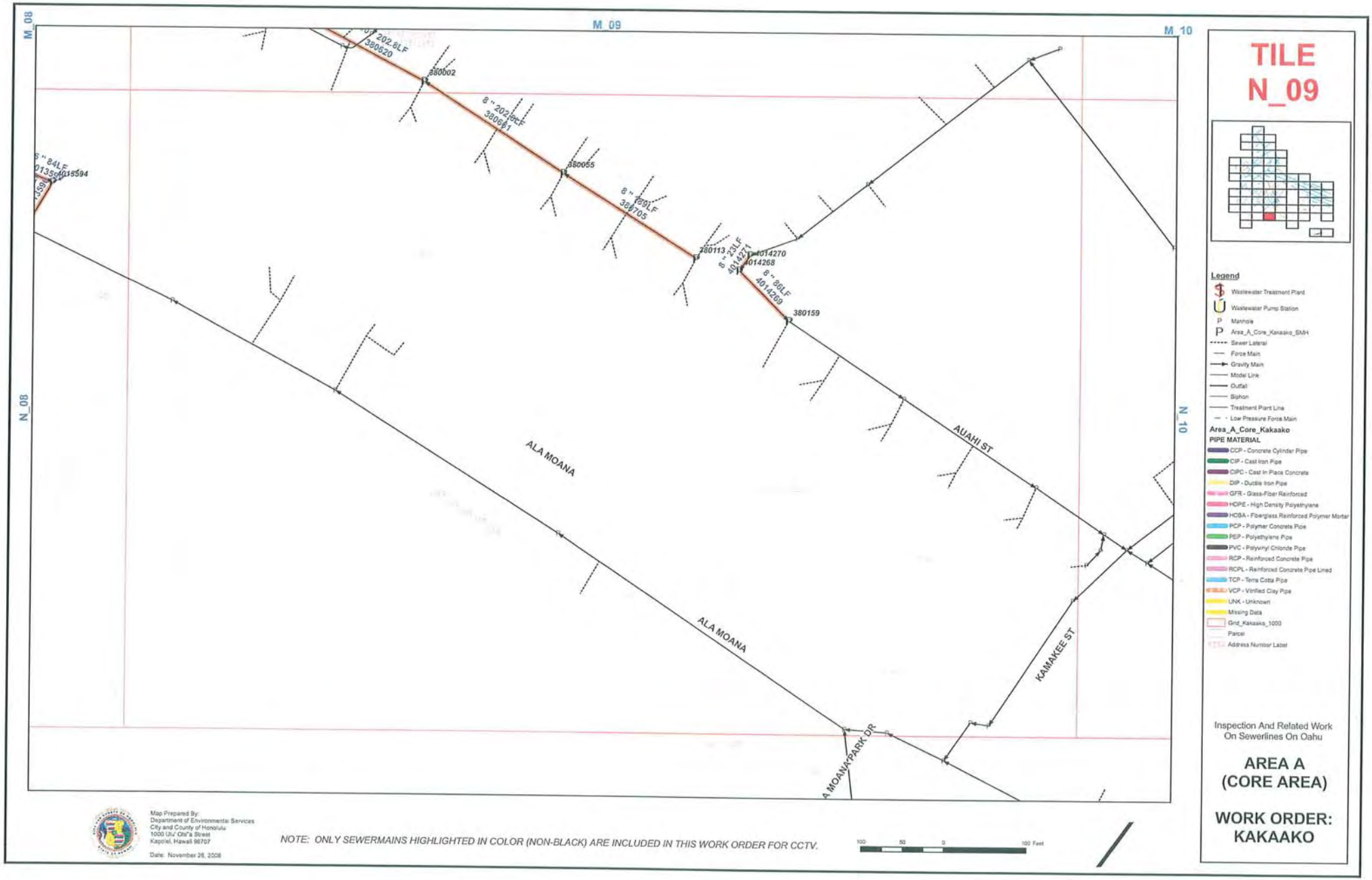
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet


M_07
M_08
M_09
N_07
O_07
60_N
KOULA ST
AHUI ST
WARD AVE
ALA MOANA
ILALO ST
4029321
8 " 181LF
4029324
4029323
4026619
12 " 80LF
4026628
4026627
12 " 220.67LF
4026630
4026629
8 " 270LF
379576
4013598 6 " 84LF
4013599
4013594
6 " 69LF
4013596
TILE
N_08
Legend
Wastewater Treatment Plant
Wastewater Pump Station
Manhole
Area_A_Core_Kakaako_SMH
Sewer Lateral
Force Main
Gravity Main
Model Link
Outfall
Siphon
Treatment Plant Line
Low Pressure Force Main
Area_A_Core_Kakaako
PIPE MATERIAL
CCP - Concrete Cylinder Pipe
CIP - Cast Iron Pipe
CIPC - Cast In Place Concrete
DIP - Ductile Iron Pipe
GFR - Glass-Fiber Reinforced
HDPE - High Density Polyethylene
HOBA - Fiberglass Reinforced Polymer Mortar
PCP - Polymer Concrete Pipe
PEP - Polyethylene Pipe
PVC - Polyvinyl Chloride Pipe
RCP - Reinforced Concrete Pipe
RCPL - Reinforced Concrete Pipe Lined
TCP - Terra Cotta Pipe
VCP - Vitrified Clay Pipe
UNK - Unknown
Missing Data
Grid_Kakaako_1000
Parcel
Address Number Label
Inspection And Related Work
On Sewerlines On Oahu
AREA A
(CORE AREA)
WORK ORDER:
KAKAAKO
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707
Date: November 26, 2008
NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.
100 50 0 100 Feet



TILE N_09

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HDSA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

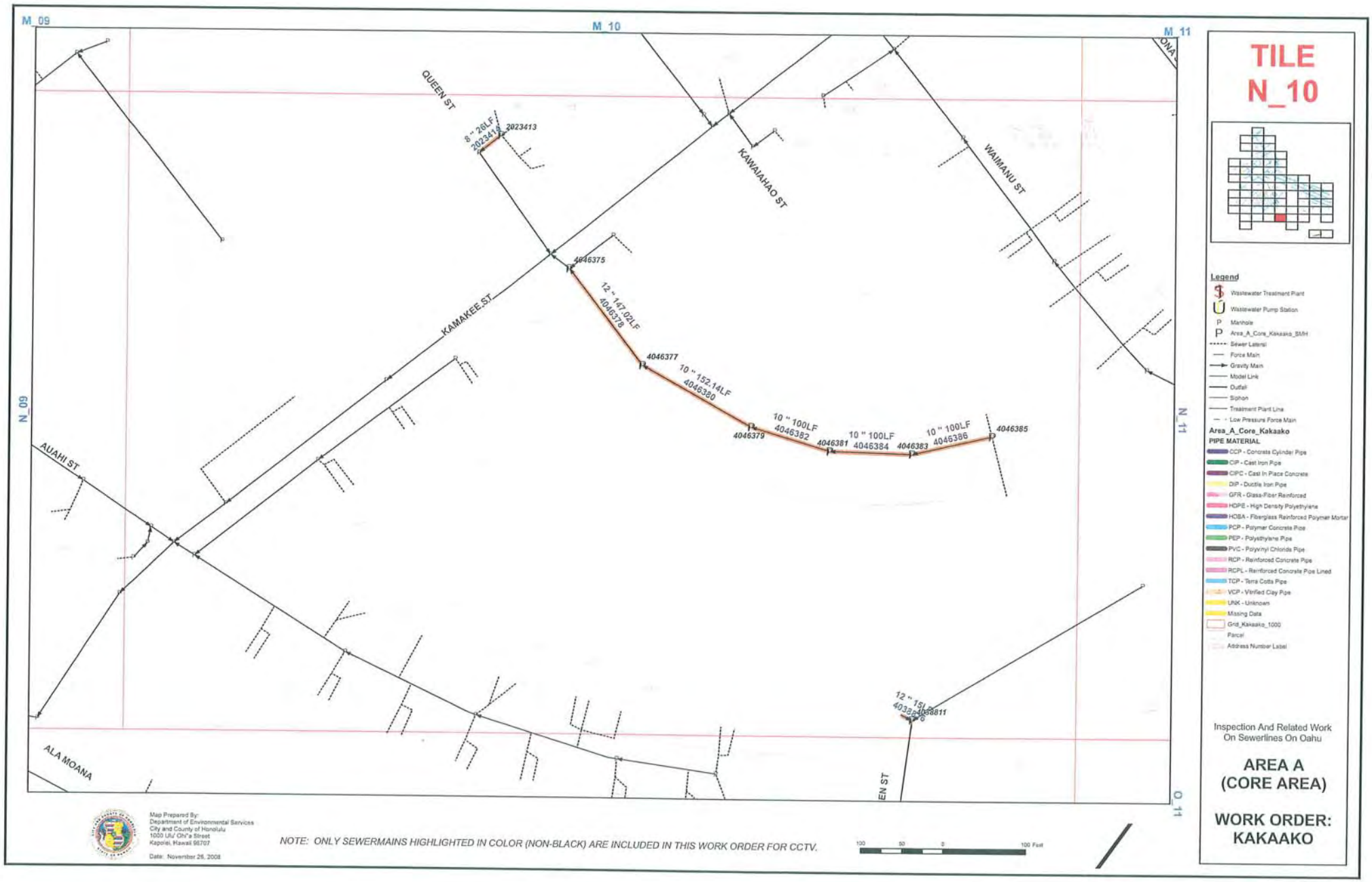
WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet



TILE N_10

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

AREA A (CORE AREA)

WORK ORDER: KAKAAKO

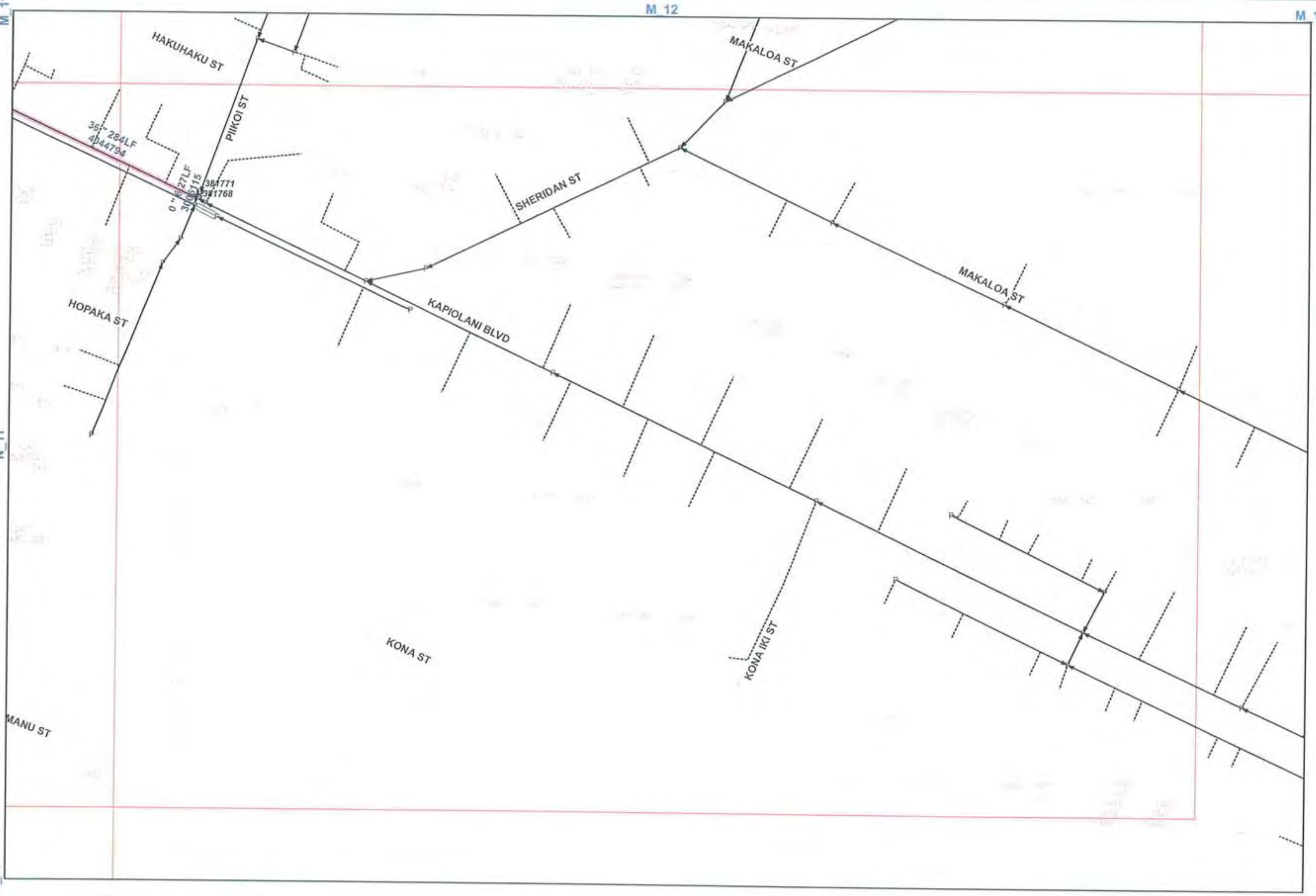
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uhi' Uhi'a Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet


M_10
M_11
M_12
N_10
N_12
O_11
HOPAKA ST
PENSACOLA ST
KONA ST
WAIMANU ST
PIIKOI ST
HAKUHAKU ST
KAPIOLANI BLVD
36 " 284LF
383568
4044793
4046385
TILE
N_11
Legend
Wastewater Treatment Plant
Wastewater Pump Station
Manhole
Area_A_Core_Kakaako_SMH
Sewer Lateral
Force Main
Gravity Main
Model Link
Outfall
Siphon
Treatment Plant Line
Low Pressure Force Main
Area_A_Core_Kakaako
PIPE MATERIAL
CCP - Concrete Cylinder Pipe
CIP - Cast Iron Pipe
CIPC - Cast In Place Concrete
DIP - Ductile Iron Pipe
GFR - Glass-Fiber Reinforced
HDPE - High Density Polyethylene
HOBA - Fiberglass Reinforced Polymer Mortar
PCP - Polymer Concrete Pipe
PEP - Polyethylene Pipe
PVC - Polyvinyl Chloride Pipe
RCP - Reinforced Concrete Pipe
RCPL - Reinforced Concrete Pipe Lined
TCP - Terra Cotta Pipe
VCP - Vitrified Clay Pipe
UNK - Unknown
Missing Data
Grid_Kakaako_1000
Parcel
Address Number Label
Inspection And Related Work
On Sewerlines On Oahu
AREA A
(CORE AREA)
WORK ORDER:
KAKAAKO
Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707
Date: November 26, 2008
NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.
100 50 0 100 Feet



TILE N_12

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako

PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- GFR - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work On Sewerlines On Oahu

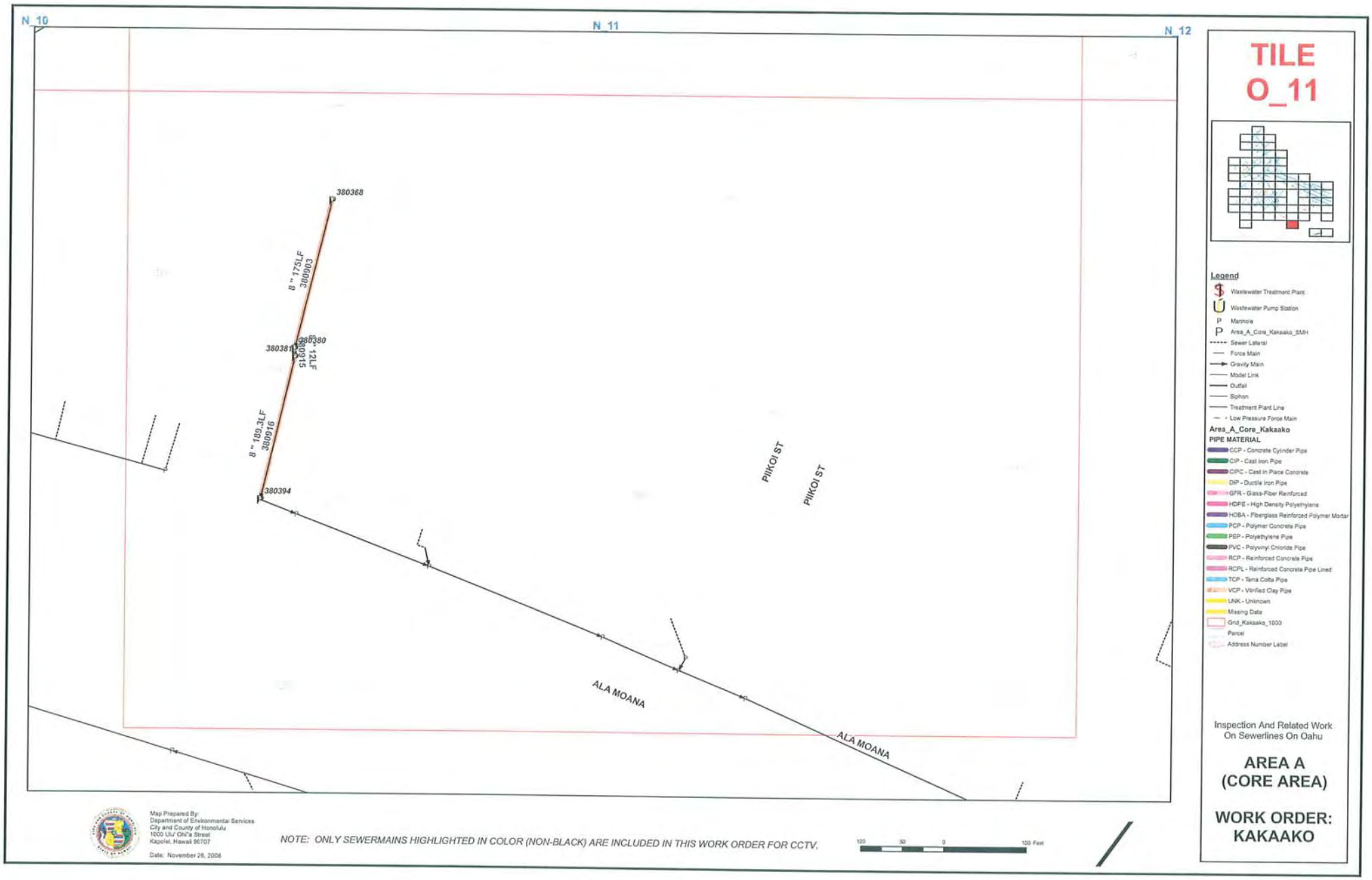
AREA A (CORE AREA)

WORK ORDER: KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Ulu' Ohi'a Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.



TILE O_11

Legend

- Wastewater Treatment Plant
- Wastewater Pump Station
- Manhole
- Area_A_Core_Kakaako_SMH
- Sewer Lateral
- Force Main
- Gravity Main
- Model Link
- Outfall
- Siphon
- Treatment Plant Line
- Low Pressure Force Main

Area_A_Core_Kakaako
PIPE MATERIAL

- CCP - Concrete Cylinder Pipe
- CIP - Cast Iron Pipe
- CIPC - Cast In Place Concrete
- DIP - Ductile Iron Pipe
- FRP - Glass-Fiber Reinforced
- HDPE - High Density Polyethylene
- HOBA - Fiberglass Reinforced Polymer Mortar
- PCP - Polymer Concrete Pipe
- PEP - Polyethylene Pipe
- PVC - Polyvinyl Chloride Pipe
- RCP - Reinforced Concrete Pipe
- RCPL - Reinforced Concrete Pipe Lined
- TCP - Terra Cotta Pipe
- VCP - Vitrified Clay Pipe
- UNK - Unknown
- Missing Data
- Grid_Kakaako_1000
- Parcel
- Address Number Label

Inspection And Related Work
On Sewerlines On Oahu

AREA A
(CORE AREA)

WORK ORDER:
KAKAAKO

Map Prepared By:
Department of Environmental Services
City and County of Honolulu
1000 Uluʻ Ohiʻa Street
Kapolei, Hawaii 96707

Date: November 26, 2008

NOTE: ONLY SEWERMAINS HIGHLIGHTED IN COLOR (NON-BLACK) ARE INCLUDED IN THIS WORK ORDER FOR CCTV.

100 50 0 100 Feet

APPENDIX F

SEWER CCTV INSPECTION REPORT FOR PORTION OF QUEEN AND SOUTH STREETS AND WARD AVENUE

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DVD DISK KAKAAKO 01

CCTV Inspection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/12/2009	2:48 PM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
341052	341119	Kakaako Mauka

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			161	160	6		Kakaako 01

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/21/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						45							45%.
21.9	DA	GS					5		3	9			2	5%.
26.0	TF	A			8				12					
160.0	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

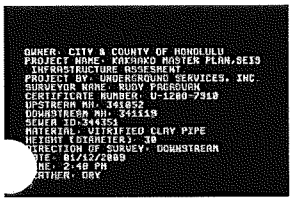
CCTV Inspection Report

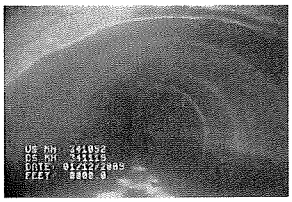
Legend:
Direction
Flow
Camera Travel

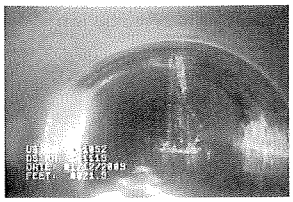
Project By:	Underground Services, inc.		
Upstream Manhole Number:	341052	**Downstream Manhole Number:**	341119
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka
Sewer ID:	344351		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 01	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/12/2009	**Height:**	30
Time:	2:48 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	161
Year Rehabilitated:		Length Surveyed:	160
QC By:	Colin James	Certificate Number:	U-1108-7739

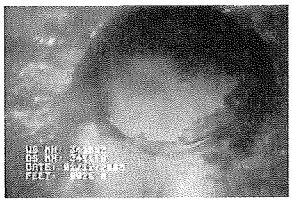
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/21/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		45%.
21.9	DAGS	Deposits Attached: Grease	3 to 9	5%.
26.0	TFA	Tap, Factory Made: Active	12	
160.0	AMH	Access Point - Manhole		Ending Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/16/2009	9:28 AM	South Street	Honolulu / Downtown

Upstream Manhole Number	Downstream Manhole Number	Further Location details
341119	3010716	Kakaako Mauka

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				170.1	6		Kakaako 01

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/21/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						45							45%.
126.0	TB	A			8				3					
134.7	DA	E					0		9	3			2	
144.9	MWL						35							35%.
170.1	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

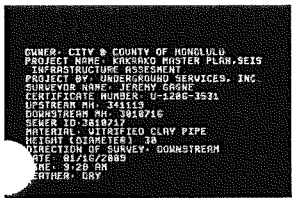
CCTV Inspection Report

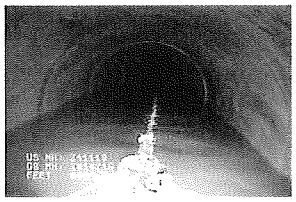
Legend:
Direction
Flow
Camera Travel

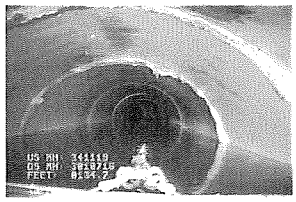
Project By:	Underground Services, inc.		
Upstream Manhole Number:	341119	**Downstream Manhole Number:**	3010716
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka
Sewer ID:	3010717		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 01	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	9:28 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	
Year Rehabilitated:		Length Surveyed:	170.1
QC By:	Colin James	Certificate Number:	U-1108-7739

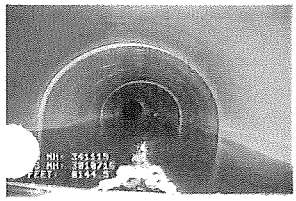
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/21/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		45%.
126.0	TBA	Tap, Break-in / Hammer: Active	3	
134.7	DAE	Deposits Attached: Encrustation	9 to 3	
144.9	MWL	Water Level		35%.

CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	341119	**Downstream Manhole Number:**	3010716
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka
Sewer ID:	3010717		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 01	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	9:28 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	
Year Rehabilitated:		Length Surveyed:	170.1
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/21/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.

Ftg.	Code	Description	Position	Comment
170.1	AMH	Access Point - Manhole		Ending Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/16/2009	11:14 AM	South Street	Honolulu / Downtown

Upstream Manhole Number	Downstream Manhole Number	Further Location details
683866	683904	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			275	266.9	6		Kakaako 01

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/22/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Infiltration dripper. Crack.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						45							45%.
56.3	TB	A			8				3					
85.1	TB	A			8				9					
169.7	ID								11				3	
173.3	CL							J	12			2		
266.9	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	2	0	0	0	2	2100	2.0	0	0	3	0	0	3	3100	3.0	0	2	3	0	0	5	3121	2.5

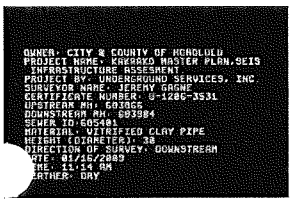
CCTV Inspection Report

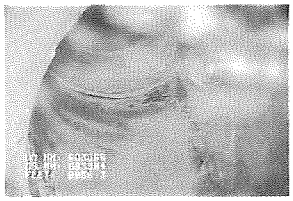
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	683866	**Downstream Manhole Number:**	683904
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	685401		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 01	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	11:14 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	275
Year Rehabilitated:		Length Surveyed:	266.9
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Infiltration dripper. Crack.





Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		45%.
56.3	TBA	Tap, Break-in / Hammer: Active	3	
85.1	TBA	Tap, Break-in / Hammer: Active	9	
169.7	ID	Infiltration - Dripper	11	

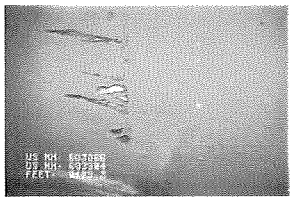
CCTV Inspection Report

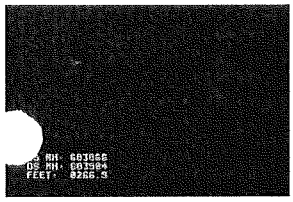
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	683866	**Downstream Manhole Number:**	683904
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	685401		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 01	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	11:14 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	275
Year Rehabilitated:		Length Surveyed:	266.9
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Infiltration dripper. Crack.





Ftg.	Code	Description	Position	Comment
173.3	CL	Crack Longitudinal	12	
266.9	AMH	Access Point - Manhole		Ending Manhole.

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DVD DISK KAKAAKO 02

CCTV Ir. ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/16/2009	9:52 AM	South Street	Honolulu / Downtown

Upstream Manhole Number	Downstream Manhole Number	Further Location details
3010716	685353	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				245.5	6		Kakaako 02

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/22/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Couldn't reach downstream manhole 683760. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						40							40%.
37.7	TB				8				12					
42.4	TB				6				3					
149.8	TF				6				12					
210.6	DA	E					0		11	3			2	0%.
245.5	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

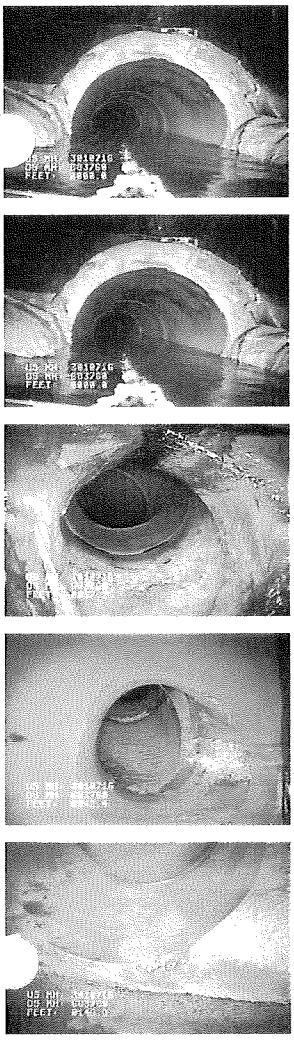
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	3010716	**Downstream Manhole Number:**	685353
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	3010718		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 02	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	9:52 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	
Year Rehabilitated:		Length Surveyed:	245.5
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Couldn't reach downstream manhole 683760. Deposits.



Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		40%.
37.7	TB	Tap, Break-in / Hammer	12	
42.4	TB	Tap, Break-in / Hammer	3	
149.8	TF	Tap, Factory Made	12	

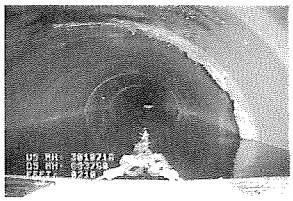
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	3010716	**Downstream Manhole Number:**	685353
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	3010718		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 02	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	9:52 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	
Year Rehabilitated:		Length Surveyed:	245.5
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Couldn't reach downstream manhole 683760. Deposits.



Ftg.	Code	Description	Position	Comment
210.6	DAE	Deposits Attached: Encrustation	11 to 3	0%.
245.5	AMH	Access Point - Manhole		Ending Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/12/2009	1:34 PM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
4025660	341052	Kakaako Mauka Aera SEISIP

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			127	128.8	6		Kakaako 02

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/22/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Material on video should say "not known". Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						45							45%.
19.8	TF				8				3					
81.1	DA	GS					5		3				2	5%.
86.4	TF	A			8				12					
110.2	TF				8				3					
128.8	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

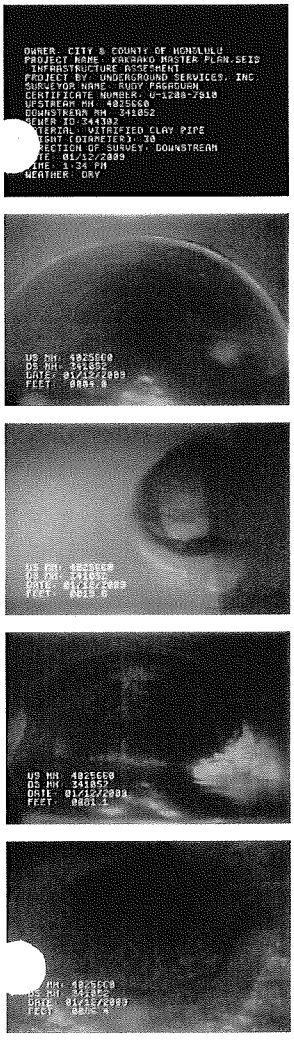
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	4025660	**Downstream Manhole Number:**	341052
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka Aera SEISIP
Sewer ID:	344302		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 02	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/12/2009	**Height:**	30
Time:	1:34 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	127
Year Rehabilitated:		Length Surveyed:	128.8
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Material on video should say "not known". Deposits.



Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		45%.
19.8	TF	Tap, Factory Made	3	
81.1	DAGS	Deposits Attached: Grease	3	5%.
86.4	TFA	Tap, Factory Made: Active	12	

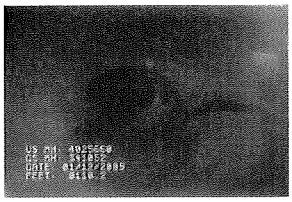
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	4025660	**Downstream Manhole Number:**	341052
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka Aera SEISIP
Sewer ID:	344302		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 02	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/12/2009	**Height:**	30
Time:	1:34 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	127
Year Rehabilitated:		Length Surveyed:	128.8
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Material on video should say "not known". Deposits.



Ftg.	Code	Description	Position	Comment
110.2	TF	Tap, Factory Made	3	
128.8	AMH	Access Point - Manhole		Ending Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/12/2009	1:18 PM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
4025661	4025660	Kakaako Mauka Aera SEISIP

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		36

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	Not known	CP		78.32	79	5		Kakaako 02

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/22/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Material on video should say "not known". Point repair. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						30							30%.
30.2	RPZ								1					
47.5	DA	Z					0		4				2	0%.
79.0	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

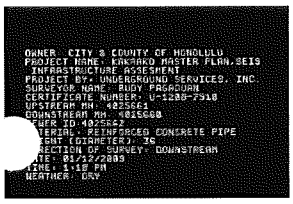
CCTV Inspection Report

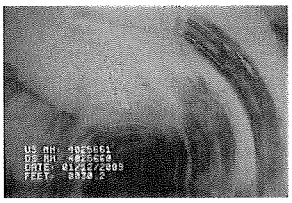
Legend:
Direction
Flow
Camera Travel

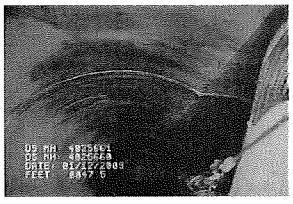
Project By:	Underground Services, inc.		
Upstream Manhole Number:	4025661	**Downstream Manhole Number:**	4025660
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka Aera SEISIP
Sewer ID:			
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Not known	Ln. Method:	Cured in place
Tape / Media Number:	Kakaako 02	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/12/2009	**Height:**	36
Time:	1:18 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	5	Total Length:	78.32
Year Rehabilitated:		Length Surveyed:	79
QC By:	Colin James	Certificate Number:	U-1108-7739

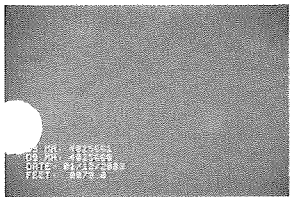
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: Material on video should say "not known". Point repair. Deposits.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		30%.
30.2	RPZ	Point Repair - Other	1	
47.5	DAZ	Deposits Attached: Other	4	0%.
79.0	AMH	Access Point - Manhole		Ending Manhole.

CCTV In[illegible]ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/12/2009	11:29 AM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
4025663	4025661	Kakaako Mauka Aera SEISIP

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		36

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	Not known	CP		286.62	281.1	5		Kakaako 02

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/22/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						30							30%.
12.0	DA	Z	S01				0		4	8			2	0%.
276.3	DA	Z	F01				0		4	8			2	0%.
281.1	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	132	0	0	0	132	2L00	2.0	0	132	0	0	0	132	2L00	2.0

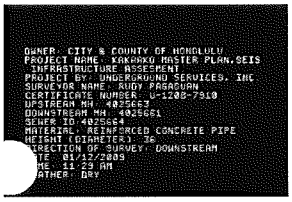
CCTV Inspection Report

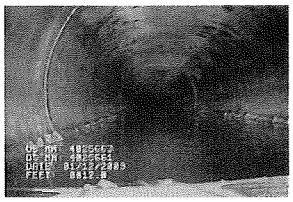
Legend:
Direction
Flow
Camera Travel

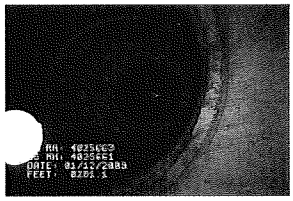
Project By:	Underground Services, inc.		
Upstream Manhole Number:	4025663	**Downstream Manhole Number:**	4025661
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	Kakaako Mauka Aera SEISIP
Sewer ID:	4025664		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Not known	Ln. Method:	Cured in place
Tape / Media Number:	Kakaako 02	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/12/2009	**Height:**	36
Time:	11:29 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	5	Total Length:	286.62
Year Rehabilitated:		Length Surveyed:	281.1
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/22/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.







Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		30%.
12.0	DAZ	Deposits Attached: Other	4 to 8	0%.
276.3	DAZ	Deposits Attached: Other	4 to 8	0%.
281.1	AMH	Access Point - Manhole		Ending Manhole.

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DVD DISK KAKAAKO 03

CCTV Inspection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/22/2009	9:44 AM	Ward Avenue	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	345149

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	167.9	4		Kakaako 03

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/29/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						20							20%.
4.0	DA	GS	S01				0		5	7			2	0%.
23.6	FM							J	9	3		4		
25.4	FM							J	7	5		4		
25.9	ID							J	12				3	
27.3	FC								12	5		2		
35.4	DA	GS	F01				0		5	7			2	0%.
36.5	DA	GS	S02				0		5	7			2	0%.
40.4	TF	A			8				12					
46.7	DA	GS	F02				0		5	7			2	0%.
47.3	DA	GS	S03				0		5	1			2	0%.
56.0	FL								3			3		
56.7	FC							J	12	12		2		
61.9	MWL						30							30%.
73.8	VC												1	
75.5	MWL						20							20%.
79.9	MWL						30							30%.
82.6	MWL						35							35%.
90.7	MWL						20							20%.
118.3	MWL						10							10%.
119.9	FC							J	8	4		2		
130.1	MWL						25							25%.
136.7	TB				8				12					

CCTV Inspection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		2

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/22/2009	9:44 AM	Ward Avenue	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	345149

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	167.9	4		Kakaako 03

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/29/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
140.1	FM							J	8	4		4		
149.6	MWL						35							35%.
150.2	FC							J	7	3		2		
167.0	MCU												4	
167.9	MSA													Unable to continue due to camera being underwater.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	8	3	12	0	23	4331	2.9	1	24	3	4	0	32	4131	2.1	1	32	6	16	0	55	4432	2.4

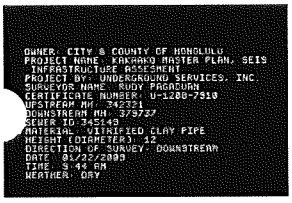
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	345149
Sewer ID:	345149		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/22/2009	**Height:**	12
Time:	9:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	167.9
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/29/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.



Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		20%.
4.0	DAGS	Deposits Attached: Grease	5 to 7	0%.
23.6	FM	Fracture Multiple	9 to 3	
25.4	FM	Fracture Multiple	7 to 5	

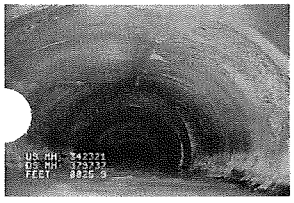
CCTV Inspection Report

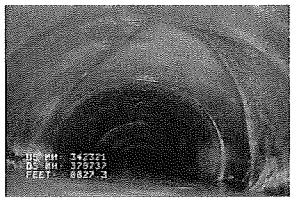
Legend:
Direction
Flow
Camera Travel

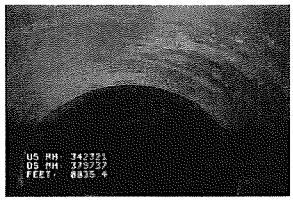
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	345149
Sewer ID:	345149		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/22/2009	**Height:**	12
Time:	9:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	167.9
QC By:	Colin James	Certificate Number:	U-1108-7739

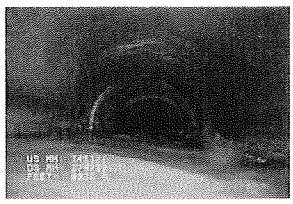
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/29/2009

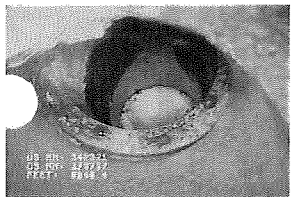
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.











Ftg.	Code	Description	Position	Comment
25.9	ID	Infiltration - Dripper	12	
27.3	FC	Fracture Circumferential	12 to 5	
35.4	DAGS	Deposits Attached: Grease	5 to 7	0%.
36.5	DAGS	Deposits Attached: Grease	5 to 7	0%.
40.4	TFA	Tap, Factory Made: Active	12	

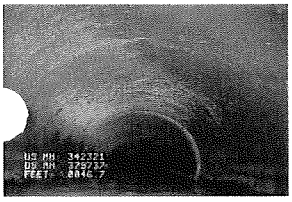
CCTV Inspection Report

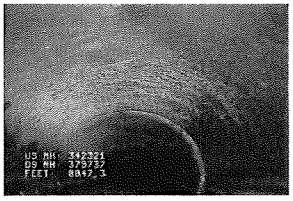
Legend:
Direction
Flow
Camera Travel

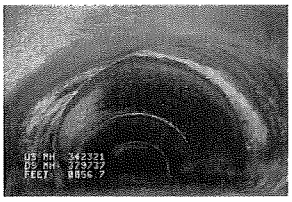
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	345149
Sewer ID:	345149		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/22/2009	**Height:**	12
Time:	9:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	167.9
QC By:	Colin James	Certificate Number:	U-1108-7739

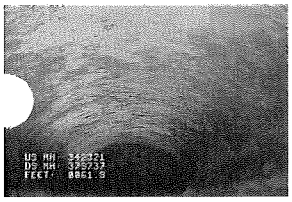
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/29/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.









Ftg.	Code	Description	Position	Comment
46.7	DAGS	Deposits Attached: Grease	5 to 7	0%.
47.3	DAGS	Deposits Attached: Grease	5 to 1	0%.
56.0	FL	Fracture Longitudinal	3	
56.7	FC	Fracture Circumferential	12 to 12	
61.9	MWL	Water Level		30%.

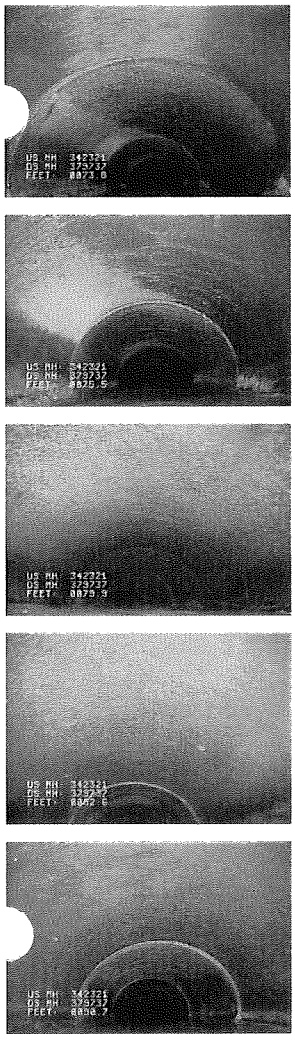
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	345149
Sewer ID:	345149		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/22/2009	**Height:**	12
Time:	9:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	167.9
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/29/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.



Ftg.	Code	Description	Position	Comment
73.8	VC	Vermin - Cockroach		
75.5	MWL	Water Level		20%.
79.9	MWL	Water Level		30%.
82.6	MWL	Water Level		35%.
90.7	MWL	Water Level		20%.

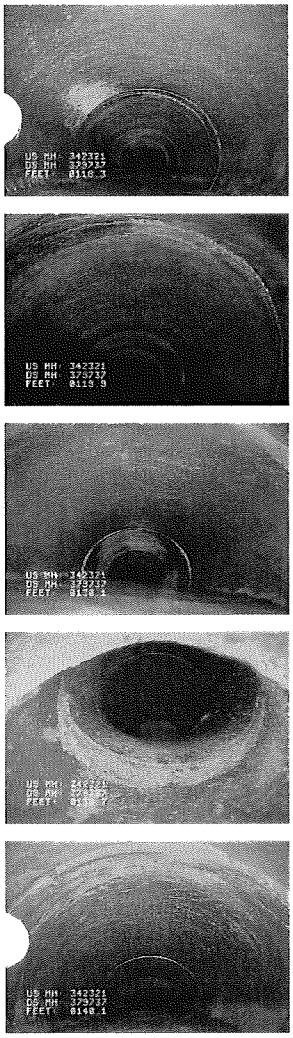
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	345149
Sewer ID:	345149		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/22/2009	**Height:**	12
Time:	9:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	167.9
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/29/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.



Ftg.	Code	Description	Position	Comment
118.3	MWL	Water Level		10%.
119.9	FC	Fracture Circumferential	8 to 4	
130.1	MWL	Water Level		25%.
136.7	TB	Tap, Break-in / Hammer	12	
140.1	FM	Fracture Multiple	8 to 4	

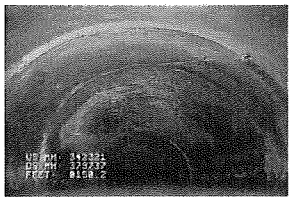
CCTV Inspection Report

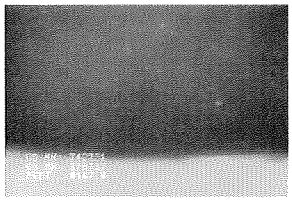
Legend:
Direction
Flow
Camera Travel

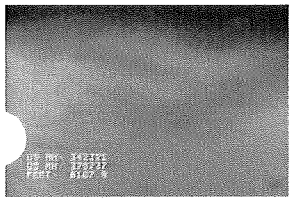
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	345149
Sewer ID:	345149		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/22/2009	**Height:**	12
Time:	9:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	167.9
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/29/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 167.9' - unable to continue due to camera being under water. Deposits. Fractures. Infiltration.







Ftg.	Code	Description	Position	Comment
149.6	MWL	Water Level		35%.
150.2	FC	Fracture Circumferential	7 to 3	
167.0	MCU	Camera Underwater		
167.9	MSA	Survey Abandoned		Unable to continue due to camera being underwater.

CCTV Inspection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/16/2009	10:43 AM	South Street	Honolulu / Downtown

Upstream Manhole Number	Downstream Manhole Number	Further Location details
683801	683866	685365

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			253	250.6	6		Kakaako 03

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/27/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Pipe okay.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						45							45%.
21.7	TB				6				10					
87.5	TB				6				2					
250.6	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	0	0	0	0	0	0000		0	0	0	0	0	0	0000	

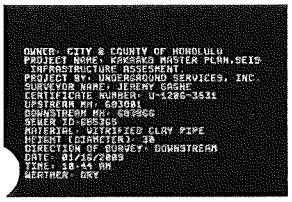
CCTV Inspection Report

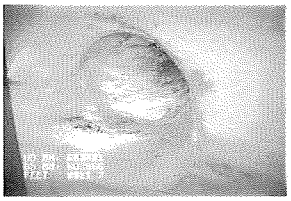
Legend:
Direction
Flow
Camera Travel

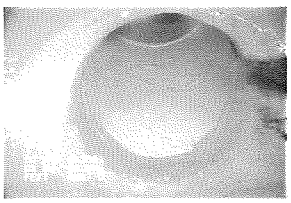
Project By:	Underground Services, inc.		
Upstream Manhole Number:	683801	**Downstream Manhole Number:**	683866
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu / Downtown	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	685365
Sewer ID:	685365		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/16/2009	**Height:**	30
Time:	10:43 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	253
Year Rehabilitated:		Length Surveyed:	250.6
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/27/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Pipe okay.







Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		45%.
21.7	TB	Tap, Break-in / Hammer	10	
87.5	TB	Tap, Break-in / Hammer	2	
250.6	AMH	Access Point - Manhole		Ending Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/26/2009	12:29 PM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
683904	683933	685428

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		30

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			295	296.1	6		Kakaako 03

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/30/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits. Fracture. Infiltration dripper.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						50							50%.
33.2	DA	GS	S01				0		9	3			2	0%.
69.2	TF	D			10				9				2	Fracture in the tap and a runner infiltration.
84.1	FL							J	11			3		
86.8	IR								12				4	
117.1	TF				10				3					
198.4	ID								12				3	
281.8	ID							J	12				3	
296.0	DA	GS	F01				0		9	3			2	0%.
296.1	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	3	0	0	3	3100	3.0	0	134	6	4	0	144	4132	2.1	0	134	9	4	0	147	4133	2.1

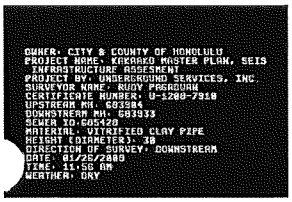
CCTV Inspection Report

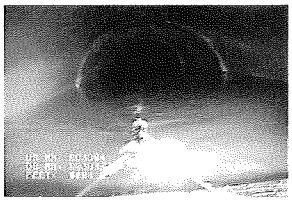
Legend:
Direction
Flow
Camera Travel

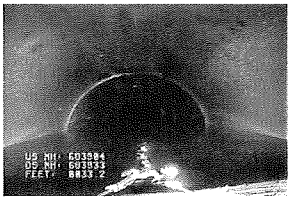
Project By:	Underground Services, inc.		
Upstream Manhole Number:	683904	**Downstream Manhole Number:**	683933
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	685428
Sewer ID:	685428		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/26/2009	**Height:**	30
Time:	12:29 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	295
Year Rehabilitated:		Length Surveyed:	296.1
QC By:	Colin James	Certificate Number:	U-1108-7739

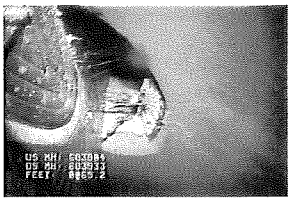
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/30/2009

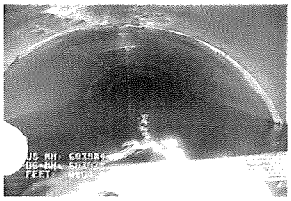
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits. Fracture. Infiltration dripper.











Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		50%.
33.2	DAGS	Deposits Attached: Grease	9 to 3	0%.
69.2	TFD	Tap, Factory Made: Defective	9	Fracture in the tap and a runner infiltration.
84.1	FL	Fracture Longitudinal	11	

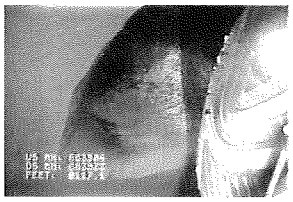
CCTV Inspection Report

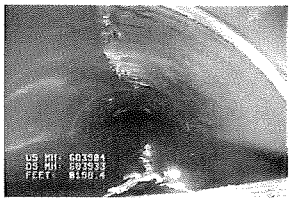
Legend:
Direction
Flow
Camera Travel

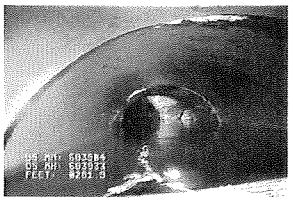
Project By:	Underground Services, inc.		
Upstream Manhole Number:	683904	**Downstream Manhole Number:**	683933
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	685428
Sewer ID:	685428		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/26/2009	**Height:**	30
Time:	12:29 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	295
Year Rehabilitated:		Length Surveyed:	296.1
QC By:	Colin James	Certificate Number:	U-1108-7739

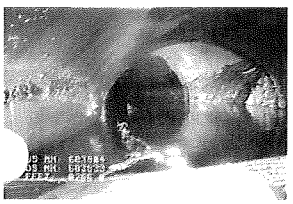
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/30/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits. Fracture. Infiltration dripper.









Ftg.	Code	Description	Position	Comment
86.8	IR	Infiltration - Runner	12	
117.1	TF	Tap, Factory Made	3	
198.4	ID	Infiltration - Dripper	12	
281.8	ID	Infiltration - Dripper	12	
296.0	DAGS	Deposits Attached: Grease	9 to 3	0%.

CCTV Inspection Report

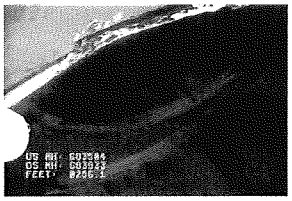
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	683904	**Downstream Manhole Number:**	683933
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	685428
Sewer ID:	685428		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 03	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/26/2009	**Height:**	30
Time:	12:29 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	295
Year Rehabilitated:		Length Surveyed:	296.1
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/30/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits. Fracture. Infiltration dripper.

Ftg.	Code	Description	Position	Comment
296.1	AMH	Access Point - Manhole		Ending Manhole.



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DVD DISK KAKAAKO 04

CCTV Inspection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/26/2009	11:34 AM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
683933	4025642	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		36

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	Not known	CP		39.2	38.8	5		Kakaako 04

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/30/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Crack.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						50							50%.
32.6	CC							J	12	12		1		
38.8	AMH													Ending Manhole.

Segment	Structural								O & M								Overall							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	1	0	0	0	0	1	1100	1.0	0	0	0	0	0	0	0000		1	0	0	0	0	1	1100	1.0

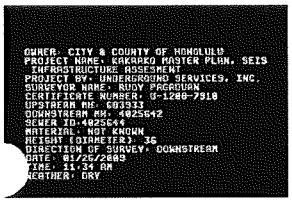
CCTV Inspection Report

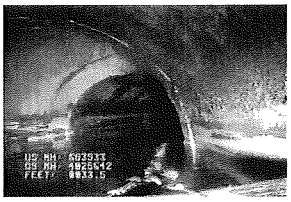
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	683933	**Downstream Manhole Number:**	4025642
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	4025644		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Not known	Ln. Method:	Cured in place
Tape / Media Number:	Kakaako 04	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/26/2009	**Height:**	36
Time:	11:34 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	5	Total Length:	39.2
Year Rehabilitated:		Length Surveyed:	38.8
QC By:	Colin James	Certificate Number:	U-1108-7739

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/30/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Crack.





Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		50%.
32.6	CC	Crack Circumferential	12 to 12	
38.8	AMH	Access Point - Manhole		Ending Manhole.

CCTV Inspection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Rudy Pagaduan	U-1208-7910	City & County of Honolulu	AECOM		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		01/26/2009	9:53 AM	South Street	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
4025642	4025640	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
							Downstream		36

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	Not known	CP		261	246	5		Kakaako 04

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		No Pre-Cleaning		Dry	Colin James	U-1108-7739

QC Date	Additional Information
1/30/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						50							50%.
15.6	DA	GS	S01				0		9	3			2	0%.
246.0	DA	GS	F01				0		9	3			2	0%
246.0	AMH													~10' from the ending manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	116	0	0	0	116	2J00	2.0	0	116	0	0	0	116	2J00	2.0

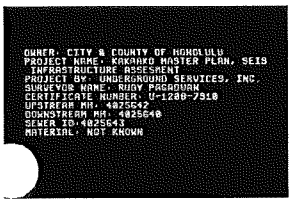
CCTV Inspection Report

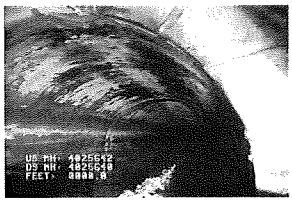
Legend:
Direction
Flow
Camera Travel

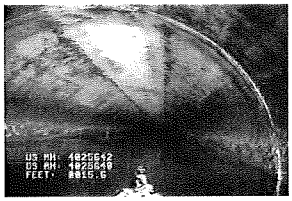
Project By:	Underground Services, inc.		
Upstream Manhole Number:	4025642	**Downstream Manhole Number:**	4025640
Surveyor's Name:	Rudy Pagaduan	**Certificate Number:**	U-1208-7910
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:		P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	South Street
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	4025643		
Use of Sewer:		Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Not known	Ln. Method:	Cured in place
Tape / Media Number:	Kakaako 04	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	No Pre-Cleaning	Weather:	Dry
Date:	01/26/2009	**Height:**	36
Time:	9:53 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	5	Total Length:	261
Year Rehabilitated:		Length Surveyed:	246
QC By:	Colin James	Certificate Number:	U-1108-7739

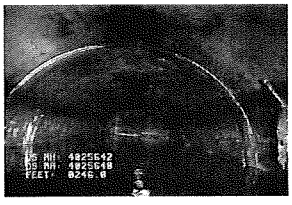
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	1/30/2009

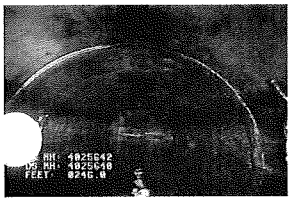
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Deposits.











Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		50%.
15.6	DAGS	Deposits Attached: Grease	9 to 3	0%.
246.0	DAGS	Deposits Attached: Grease	9 to 3	0%
246.0	AMH	Access Point - Manhole		~10' from the ending manhole.

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DVD DISK KAKAAKO 05

CCTV In[illegible]ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/19/2009	11:28 PM	Ward Avenue	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342231	342244	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			41	4.1	6		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Few cracks.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.2	MWL						35							35%
0.2	VC												1	
0.4	CM								10	2		3		
4.1	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	3	0	0	3	3100	3.0	1	0	0	0	0	1	1100	1.0	1	0	3	0	0	4	3111	2.0

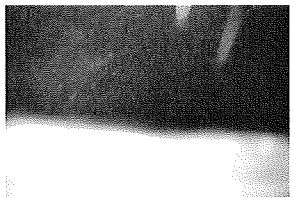
CCTV Inspection Report

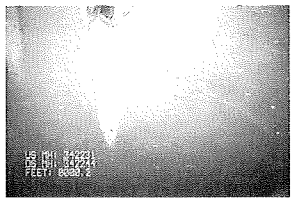
Legend:
Direction
Flow
Camera Travel

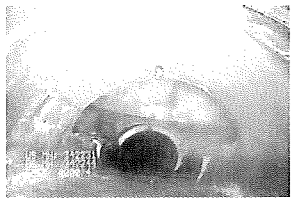
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342231	**Downstream Manhole Number:**	342244
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward Avenue
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345085		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	11:28 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	41
Year Rehabilitated:		Length Surveyed:	4.1
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

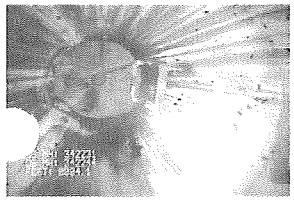
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Few cracks.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.2	MWL	Water Level		35%
0.2	VC	Vermin - Cockroach		
0.4	CM	Crack Multiple	10 to 2	
4.1	AMH	Access Point - Manhole		Ending Manhole.

CCTV In. ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/19/2009	9:52 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342244	342321	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			239.76	228	6		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Couple of infiltrations. Few cracks.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						25							25%
4.0	DA	GS	S01				0		8	4			2	0%
20.0	CM							J	12	12		3		
30.5	VC												1	
105.1	ID							J	12				3	
121.3	TF	C			8				9					
124.0	TB	D			6				2				3	
124.0	ID								2				3	
163.6	CC							J	12	6		1		
172.1	TF	C			6				9					
225.4	DA	GS	F01				0		8	4			2	0%
228.0	AMH													Ending Manhole.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	1	0	3	0	0	4	3111	2.0	1	110	9	0	0	120	332J	2.0	2	110	12	0	0	124	342J	2.0

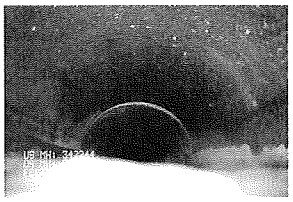
CCTV Inspection Report

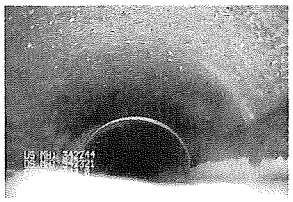
Legend:
Direction
Flow
Camera Travel

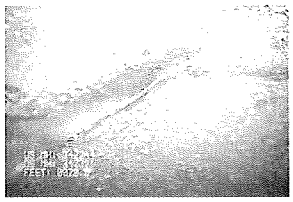
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342244	**Downstream Manhole Number:**	342321
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345095		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	9:52 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	239.76
Year Rehabilitated:		Length Surveyed:	228
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

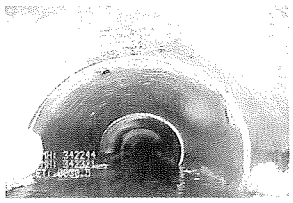
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Couple of infiltrations. Few cracks.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		25%
4.0	DAGS	Deposits Attached: Grease	8 to 4	0%
20.0	CM	Crack Multiple	12 to 12	
30.5	VC	Vermin - Cockroach		

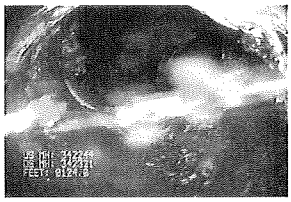
CCTV Inspection Report

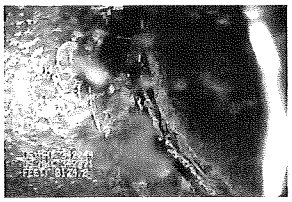
Legend:
Direction
Flow
Camera Travel

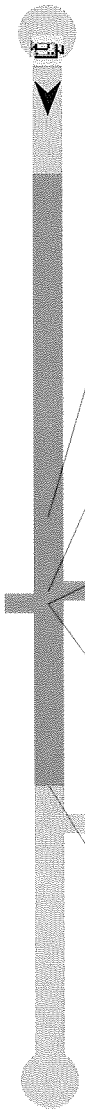
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342244	**Downstream Manhole Number:**	342321
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345095		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	9:52 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	239.76
Year Rehabilitated:		Length Surveyed:	228
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Couple of infiltrations. Few cracks.







Ftg.	Code	Description	Position	Comment
105.1	ID	Infiltration - Dripper	12	
121.3	TFC	Tap, Factory Made: Capped	9	
124.0	TBD	Tap, Break-in / Hammer: Defective	2	
124.0	ID	Infiltration - Dripper	2	
163.6	CC	Crack Circumferential	12 to 6	

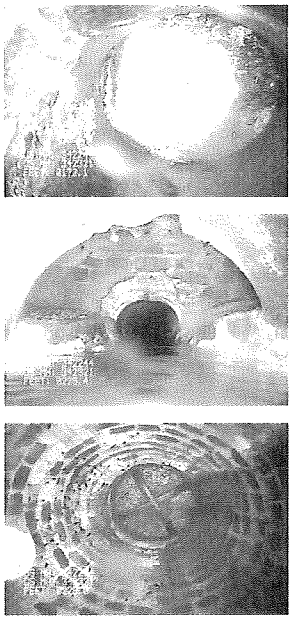
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	342244	**Downstream Manhole Number:**	342321
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345095		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	9:52 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	239.76
Year Rehabilitated:		Length Surveyed:	228
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Couple of infiltrations. Few cracks.



Ftg.	Code	Description	Position	Comment
172.1	TFC	Tap, Factory Made: Capped	9	
225.4	DAGS	Deposits Attached: Grease	8 to 4	0%
228.0	AMH	Access Point - Manhole		Ending Manhole.

CCTV In[illegible]ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/19/2009	11:45 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Upstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	8.1	4		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 8.1' - Unable to continue due to camera being underwater.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						60							60%
4.1	MCU												4	
8.1	MSA													Unable to continue due to camera being underwater.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	0	0	4	0	4	4100	4.0	0	0	0	4	0	4	4100	4.0

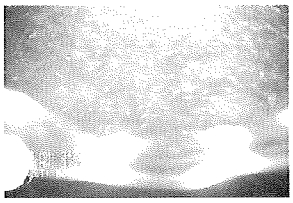
CCTV Inspection Report

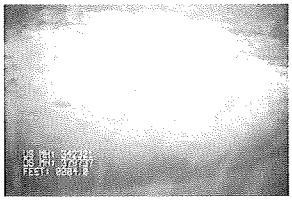
Legend:
Direction
Flow
Camera Travel

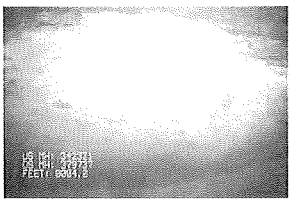
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Upstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	11:45 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	8.1
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

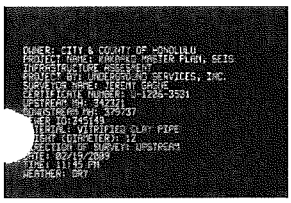
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 8.1' - Unable to continue due to camera being underwater.









Ftg.	Code	Description	Position	Comment
8.1	MSA	Survey Abandoned		Unable to continue due to camera being underwater.
4.1	MCU	Camera Underwater		
4.0	MWL	Water Level		60%
0.0	AMH	Access Point - Manhole		Starting Manhole.

CCTV In[illegible]ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/19/2009	10:59 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	174.7	4		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 174.7' - cannot pass deposits. Few fractures and cracks. Couple of infiltrations.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						25							25%
4.0	DA	GS	S01				0		4	8			2	0%
25.2	FM		S02						8	4		4		
27.3	ID							J	12				3	
29.8	FM		F02						8	4		4		
41.7	TF	A			6				12					
49.6	VC												1	
58.9	ID								11				3	
58.9	FC							J	7	2		2		
87.4	TF				6				12					
121.5	MWL						10							10%
130.0	MWL						25							25%
138.1	TB	D			6				12				3	Cracks.
142.5	CC								8	4		1		
152.3	FC							J	8	1		2		
153.2	MWL						35							35%
171.5	MWL						45							45%
174.7	MSA													Unable to pass deposits.

CCTV In. .ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	2

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/19/2009	10:59 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	174.7	4		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 174.7' - cannot pass deposits. Few fractures and cracks. Couple of infiltrations.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				

Segment	Structural								O & M								Overall							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	1	4	0	4	0	9	4122	2.3	1	2	9	0	0	12	3321	2.4	2	6	9	4	0	21	4133	2.3

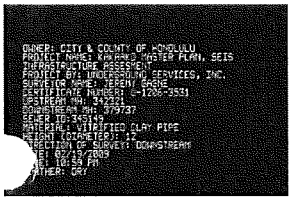
CCTV Inspection Report

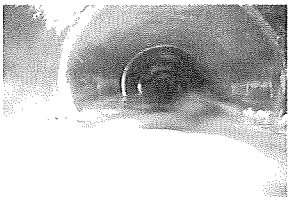
Legend:
Direction
Flow
Camera Travel

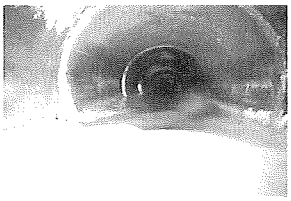
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	10:59 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	174.7
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

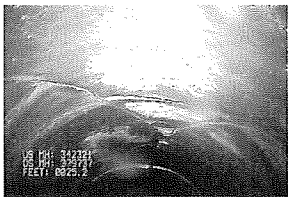
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

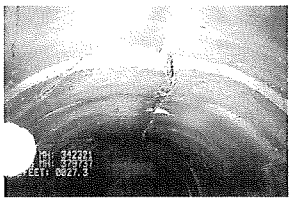
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 174.7' - cannot pass deposits. Few fractures and cracks. Couple of infiltrations.











Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		25%
4.0	DAGS	Deposits Attached: Grease	4 to 8	0%
25.2	FM	Fracture Multiple	8 to 4	
27.3	ID	Infiltration - Dripper	12	

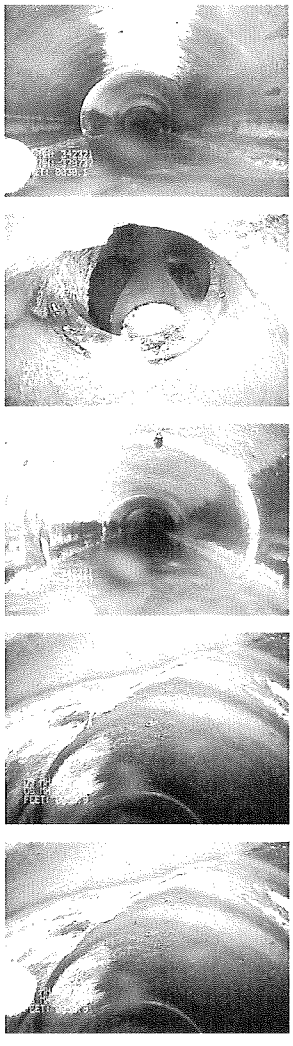
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	10:59 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	174.7
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 174.7' - cannot pass deposits. Few fractures and cracks. Couple of infiltrations.



Ftg.	Code	Description	Position	Comment
29.8	FM	Fracture Multiple	8 to 4	
41.7	TFA	Tap, Factory Made: Active	12	
49.6	VC	Vermin - Cockroach		
58.9	ID	Infiltration - Dripper	11	
58.9	FC	Fracture Circumferential	7 to 2	

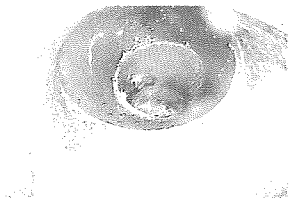
CCTV Inspection Report

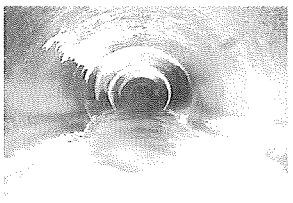
Legend:
Direction
Flow
Camera Travel

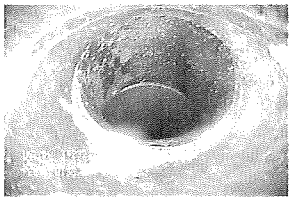
Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	10:59 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	174.7
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

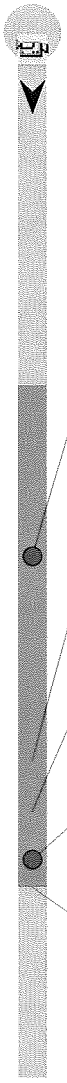
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 174.7' - cannot pass deposits. Few fractures and cracks. Couple of infiltrations.









Ftg.	Code	Description	Position	Comment
87.4	TF	Tap, Factory Made	12	
121.5	MWL	Water Level		10%
130.0	MWL	Water Level		25%
138.1	TBD	Tap, Break-in / Hammer: Defective	12	Cracks.
142.5	CC	Crack Circumferential	8 to 4	

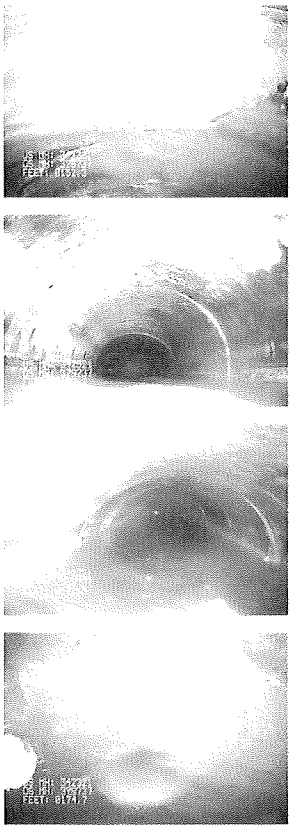
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	10:59 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	174.7
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 174.7' - cannot pass deposits. Few fractures and cracks. Couple of infiltrations.



Ftg.	Code	Description	Position	Comment
152.3	FC	Fracture Circumferential	8 to 1	
153.2	MWL	Water Level		35%
171.5	MWL	Water Level		45%
174.7	MSA	Survey Abandoned		Unable to pass deposits.

CCTV In[illegible]ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/20/2009	1:44 AM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379737	379790	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Upstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			250	49.5	4		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 49.5' - cannot continue due to heavy grease. Deposits. Cracks and a fracture. Couple of infiltrations.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						45							45%
4.1	DA	GS	S01				0		8	4			2	0%
10.3	CM								9	3		3		
18.4	TF				6				12					
30.5	IG							J	3				5	
30.5	FC								8	4		2		
49.4	IG								9				5	
49.5	MSA													Unable to continue due to grease in the line.

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	2	3	0	0	5	3121	2.5	0	2	0	0	10	12	5221	4.0	0	4	3	0	10	17	5231	3.4

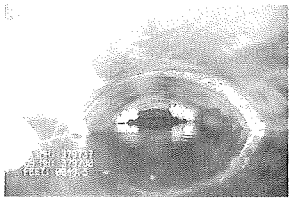
CCTV Inspection Report

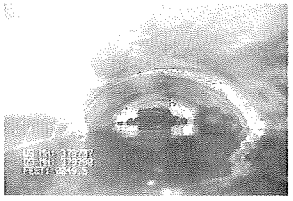
Legend:
Direction
Flow
Camera Travel

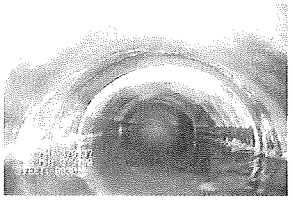
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379737	**Downstream Manhole Number:**	379790
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380425		
Use of Sewer:	Sanitary	Direction:	Upstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	12
Time:	1:44 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	49.5
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

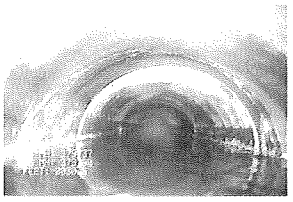
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

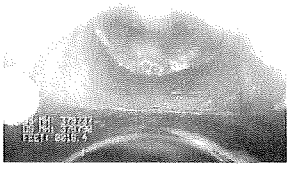
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 49.5' - cannot continue due to heavy grease. Deposits. Cracks and a fracture. Couple of infiltrations.











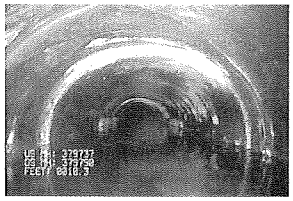
Ftg.	Code	Description	Position	Comment
49.5	MSA	Survey Abandoned		Unable to continue due to grease in the line.
49.4	IG	Infiltration - Gusher	9	
30.5	IG	Infiltration - Gusher	3	
30.5	FC	Fracture Circumferential	8 to 4	
18.4	TF	Tap, Factory Made	12	

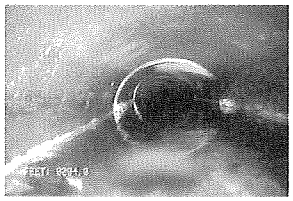
CCTV Inspection Report

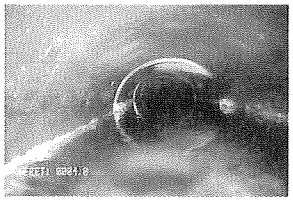
Legend:
Direction
Flow
Camera Travel

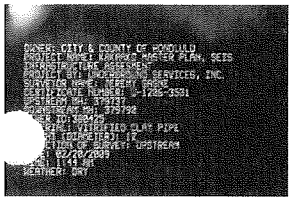
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379737	**Downstream Manhole Number:**	379790
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380425		
Use of Sewer:	Sanitary	Direction:	Upstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:** 12	Measurements: **U/D**
Time:	1:44 AM	Width:	Rim to Invert: /
Cleaned:		Pipe Joint Length:	Grade to Invert: /
Year Laid:	4	Total Length: 250	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 49.5	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 49.5' - cannot continue due to heavy grease. Deposits. Cracks and a fracture. Couple of infiltrations.









Ftg.	Code	Description	Position	Comment
10.3	CM	Crack Multiple	9 to 3	
4.1	DAGS	Deposits Attached: Grease	8 to 4	0%
4.0	MWL	Water Level		45%
0.0	AMH	Access Point - Manhole		Starting Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/19/2009	11:59 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379737	379790	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			250	5.9	4		Kakaako 05

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 5.9' - cannot continue due to camera being underwater. One crack. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						65							65%
4.0	MCU												4	
4.8	CC							J	12	3		1		
5.9	DS	Z					10		6				2	10%
5.9	MCU												4	Unable to continue due to camera being underwater.

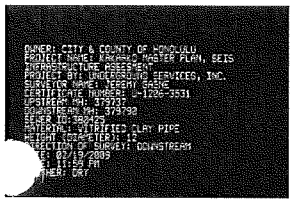
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	1	0	0	0	0	1	1100	1.0	0	2	0	8	0	10	4221	3.3	1	2	0	8	0	11	4221	2.8

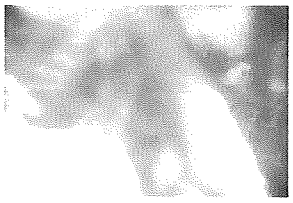
CCTV Inspection Report

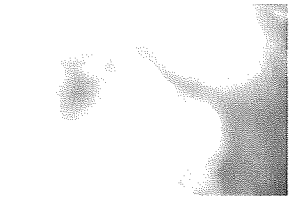
Legend:
Direction
Flow
Camera Travel

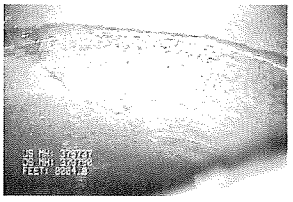
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379737	**Downstream Manhole Number:**	379790
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380425		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:** 12	Measurements: **U/D**
Time:	11:59 PM	Width:	Rim to Invert: /
Cleaned:		Pipe Joint Length:	Grade to Invert: /
Year Laid:	4	Total Length: 250	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 5.9	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 5.9' - cannot continue due to camera being underwater. One crack. Deposits.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		65%
4.0	MCU	Camera Underwater		
4.8	CC	Crack Circumferential	12 to 3	
5.9	DSZ	Deposits Settled: Other	6	10%

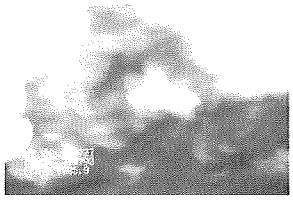
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	379737	**Downstream Manhole Number:**	379790
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380425		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 05	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/19/2009	**Height:**	12
Time:	11:59 PM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	5.9
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 5.9' - cannot continue due to camera being underwater. One crack. Deposits.



Ftg.	Code	Description	Position	Comment
5.9	MCU	Camera Underwater		Unable to continue due to camera being underwater.

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DVD DISK KAKAAKO 06

CCTV In[illegible]ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/20/2009	12:31 AM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379790	379855	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		14

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			250	247	4		Kakaako 06

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						25							25%
4.0	DA	GS	S01				0		8	4			2	0%
7.7	CM							J	8	4		3		
29.6	TF	A			6				12					
36.2	MWL						40							40%
44.2	FC								11	12		2		
44.2	MCU												4	
49.9	MWL						40							40%
54.2	ID								2				3	
72.4	FC								8	4		2		
72.9	MWL						25							25%
80.7	TB	A			6				12					
81.3	ID								1				3	
81.4	FC							J	1	6		2		
87.0	CM								1	5		3		
97.5	MWL						30							30%
125.4	CC							J	2	4		1		
127.9	TB	A			6				12					
142.7	H								1			5		
144.9	CM							J	9	12		3		
147.8	H								12			3		
153.8	MWL						30							30%
178.9	TF	A			6				12					
180.5	ID							J	12				3	

CCTV Ir. ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	2

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/20/2009	12:31 AM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379790	379855	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		14

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			250	247	4		Kakaako 06

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/26/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
183.1	MWL						20							20%
191.2	MWL						30							30%
211.3	CM							J	11	1		3		
215.0	MWL						45							45%
219.8	CM								10	2		3		
224.4	MWL						25							25%
228.2	TB				6				12					
243.7	DA	GS	F01				0		8	4			2	0%
247.0	AMH													Ending Manhole.

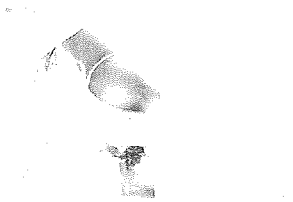
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	1	6	18	0	5	30	5136	2.7	0	120	9	4	0	133	4133	2.1	1	126	27	4	5	163	5141	2.2

CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:** 14	Measurements: **U/D**
Time:	12:31 AM	Width:	Rim to Invert: /
Cleaned:		Pipe Joint Length:	Grade to Invert: /
Year Laid:	4	Total Length: 250	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 247	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.



Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		25%
4.0	DAGS	Deposits Attached: Grease	8 to 4	0%
7.7	CM	Crack Multiple	8 to 4	
29.6	TFA	Tap, Factory Made: Active	12	

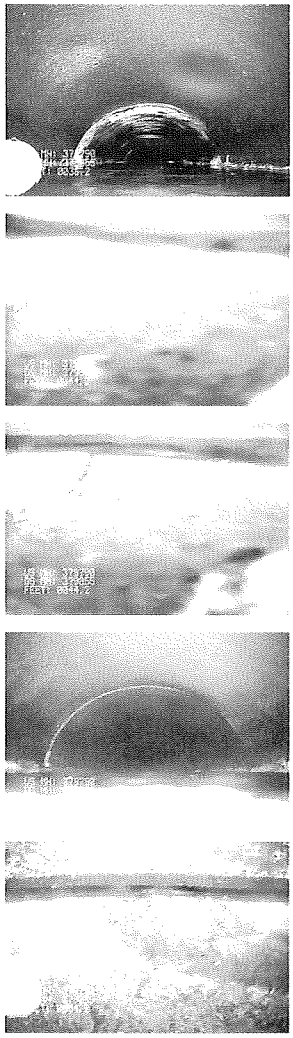
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	12:31 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	247
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.



Ftg.	Code	Description	Position	Comment
36.2	MWL	Water Level		40%
44.2	FC	Fracture Circumferential	11 to 12	
44.2	MCU	Camera Underwater		
49.9	MWL	Water Level		40%
54.2	ID	Infiltration - Dripper	2	

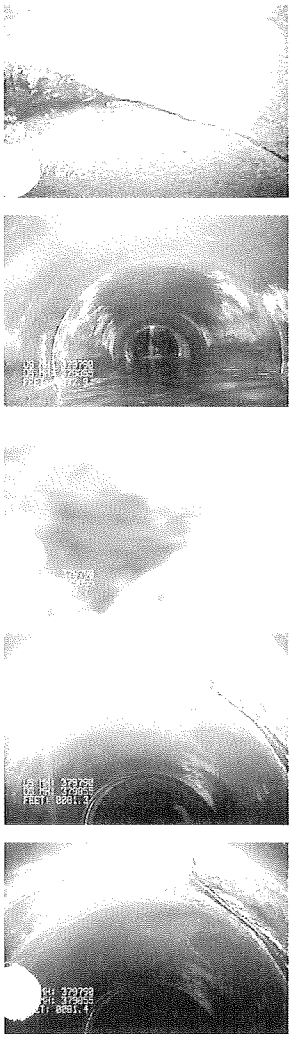
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	12:31 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	247
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.



Ftg.	Code	Description	Position	Comment
72.4	FC	Fracture Circumferential	8 to 4	
72.9	MWL	Water Level		25%
80.7	TBA	Tap, Break-in / Hammer: Active	12	
81.3	ID	Infiltration - Dripper	1	
81.4	FC	Fracture Circumferential	1 to 6	

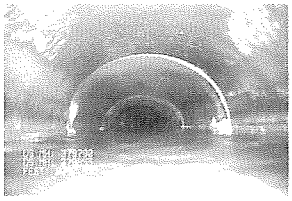
CCTV Inspection Report

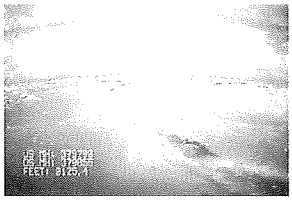
Legend:
Direction
Flow
Camera Travel

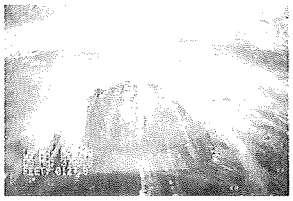
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	12:31 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	247
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

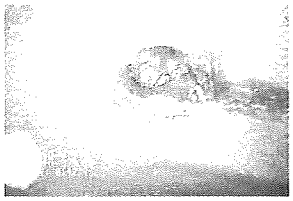
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

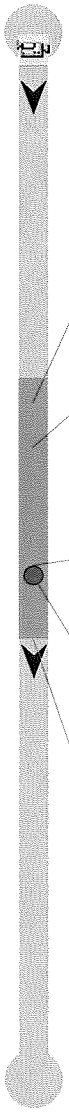
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.











Ftg.	Code	Description	Position	Comment
87.0	CM	Crack Multiple	1 to 5	
97.5	MWL	Water Level		30%
125.4	CC	Crack Circumferential	2 to 4	
127.9	TBA	Tap, Break-in / Hammer: Active	12	
142.7	H	Hole in Pipe	1	

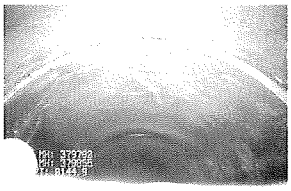
CCTV Inspection Report

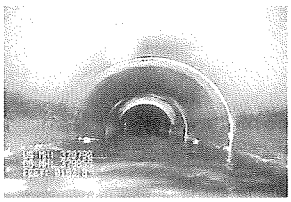
Legend:
Direction
Flow
Camera Travel

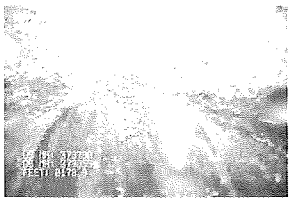
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	12:31 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	247
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

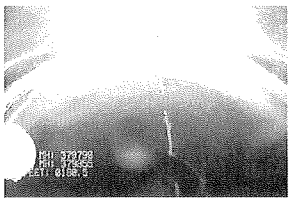
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.









Ftg.	Code	Description	Position	Comment
144.9	CM	Crack Multiple	9 to 12	
147.8	H	Hole in Pipe	12	
153.8	MWL	Water Level		30%
178.9	TFA	Tap, Factory Made: Active	12	
180.5	ID	Infiltration - Dripper	12	

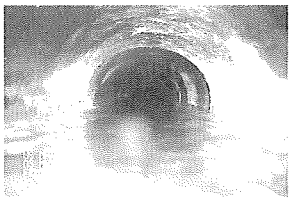
CCTV Inspection Report

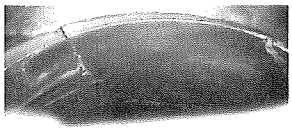
Legend:
Direction
Flow
Camera Travel

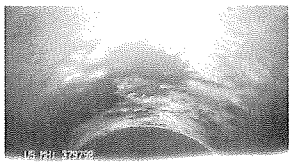
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	12:31 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	247
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

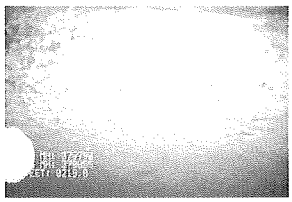
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.









Ftg.	Code	Description	Position	Comment
183.1	MWL	Water Level		20%
191.2	MWL	Water Level		30%
211.3	CM	Crack Multiple	11 to 1	
215.0	MWL	Water Level		45%
219.8	CM	Crack Multiple	10 to 2	

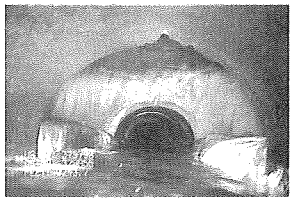
CCTV Inspection Report

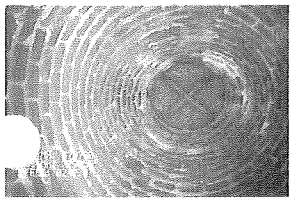
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	379790	**Downstream Manhole Number:**	379855
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380462		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	12:31 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	4	Total Length:	250
Year Rehabilitated:		Length Surveyed:	247
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/26/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits. Cracks and fractures. Few infiltrations. Couple of holes.





Ftg.	Code	Description	Position	Comment
224.4	MWL	Water Level		25%
228.2	TB	Tap, Break-in / Hammer	12	
243.7	DAGS	Deposits Attached: Grease	8 to 4	0%
247.0	AMH	Access Point - Manhole		Ending Manhole.

CCTV I ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/20/2009	1:00 AM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379855	379874	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		14

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			70	67.5	6		Kakaako 06

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/27/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Many cracks and fractures. Deposits. Couple of infiltrations.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
0.0	MWL						35							35%
3.7	CC								8	4		1		
7.9	CC							J	11	4		1		
9.5	DA	GS	S01				0		8	4			2	0%
13.1	CM							J	8	1		3		
19.3	MWL						40							40%
21.8	FC							J	11	4		2		
25.6	IG								2				5	
25.6	FM								9	3		4		
29.9	TF				6				12					
35.0	TB	A			6				12					
45.4	TB	A			6				12					
50.7	ID							J	12				3	
50.7	FM							J	10	2		4		
53.9	FM							J	9	3		4		
64.6	DA	GS	F01				0		8	4			2	0%
67.5	AMH													Ending Manhole.

CCTV In[illegible]ection Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Services, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	2

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		02/20/2009	1:00 AM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379855	379874	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream		14

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			70	67.5	6		Kakaako 06

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Not Known		Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
02/27/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Many cracks and fractures. Deposits. Couple of infiltrations.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	2	2	3	12	0	19	4331	2.7	0	28	3	0	5	36	5131	2.3	2	30	6	12	5	55	5143	2.4

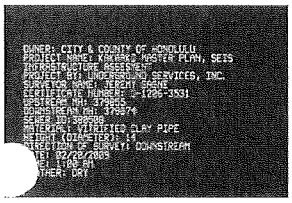
CCTV Inspection Report

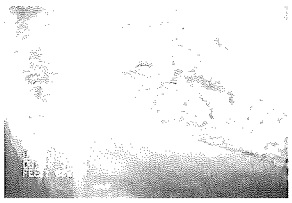
Legend:
Direction
Flow
Camera Travel

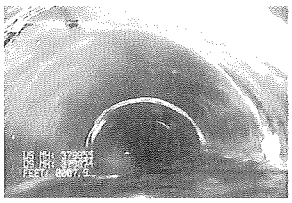
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379855	**Downstream Manhole Number:**	379874
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380508		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	1:00 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	70
Year Rehabilitated:		Length Surveyed:	67.5
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

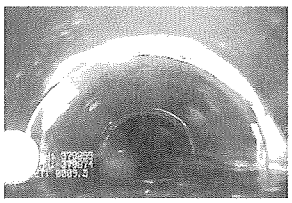
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/27/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Many cracks and fractures. Deposits. Couple of infiltrations.









Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
0.0	MWL	Water Level		35%
3.7	CC	Crack Circumferential	8 to 4	
7.9	CC	Crack Circumferential	11 to 4	
9.5	DAGS	Deposits Attached: Grease	8 to 4	0%

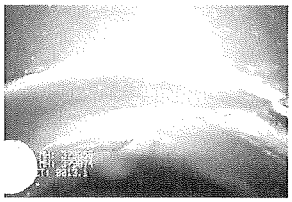
CCTV Inspection Report

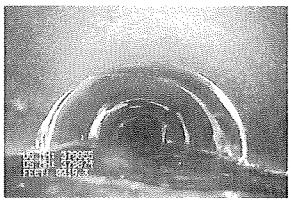
Legend:
Direction
Flow
Camera Travel

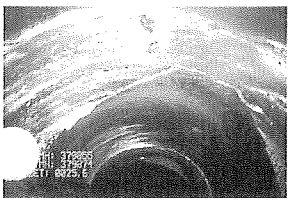
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379855	**Downstream Manhole Number:**	379874
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380508		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	1:00 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	70
Year Rehabilitated:		Length Surveyed:	67.5
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/27/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Many cracks and fractures. Deposits. Couple of infiltrations.







Ftg.	Code	Description	Position	Comment
13.1	CM	Crack Multiple	8 to 1	
19.3	MWL	Water Level		40%
21.8	FC	Fracture Circumferential	11 to 4	
25.6	IG	Infiltration - Gusher	2	
25.6	FM	Fracture Multiple	9 to 3	

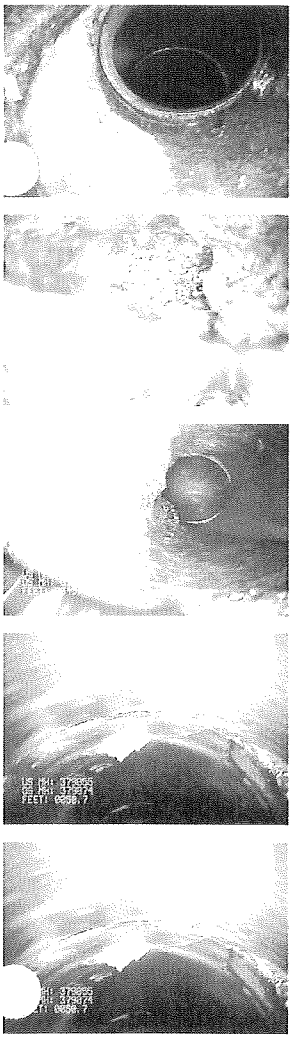
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Services, inc.		
Upstream Manhole Number:	379855	**Downstream Manhole Number:**	379874
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380508		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	1:00 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	70
Year Rehabilitated:		Length Surveyed:	67.5
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/27/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Many cracks and fractures. Deposits. Couple of infiltrations.



Ftg.	Code	Description	Position	Comment
29.9	TF	Tap, Factory Made	12	
35.0	TBA	Tap, Break-in / Hammer: Active	12	
45.4	TBA	Tap, Break-in / Hammer: Active	12	
50.7	ID	Infiltration - Dripper	12	
50.7	FM	Fracture Multiple	10 to 2	

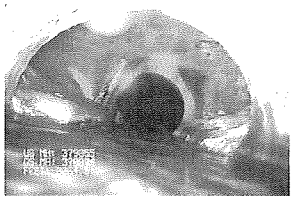
CCTV Inspection Report

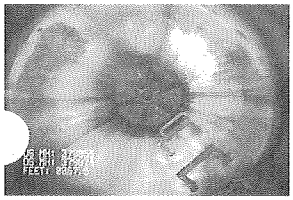
Legend:
Direction
Flow
Camera Travel

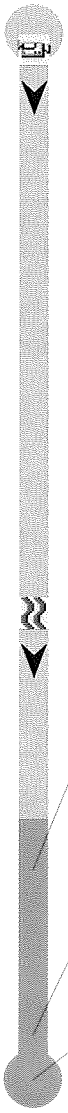
Project By:	Underground Services, inc.		
Upstream Manhole Number:	379855	**Downstream Manhole Number:**	379874
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380508		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:		Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 06	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Not Known	Weather:	Dry
Date:	02/20/2009	**Height:**	14
Time:	1:00 AM	Width:	
Cleaned:		Pipe Joint Length:	
Year Laid:	6	Total Length:	70
Year Rehabilitated:		Length Surveyed:	67.5
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	02/27/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Many cracks and fractures. Deposits. Couple of infiltrations.







Ftg.	Code	Description	Position	Comment
53.9	FM	Fracture Multiple	9 to 3	
64.6	DAGS	Deposits Attached: Grease	8 to 4	0%
67.5	AMH	Access Point - Manhole		Ending Manhole.

DVD DISK KAKAAKO 07

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CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Sevices, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		03/05/2009	9:03 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342078	342088	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Upstream	N	10

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			13	11.2	6		Kakaako 07

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Jetting	3/4/2009	Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
03/07/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						65							65%
4.5	DA	GS	S01				10		12	12			2	10%
11.1	DA	GS					0		12	12			2	010%
11.2	AMH													Ending Manhole.

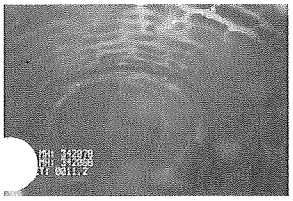
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	4	0	0	0	4	2200	2.0	0	4	0	0	0	4	2200	2.0

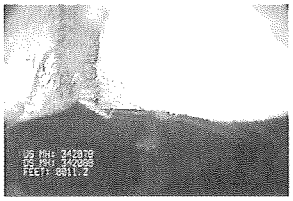
CCTV Inspection Report

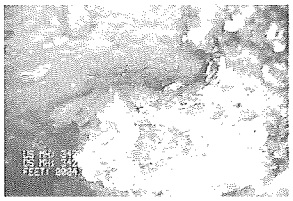
Legend:
Direction
Flow
Camera Travel

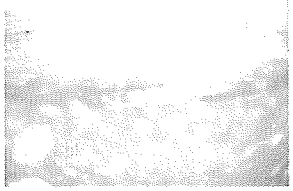
Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342078	**Downstream Manhole Number:**	342088
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	344981		
Use of Sewer:	Sanitary	Direction:	Upstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:** 10	Measurements: **U/D**
Time:	9:03 PM	Width:	Rim to Invert: /
Cleaned:	3/4/2009	Pipe Joint Length:	Grade to Invert: /
Year Laid:	6	Total Length: 13	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 11.2	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 03/07/2009

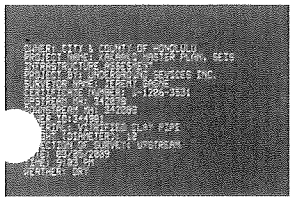
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. Deposits.











Ftg.	Code	Description	Position	Comment
11.2	AMH	Access Point - Manhole		Ending Manhole.
11.1	DAGS	Deposits Attached: Grease	12 to 12	010%
4.5	DAGS	Deposits Attached: Grease	12 to 12	10%
4.0	MWL	Water Level		65%
0.0	AMH	Access Point - Manhole		Starting Manhole.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Sevices, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		03/05/2009	8:55 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342088	342157	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream	N	10

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			250	4.1	6		Kakaako 07

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Jetting	3/4/2009	Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
03/06/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 4.1' - cannot pass deposits. One fracture.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						60							60%
4.0	DA	GS	S01				5		8	4			2	5%
4.0	FC								8	1		2		
4.1	MSA													Unable to pass grease.

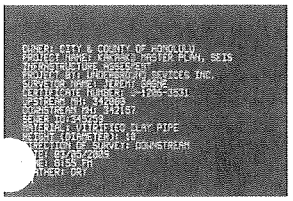
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0	0	4	0	0	0	4	2200	2.0

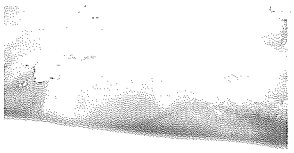
CCTV Inspection Report

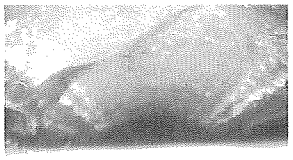
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342088	**Downstream Manhole Number:**	342157
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345259		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:** 10	Measurements: **U/D**
Time:	8:55 PM	Width:	Rim to Invert: /
Cleaned:	3/4/2009	Pipe Joint Length:	Grade to Invert: /
Year Laid:	6	Total Length: 250	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 4.1	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 03/06/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 4.1' - cannot pass deposits. One fracture.







Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		60%
4.0	DAGS	Deposits Attached: Grease	8 to 4	5%
4.0	FC	Fracture Circumferential	8 to 1	
4.1	MSA	Survey Abandoned		Unable to pass grease.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Sevices, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		03/05/2009	9:09 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342157	342231	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream	N	10

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			244	238.8	4		Kakaako 07

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Jetting	3/4/2009	Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
03/06/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 238.8' - cannot pass deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						25							25%
13.7	MWL						30							30%
89.7	TF	D			6				3				2	Fractures.
167.2	TF	D			6				3				2	Broken.
181.6	MWL						40							40%
238.8	DS	Z					20		6	10			3	20%. Piece of VCP Pipe.
238.8	MSA													Unable to pass deposits.

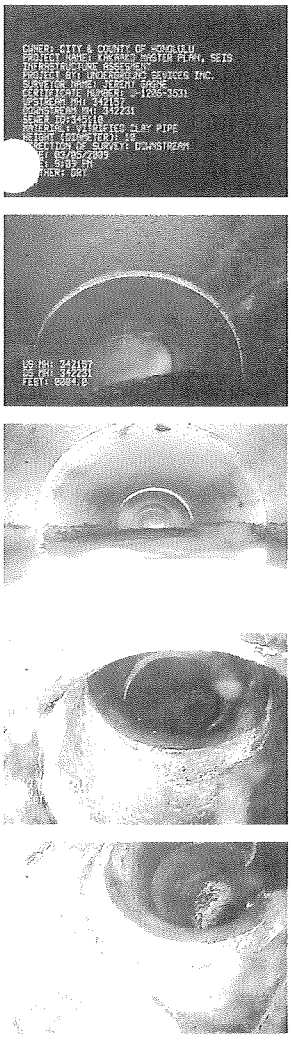
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	4	3	0	0	7	3122	2.3	0	4	3	0	0	7	3122	2.3

CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342157	**Downstream Manhole Number:**	342231
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345110		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:** 10	Measurements: **U/D**
Time:	9:09 PM	Width:	Rim to Invert: /
Cleaned:	3/4/2009	Pipe Joint Length:	Grade to Invert: /
Year Laid:	4	Total Length: 244	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 238.8	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 03/06/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 238.8' - cannot pass deposits.



Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		25%
13.7	MWL	Water Level		30%
89.7	TFD	Tap, Factory Made: Defective	3	Fractures.
167.2	TFD	Tap, Factory Made: Defective	3	Broken.

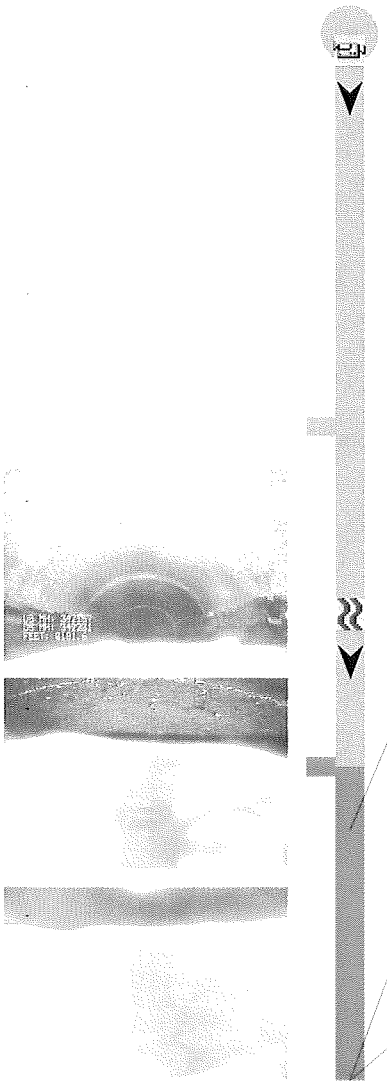
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342157	**Downstream Manhole Number:**	342231
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345110		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:**	10
Time:	9:09 PM	Width:	
Cleaned:	3/4/2009	Pipe Joint Length:	
Year Laid:	4	Total Length:	244
Year Rehabilitated:		Length Surveyed:	238.8
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	03/06/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 238.8' - cannot pass deposits.



Ftg.	Code	Description	Position	Comment
181.6	MWL	Water Level		40%
238.8	DSZ	Deposits Settled: Other	6 to 10	20%. Piece of VCP Pipe.
238.8	MSA	Survey Abandoned		Unable to pass deposits.

CCTV In ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Sevices, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		03/05/2009	9:53 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream	N	12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	249.8	4		Kakaako 07

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Jetting	3/4/2009	Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
03/07/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
4.0	MWL						20							20%
13.5	DA	GS	S01				0		8	4			2	0%
15.0	CC								8	10		1		
24.8	FM		S02						9	3		4		
26.8	ID								12				3	
29.7	FM		F02						9	3		4		
41.9	TF	A			6				12					
58.4	FM								8	4		4		
87.4	TF				6				12					
121.7	FC							J	8	4		2		
137.8	TF				6				12					
141.9	CM							J	8	4		3		
151.1	FM							J	8	2		4		
164.0	MWL						40							40%
171.1	FC							J	2	4		2		
182.6	DA	GS	F01				0		8	4			2	0%
188.9	TF	A			6				12					
218.1	MWL						15							15%
225.0	MWL						40							40%
236.4	TF				6				12					
249.8	MSA													Unable to pass deposits.

CCTV Ir. ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Sevices, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	2

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		03/05/2009	9:53 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
342321	379737	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream	N	12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			258.7	249.8	4		Kakaako 07

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Jetting	3/4/2009	Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
03/07/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				

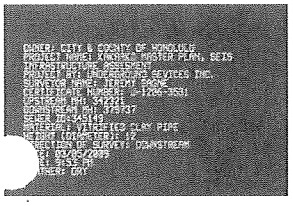
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	1	4	3	12	0	20	4331	2.9	0	84	3	0	0	87	312G	2.0	1	88	6	12	0	107	4332	2.1

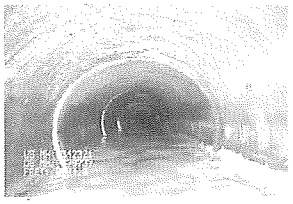
CCTV Inspection Report

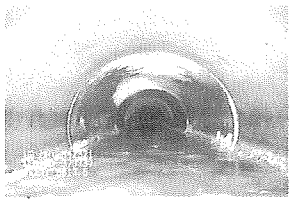
Legend:
Direction
Flow
Camera Travel

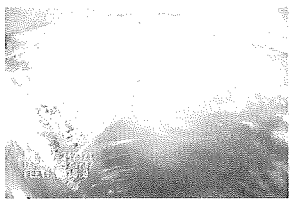
Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:** 12	Measurements: **U/D**
Time:	9:53 PM	Width:	Rim to Invert: /
Cleaned:	3/4/2009	Pipe Joint Length:	Grade to Invert: /
Year Laid:	4	Total Length: 258.7	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 249.8	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 03/07/2009

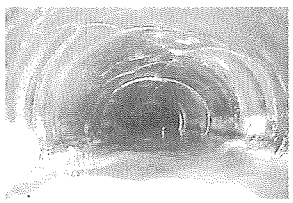
Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.











Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
4.0	MWL	Water Level		20%
13.5	DAGS	Deposits Attached: Grease	8 to 4	0%
15.0	CC	Crack Circumferential	8 to 10	
24.8	FM	Fracture Multiple	9 to 3	

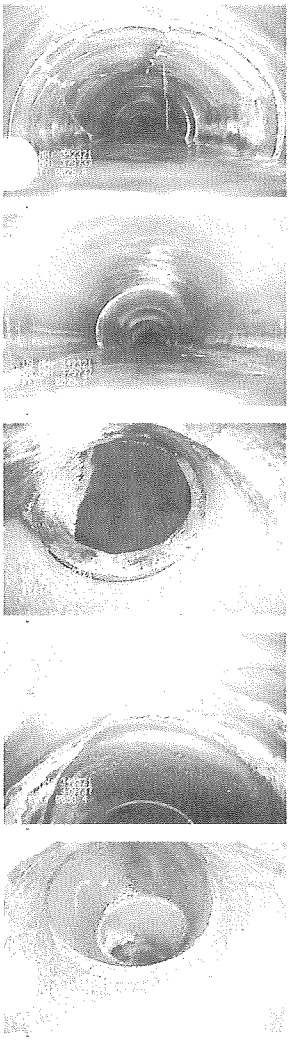
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:**	12
Time:	9:53 PM	Width:	
Cleaned:	3/4/2009	Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	249.8
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	03/07/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.



Ftg.	Code	Description	Position	Comment
26.8	ID	Infiltration - Dripper	12	
29.7	FM	Fracture Multiple	9 to 3	
41.9	TFA	Tap, Factory Made: Active	12	
58.4	FM	Fracture Multiple	8 to 4	
87.4	TF	Tap, Factory Made	12	

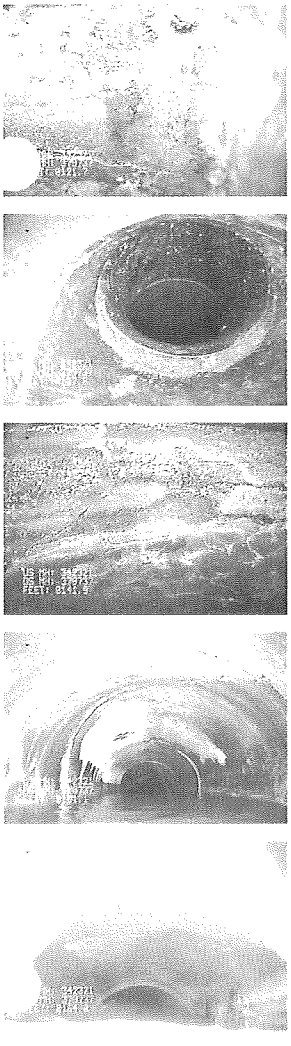
CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:**	12
Time:	9:53 PM	Width:	
Cleaned:	3/4/2009	Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	249.8
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	03/07/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.



Ftg.	Code	Description	Position	Comment
121.7	FC	Fracture Circumferential	8 to 4	
137.8	TF	Tap, Factory Made	12	
141.9	CM	Crack Multiple	8 to 4	
151.1	FM	Fracture Multiple	8 to 2	
164.0	MWL	Water Level		40%

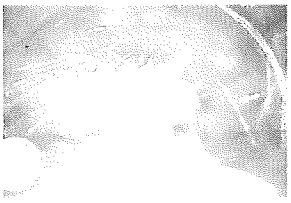
CCTV Inspection Report

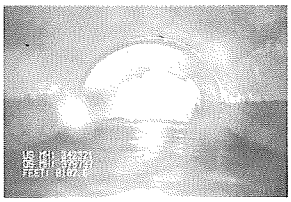
Legend:
Direction
Flow
Camera Travel

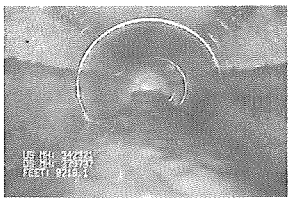
Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:**	12
Time:	9:53 PM	Width:	
Cleaned:	3/4/2009	Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	249.8
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

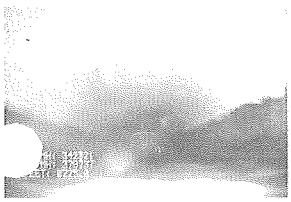
Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	03/07/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.









Ftg.	Code	Description	Position	Comment
171.1	FC	Fracture Circumferential	2 to 4	
182.6	DAGS	Deposits Attached: Grease	8 to 4	0%
188.9	TFA	Tap, Factory Made: Active	12	
218.1	MWL	Water Level		15%
225.0	MWL	Water Level		40%

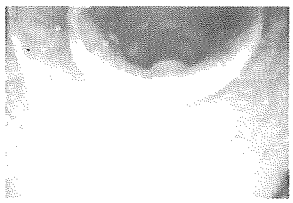
CCTV Inspection Report

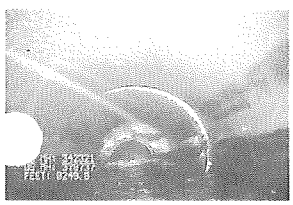
Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	342321	**Downstream Manhole Number:**	379737
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	345149		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:**	12
Time:	9:53 PM	Width:	
Cleaned:	3/4/2009	Pipe Joint Length:	
Year Laid:	4	Total Length:	258.7
Year Rehabilitated:		Length Surveyed:	249.8
QC By:	Shawn Rodrigo	Certificate Number:	U-306-2585

Measurements:	U/D
Rim to Invert:	/
Grade to Invert:	/
Rim to Grade:	/
Sewer Category:	
QC Date:	03/07/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 249.8' - cannot pass deposits. Fractures and cracks. One infiltration.





Ftg.	Code	Description	Position	Comment
236.4	TF	Tap, Factory Made	12	
249.8	MSA	Survey Abandoned		Unable to pass deposits.

CCTV Ir. ction Report

Project By	Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
Underground Sevices, inc.	Jeremy Gagne	U-1206-3531	City & County of Honolulu	AECOM	SI	1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		03/05/2009	10:57 PM	Ward	Honolulu

Upstream Manhole Number	Downstream Manhole Number	Further Location details
379737	379790	

Rim to Invert (U)	Grade to Invert (U)	Rim to Grade (U)	Rim to Invert (D)	Grade to Invert (D)	Rim to Grade (D)	Use of Sewer	Direction	Flow Control	Height
						Sanitary	Downstream	N	12

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP			250	24.6	4		Kakaako 07

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	QC By	Certificate Number
G		Jetting	3/4/2009	Dry	Shawn Rodrigo	U-306-2585

QC Date	Additional Information
03/07/2009	Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 24.6' - Unable to pass deposits.

Distance (Feet)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH													Starting Manhole.
6.4	MWL						70							70%
9.9	MWL						35							35%
21.0	DS	Z					10		5	7			2	10%
24.6	MSA													Unable to pass deposits.

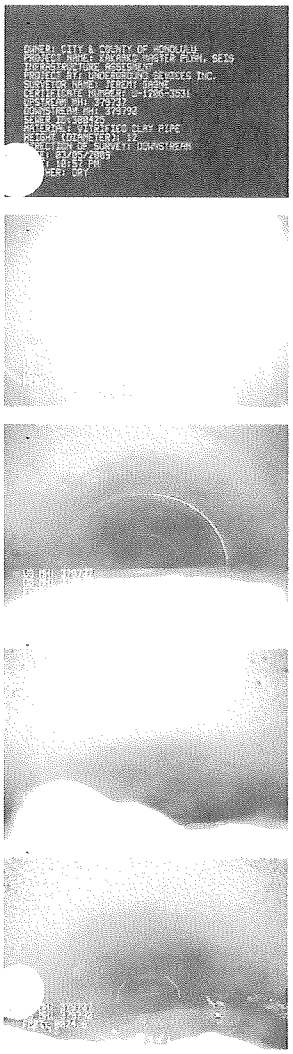
	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

CCTV Inspection Report

Legend:
Direction
Flow
Camera Travel

Project By:	Underground Sevices, inc.		
Upstream Manhole Number:	379737	**Downstream Manhole Number:**	379790
Surveyor's Name:	Jeremy Gagne	**Certificate Number:**	U-1206-3531
System Owner:	City & County of Honolulu	Survey Customer:	AECOM
Drainage Area:	SI	P/O No.:	
Locality:	Honolulu	**Location (Street Name and Number):**	Ward
Pipeline Segment Reference:		Further Location Details:	
Sewer ID:	380425		
Use of Sewer:	Sanitary	Direction:	Downstream
Flow Control:	Not controlled	Shape:	Circular
Material:	Vitrified Clay Pipe	Ln. Method:	
Tape / Media Number:	Kakaako 07	Purpose:	Capital Improvement Program Assessment
Pre-Cleaning:	Jetting	Weather:	Dry
Date:	03/05/2009	**Height:** 12	Measurements: **U/D**
Time:	10:57 PM	Width:	Rim to Invert: /
Cleaned:	3/4/2009	Pipe Joint Length:	Grade to Invert: /
Year Laid:	4	Total Length: 250	Rim to Grade: /
Year Rehabilitated:		Length Surveyed: 24.6	Sewer Category:
QC By:	Shawn Rodrigo	Certificate Number: U-306-2585	QC Date: 03/07/2009

Additional Information: Kakaako Master Plan, SEIS Infrastructure Assesment. Note: PACP doesn't have a code for TCP. End inspection 24.6' - Unable to pass deposits.



Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole.
6.4	MWL	Water Level		70%
9.9	MWL	Water Level		35%
21.0	DSZ	Deposits Settled: Other	5 to 7	10%
24.6	MSA	Survey Abandoned		Unable to pass deposits.





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